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Insights 1.2.1 Documentation

THE SCIENCE OF WHERE

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What is Insights for ArcGIS?

Insights is an app that allows you to perform iterative and exploratory data analysis. With a drag-and-drop interface, you can answer questions with data from ArcGIS, Excel spreadsheets, and business databases.

Key features

In Insights, you organize your work in workbooks, which can contain multiple pages. An Insights workbook is a new item type in your organization.

With an Insights workbook, you can do the following:

- Integrate data based on geography or common attributes
- Analyze data from multiple sources, such as ArcGIS, Excel, and databases
- Apply spatial analysis tools as a seamless part of your question-and-answer workflow
- Create great-looking maps, charts, and tables using smart visualization defaults
- Enable location for your data with geocoding services, boundary layers from your organization, or custom locations such as sales territories
- Recognize patterns, outliers, and dependencies in your data by interacting directly with maps, charts, and tables
- Automate your analysis with models
- Share your work, data, and results

Accessing help documentation for Linux

If you see a **page not found** error when accessing documentation from the Insights **Help** menu for a Linux installation, manually change the URL so that the protocol is `https` and the filename is `apps/insights/help/en/index.html`. You can also access the Linux instruction in Install Insights in this guide.

Resources to get you started

Use the following resources to get started with Insights:

- Get started FAQ
- Create your first workbook
- Supported browsers for Insights

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Acknowledgments (https://enterprise.arcgis.com/en/server/10.5/cloud/amazon/acknowlegements.htm)

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Get started

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What's new

Insights for ArcGIS 1.2.1 is a software quality release that addresses an issue of requests failing in some high availability ArcGIS Server deployments. Insights 1.2.1 is built on 1.2, which was a software quality release that improved performance throughout the software including in database datasets and relationship views. The Insights team is also continually adding to the resources available to Insights users, including tutorials, blog posts, and videos.

Database datasets

You can now specify a unique ID field when you add a spatial dataset from a database that does not already have a primary key. An ID field must be set to add a spatial dataset from a database.

Relationship view

The **Relationship view** has been enhanced to make it easier to join your datasets using common fields. The improved **Create Relationships** window can now be moved around on your page so that you can interact with the **My Data** pane while you create your relationships.

Resources

The ArcGIS Blog has new posts about Insights (https://www.esri.com/arcgis-blog/?s=#&products=insights). Use the Insights for ArcGIS tag to find news and tips for using Insights. The ArcGIS YouTube channel also includes an Insights for ArcGIS playlist (https://www.youtube.com/playlist?list=PLGZUzt4E4O2LEMMMP3AEZz9MOSFMfo7LF) that can be used to find other helpful tips.

The quick exercise Get started with Insights for ArcGIS has been updated for version 1.2. This exercise is a great resource if you are new to Insights or if you are looking for some inspiration in your analysis.

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Create your first workbook

Welcome to Insights for ArcGIS! Got data and questions? You've come to the right place. This exercise walks you through the process of creating a workbook, adding data, and visualizing and interacting with data to find answers to your questions. The data used in this exercise is not available in your portal, but you can use your own data and follow along. To perform spatial aggregation, you will need two datasets—one with a location field that shows point features, and one with a location field that shows area features.

Prerequisites

Before you begin, review the following:

- Supported data
- If adding Excel data, see Prepare your Excel data
- If adding data from databases, see Create a database connection

Add and visualize data

To create a workbook and add data to it, complete the following steps:

1. Access Insights for ArcGIS.
2. Click **New workbook**.
3. In the **Add to Page** window, click one of the following data sources:

My Content	Add feature layers you created in Portal for ArcGIS.
My Organization	Add feature layers that have been shared with you in your portal.
Excel	Add Excel (`.xlsx`) files.
Database	A card with three drop zones: **Create Map**, **Create Chart**, and **Show Table**.

4. Choose the datasets you want to add from one or more of the above sources, and click **Add**.
   Datasets populate **My Data**. One or more map cards appear on the page if you added spatial data.

   If you see a gray card with the **Create Chart** and **Show Table** drop zones on it, then your data does not contain location information. Enable location for your data, and then proceed to the next step.
5. Click to expand a dataset.
   All your data are exposed as fields and each field is assigned a field role based on the type of data it contains. Field roles determine the type of default map or chart that you create. You can interact directly with your data.
6. Click to select a string field or a numeric field, and drag the fields onto the **Create Chart** drop zone. Instead of dragging the field, you can use the **Chart** button above **My Data**.

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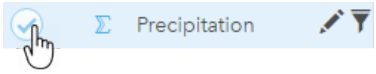
To choose more than one field at a time, you can do one of the following:

- Hover over each additional field, and click the blue checkmark that appears to the left of the field icon. See the example below:



- Press **Ctrl** + click to choose more than one field

Note: If, after making your field selections, you notice that the drop zones or buttons above **My Data** are disabled, it means that your field selections are not compatible with the supported visualization types.
To learn more about the data requirements for each visualization type, see the Visualization catalog. From the catalog, you can see examples, and learn more about card properties you can change and interact with.

If you added a string field to the chart drop zone, a bar chart appears. If you added a numeric field as a chart, a histogram appears.

7. To create another map, choose a field from **My Data**, and drag it onto the **Create Map** drop zone. The table below lists the field roles and the type of map each field creates:

Location field	Location map
String field	Category map
Numeric field	Proportional symbol map
Rate/Ratio field	Choropleth maps

Visualizations appear as cards on your workbook page. Now that you have a few cards to work with, what you do next is up to you.

You interact directly with cards. You can make selections on one card to see related cards update. You can drag other fields onto the page or onto existing cards. You can apply spatial analytics to your maps to discover the spatial intelligence in your data.

Interact directly with selections and filtering

To see how cards from the same dataset interact, complete the following steps:

1. On a chart, click a bar or point.
   The related map updates to reflect your selection on the chart.
2. Click an area or point on the map.
   Related cards update to reflect your selections.

Tip: Press Ctrl + click, or Shift + click to make multiple selections on maps, charts, or tables. To access other selection tools available, such as **Lasso**, click **Selection tools** on the card toolbar.

3. To clear selections on a card, click a blank area on your card (outside your selections).

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For more information about filtering and other interactions, see Interact with cards.

Change, delete, or create a new card

You can change, delete, or create a new card.

Tip: You can also click **Undo** to delete changes you've made to a card.

Change a card

Maybe your card doesn't give you the information you were looking for, or adding another field to a bar chart to further group the chart might answer your next question. Maybe you want to see different fields in the map or chart. Changing a card allows you to see data from another perspective. For example, changing a category map showing hospitals by ownership to a bar chart allows you to see more statistics for each ownership category.

To change your card, do one or more of the following:

- Style a map using a different field from **My Data**, or change the style from **Layer Style** properties.
- Choose different data to show on a chart. Click the field label on a chart axis and choose a different field.
- Group a bar chart or time-series graph using the **Group by** field.
- Select your card, and click **Visualization type** to change to a different visualization type.

For more information about card properties you can change, see the Visualization catalog.

Delete a card

1. Click the card to select it.
2. Click the **Delete** button at the upper right corner of the card.

Note: You can also delete map layers one at a time using the white **Delete** button on the expanded legend. If you delete a card by mistake when you meant to delete a map layer, or vice versa, you can use the **Undo** button at the upper left of your workbook to restore the card or map layer.

Create a card

To create a new card with different data, drag one or two fields from **My Data** onto the map, chart, or table drop zone. For instructions on how to visualize your data in different ways, see the following:

- Create maps
- Create charts
- Summary tables

Tip: To create a new card using data from an existing map, select the legend from a map layer, drag it onto the page, and drop it onto the map, chart, or table drop zone.

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Use spatial analytics to find answers

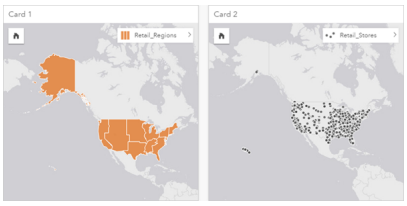
With a map on your page, you can apply spatial tools, such as Create Buffer/Drive Times, Spatial Aggregation, and Spatial Filter to ask questions and find answers in your data.

When you run a spatial tool on a map, Insights for ArcGIS generates a dataset of your results as the topmost dataset in **My Data**. Results are indicated with this icon .

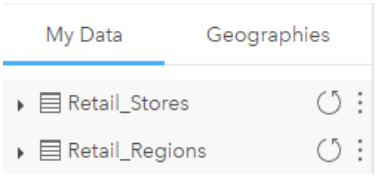
Sometimes results provide your answer, and sometimes they're a step to refining your questions, so you can get a better answer. Results are something you use on your current page, on other pages, or even in other workbooks.

The following is an example of how you can apply spatial analysis to answer a question. The question here is, which customer service areas in our Central sales region account for the highest and lowest revenue?

On the workbook page, there are two maps; one map has an area layer showing United States sales regions, the second map shows store locations as point features and contains sales information.



In **My Data**, there are two datasets—one called `Retail_Stores`, which contains point features, and another called `Retail_Regions`, which contains area features.



Follow along with your own data. You need two datasets—one with a location field containing area features (such as provinces or counties), and one with a location field containing point features, such as hockey arenas or polling stations.

1. Filter the store location map spatially using a single area feature.
   a. From the `Retail_Regions` map, click the `Central sales` area feature.
   b. Drag the `Central sales` area feature onto the `Retail_Stores` map, and drop it onto the **Filter by selected feature** drop zone.

   c. In the Spatial Filter window, choose the layer to filter. In this example, it's the `Retail_Stores` layer.

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d. Choose the layer to filter by. In this example, it's the `Retail_Regions` layer.

e. Choose the type of filter. In this example, you'll use `Intersects`.

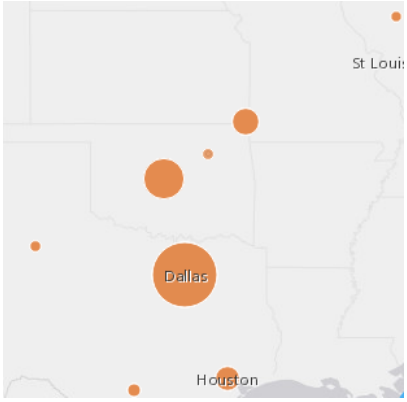
f. Click **Run**.

The `Retail_Stores` layer updates to show only those stores contained in the `Central sales` area. A dataset of the filtered results appears under **My Data**.

2. Create a buffer representing your customer service area around each store location.
   a. Click the filtered store locations map, and click the **Action** button.
   b. Click Create Buffer/Drive Times.
   c. Choose the filtered `Retail_Stores` layer you want to buffer.
   d. Set your distance and units. In this case, the customer service areas are 10 km.
   e. Leave the default buffer style (**Overlap**), and click **Run**.
   A layer showing 10-km buffers around each store is added to each store location in the `Central sales` region. The buffer appears as another layer on the map.
3. Aggregate the numeric field (`SalesAmount`) spatially using the customer service areas you created with buffers in the `Central sales` region.
   a. In **My Data**, click the `SalesAmount` field, and drag the field onto the **Spatial Aggregation** drop zone on the buffered store locations map.
   By default, the map is styled by the selected field. In this case it's a number, and the sum statistic type is applied. If you want other statistics calculated, such as `Min` or `Avg`, and included in your results, expand **Additional options**, and choose additional fields and statistic types.

   Note: You can also access Spatial Aggregation using the **Action** button.

   b. Click **Run**.
   A map layer containing the aggregated `SalesAmount` values for each customer service area is added to the map. Numeric values are shown with proportional symbols. Small circles represent lower values. Larger circles represent higher values. Looking at the aggregated map layer, it's apparent that the customer service area in Dallas has the highest sales.



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A dataset of your results is added to **My Data**.

You can answer more questions by doing one or both of the following:

- Hover over a map symbol to view pop-up information for a specific feature.
- Click the **Info** button ⓘ to flip the map card over and see all the available statistics for the map.
- See how category values are distributed in a specific field by choosing and dragging a string field from the results dataset onto the **Create Chart** drop zone.

  Tip: To get a quick view of your highest and lowest values, sort your bar chart in ascending order.

You can share your results data with members of your team or organization.

Adjust styling for maps and charts

Insights for ArcGIS uses smart defaults, so you get great-looking maps and charts as soon as you create them.

You can, however, change the default styles or colors on maps to make colors more transparent for a layer on a multilayered map, or to change the style or color of symbols.

1. Click **Expand** › next to the layer in the map legend.
   Layer Style properties appear. Styling options vary depending on the type of data you mapped.
2. Adjust the desired style properties.
   The map updates to reflect your changes.

Refresh data

In Insights 1.1 and later you have the ability to refresh pages and datasets that are compatible with data updates.* When analysis is performed in Insights, sometimes a copy of the data is created. If the original data is edited, the analysis can be re-run to pick up the latest data by refreshing the page or the dataset. All cards and analysis steps are updated when a dataset is refreshed.

There are two refresh options available in Insights:

- Refresh a page: The option to refresh a page will only appear when there is at least one dataset on the page that can be refreshed. Refreshing a page will refresh all applicable datasets on the page.

  Tip: It is best practice to refresh your pages often if your data is subject to change.

- Refresh a dataset: A dataset can be refreshed by clicking the refresh button next to the dataset in **My Data** or in the **Analysis view**. Refreshing a dataset will re-run any analysis steps that use that dataset. Updating a dataset will update associated result layers and cards in your workbook.

*The refresh button is available on datasets whose data can be updated, such as database tables and feature services. Excel files, standard geographies, and Living Atlas layers are examples of datasets that cannot be refreshed.

Options

You can also do any of the following:

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- Apply other spatial tools, or use the Find answers UI to guide your next action based on the type of question you ask.
- Create another map or more charts and tables.
- Rerun your analysis using the model.
- Share your work.

Additional resources

For more helpful information, see the following resources:

- Frequently asked questions
- Insightful tips

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Get started FAQ

What can I do with Insights for ArcGIS?

Insights for ArcGIS allows you to ask questions of your data and get answers. With Insights for ArcGIS, you can do the following:

- Discover spatial intelligence in your data with little effort. Create and update maps, draw buffers, aggregate numeric data across any geography, and more with one or two clicks.
- Add data wherever that data happens to be: ArcGIS, Excel workbooks, or enterprise databases.
- Find answers by applying spatial tools, slicing, and summarizing data by any field.
- Create maps, charts, and tables so you can compare them side by side
- Sustain your analytical momentum knowing that models are automatically recorded in the Analysis view. You don't have to stop and take notes when you find the winning combination of analytical steps and styling. You can use these models with different input data to automate analytics across your organization.

How do I access Insights for ArcGIS?

See Access Insights for ArcGIS.

Where do I start?

For step-by-step instructions with useful examples, see Create your first workbook. For the condensed version, see the following quick start steps.

Quick start guide

1. Access Insights for ArcGIS.
2. From **My Workbooks**, click **Start new workbook**, and add data from multiple sources, or a model to your workbook page. Datasets you add to your page appear in the data pane, under **My Data**.

   By default, a feature layer is added as a map card. A general card is created for datasets added from Excel or supported databases
3. Create maps, charts, and tables. Visualizing your data in multiple ways on a single page allows you to see patterns you may not otherwise see in a single map.
4. Explore and analyze your data.
5. Save and share your workbook.
   The following are possible next steps:
   - Enable a location (for a dataset from Excel or a database), so you can map your data.
   - Create relationships to join datasets.

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What do I need to know about workbooks, pages, and cards?

Workbooks and their contents (pages and cards) provide a workbench for your analysis. A workbook is where you manage your project, including data connections, iterative analysis, visualizations, workflows, and discoveries.

Within a workbook, you can divide your work between different pages. A page is where you connect to data, explore themes, and collect related content.

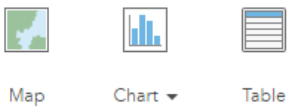
Your data is visualized on cards as maps, charts, and tables. Cards are easy to create and modify. Create as many cards as you like, and toggle to different visualizations. If you don't see the answer you want, modify the card by adding more content. Cards are the primary way you interact with Insights for ArcGIS.

Initially, cards are arranged in a grid-like pattern, but you can change the size or placement of cards on a page. The page layout is flexible. If your page gets too crowded, or you want to explore an emerging theme, start a new page. Another approach is to use one page per question. It's up to you.

What if I don't want to or can't use a drag-and-drop interface?

There's more than one way to do things. You can use buttons to create visualizations or drag and drop. In keeping with Section 508 and Esri's commitment to accessibility (https://www.esri.com/en-us/legal/accessibility/section-508), keyboard alternatives to drag-and-drop operations are provided.

Instead of dragging and dropping fields from **My Data** onto the page, you can choose your fields, and click the **Map**, **Chart**, or **Table** button available above **My Data**.



All spatial analysis options are available from the **Action** button on map cards.

What data does Insights for ArcGIS support?

For information about supported data sources, see Add data to your page.

Can I connect to my geodatabase in Insights?

Currently, Insights for ArcGIS does not allow you to create a connection to a relational database that has an enterprise geodatabase defined. Similarly, Insights does not work directly with file and personal geodatabases. For geodatabase tables and feature classes to be used in Insights, they must be made available in your portal organization as either hosted or registered feature layers (https://enterprise.arcgis.com/en/portal/10.5/use/layers.htm), and then added to your workbook page. For more information, see the following resources:

- Use ArcGIS Desktop with your portal (https://enterprise.arcgis.com/en/portal/10.5/use/use-with-desktop.htm)
- Relationships between web services and portal items (https://enterprise.arcgis.com/en/server/10.5/administer/windows/relationships-between-web-services-and-portal-items.htm)
- Types of geodatabases (https://desktop.arcgis.com/en/arcmap/10.5/manage-data/geodatabases/types-of-geodatabases.htm)

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What is spatial analysis?

For a definition, see spatial analysis.

Use spatial analysis to find answers to questions, such as the following:

- How is it distributed?
- How is it related?
- What's nearby?
- How has it changed?

Spatial analysis starts with a map containing one or two layers of data. Let your questions take you from there. To get started with spatial analysis in Insights for ArcGIS, complete the following steps:

1. Create a map or choose an existing map on your page.
2. Click the **Action** button .
3. Select a spatial analysis tool to answer your question.

For more information about getting started with Insights for ArcGIS, see Create your first workbook.

For more information about spatial analysis, see Analytics (https://www.esri.com/en-us/arcgis/analytics/overview).

What if I have too much data on a map or chart to make sense of it?

As more and more live data streams and extracts are available, making sense of it all is a challenge. Filtering is one way to target your focus to help the story emerge from your data. For example, you might want to understand retail patterns in California but not the entire United States, or see what those patterns look like on Fridays, rather than on other days of the week.

You can filter data for all cards from a specific dataset or for a single card.

You can also perform spatial filtering on map cards and apply the spatial filter to other maps, charts, or tables by dragging and dropping the selected polygon onto the target card.

What if my data doesn't contain locations I can map?

Where possible, the geography is supplied to you. As a start, Insights for ArcGIS requires a location description, such as a country name, a street address, or a postal code to supply the geographic coordinates that allow that data to be shown on a map. The following are two ways that Insights for ArcGIS helps you to map your data:

- Use boundary layers available in the **Geographies** section of the data pane for every page in your workbook to enable locations for your data.
- If you are adding data from other sources, such as an Excel file or a database, you can select fields that you want to geocode as part of the connection process.

What are helpful tips for users?

Insights is an interactive application, so the best way to get comfortable with it is to use it yourself. If you need some help getting started, you can go through the Get started with Insights for ArcGIS exercise. The scenario-based exercise includes access to data and step-by-step instructions to solve spatial problems and answer real-world questions.

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If you would like more tips on how to make the most of your analysis in Insights, please see the Insightful tips topic. You can also visit the ArcGIS Blog (https://www.esri.com/arcgis-blog/?s=#&products=insights) or the Insights playlist (https://www.youtube.com/playlist?list=PLGZUzt4E4O2LEMMMP3AEZz9MOSFMfo7LF) on the ArcGIS YouTube channel.

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Insightful tips

Using filters

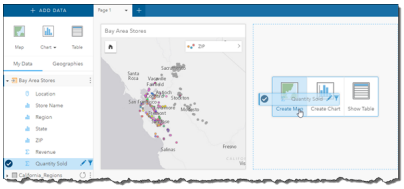
There are several ways to filter your data in Insights, including both attribute and spatial filters. Attribute filters can be found in **My Data** and on each map or chart card.

The Spatial Filter tool can be used to filter your data using a spatial relationship with another dataset. The Spatial Filter tool can be accessed using the **Action** button or by dragging a dataset onto a map and dropping it in the **Filter by selected feature** drop zone. You can also filter by a subset of your data by selecting one or more features and dragging the selection to the **Filter by selected feature** drop zone.

Using result datasets

Result datasets are created when analysis is performed in Insights. Results are temporary datasets signified in **My Data** using the **Result** symbol .

You can use result datasets in many of the same ways that you use your original data. Result datasets can be used to create maps, charts, and summary tables as well as being used in analysis tools.



Standard geographies

Standard geographies are boundary datasets provided by Esri and configured by your portal administrator (https://enterprise.arcgis.com/en/portal/10.5/administer/windows/configure-boundary-layers.htm). Boundaries such as world countries, ZIP Codes, and block groups are included. Standard geographies are especially useful to use as boundary layers in the Spatial Aggregation and Spatial Filter tools or for geocoding using **Enable Location**. You can access standard geographies using the **Geographies** tab next to **My Data**.

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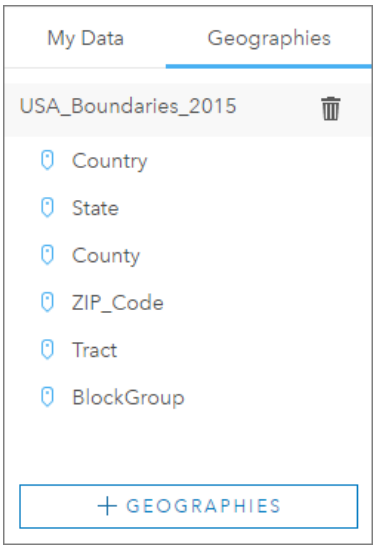
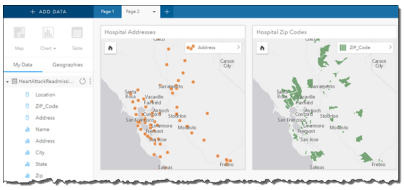


Enabling multiple locations on a dataset

Enable Location can be used to geocode datasets using coordinates, addresses, or standard geographies. Enabling locations is important in files that do not have a pre-existing location field, but can also be done on datasets that already have a location. For example, a dataset with store locations may also include a field with ZIP Codes. **Enable Location** can be used to add a `Geography` location field by matching the ZIP Code field to the ZIP Code standard geography. The dataset will then have two separate location fields: one will create a map of points, and one will create a map of areas.



Do side-by-side map comparisons

Map cards with several layers can be difficult to work with. Instead, you can create additional maps for side-by-side comparison. This is a departure from traditional GIS that has a single map that holds all of your content.

If you want all of the maps on your page to display the same spatial extent when you zoom and pan, turn on **Sync Maps**. It's helpful to have all the maps on your page update to reflect the location and zoom level for your area of interest.

Undo and redo actions

You can improvise your analytics while secure in the knowledge that any action you take in Insights for ArcGIS does not change the underlying data and can be undone or redone with the **Undo** and **Redo** buttons at the top of your page.

Note: If your last action was performed on a previous page and you undo it, the action is undone while your point of focus remains on the current page.

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View statistics

Summary statistics are another way to see patterns emerge about the people or objects you measure. For example, if you are viewing pine tree sample data in a map or chart, you may want to see a summary of the numeric values from that field on your map or chart to get a quick view of average height or median age of the trees. The steps vary slightly depending on whether you want to view statistics on a map or chart.

View statistics on a map

A list of statistics is provided on the back of the map card.

1. Click the map to select it.
2. Do one of the following:
   - Click the **Info** button ⓘ to flip the card over and see summary statistics on the back.
   - Click a symbol on the map to view summary information in a pop-up window about a specific feature.

View chart statistics

1. Click the chart that you want to see summary statistics for.
2. Click the **Chart statistics** button ↗.
3. From **Chart Statistics**, check the statistics you want to see on your chart.
   The chart updates to show the statistics you selected.

Add more data

At any point in your workflow, you can add more datasets to your page with the **Add data** button above **My Data**.

To use data from one page to another, click the dataset from the data pane, and drag the dataset onto the tab of the page you want to use it on. If you haven't created an additional page, you can drag your selected dataset onto the plus-sign (+), and a new page is created and populated with the selected dataset.

Reduce data pane clutter

If you find datasets on your page to be unhelpful to your analysis, remove them from **My Data** using the following steps:

1. Click the **Dataset options** button ⋮ next to the dataset you want to remove.
2. Click **Remove Dataset**.
   If there are cards on your page that contain data from the dataset you are about to remove, the following message appears: **Are you sure? You are about to remove <dataset-name> from the page. <#> card(s) will be affected**. If you choose **Yes, Remove**, the dataset and all cards containing data from the dataset are removed.

If your maps or charts are too cluttered with information, target your analysis with filtering. Filtering, along with aggregation, are great ways to step back from your data and see a bigger picture.

Access Esri demographic data

Get access to the latest and most in-depth demographic information for over 100 countries with the Enrich Data spatial tool.

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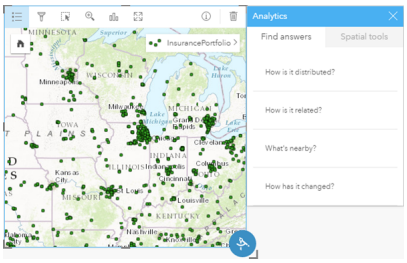
Rename fields or datasets

Sometimes field names or dataset names don't seem to make sense. For example, a field named `m_sl` contains median sales data. Others who have access to your workbook or presentation may not understand the field name and how it relates to the maps and charts in which it's included.

You can rename the field or dataset with a new alias from **My Data**. Renaming a field or dataset does not change the name in the underlying data, only how that field name appears in Insights for ArcGIS. See Change the alias for a field or dataset.

Using the Find Answers tab

The **Find Answers** tab is a great resource if you are trying to answer a question but do not know which tools to use. Similar tools are grouped based on which type of question they can answer, making it easy to find the right tool for your analysis. The **Find Answers** tab includes both spatial and non-spatial analytics tools and can be found using the **Action** button.



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Access Insights

There are several ways you can access Insights for ArcGIS, including from Portal for ArcGIS, through a URL, or from an Insights item.

Prerequisites

Before you can access Insights for ArcGIS, you need to have the following:

- A base ArcGIS Enterprise deployment (https://enterprise.arcgis.com/en/get-started/10.5/windows/base-arcgis-enterprise-deployment.htm) configured for your organization.
- Insights installed in your portal.
- A named user account.
- The Publisher role (https://enterprise.arcgis.com/en/portal/10.5/use/roles.htm) to be able to add data, create visualizations, and use spatial analytics.
- A supported web browser.

Access options

You can access Insights by doing one of the following:

1. Access the gallery of apps on your Portal for ArcGIS site (https://enterprise.arcgis.com/en/portal/10.5/use/get-started-portal.htm), search for Insights for ArcGIS, and click **View Application**.
2. If you prefer to use a URL, append `/apps/insights` to your Web GIS. For example, `http://myserver.mycompany.com/portal/apps/insights`. If you don't know the URL, contact your ArcGIS administrator.
3. Open one of the following Insights items:
   - A workbook that you created
   - A model that you created or that was shared with you

Provide your portal account user name and password to sign in when prompted.

Additional resources

- Create your first workbook
- Frequently asked questions
- Insightful tips

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Publish data from ArcGIS Pro

When you add data to your workbook, content from your organization's portal is available to you from the **My Content** and **My Organization** tabs in the Add to Page window.

Can't find your ArcGIS Pro data? Perhaps you haven't yet published your data as hosted feature layers to your portal. When you publish a hosted feature layer to your portal, feature data is copied from your source to the relational data store registered with your portal's hosting server.

By default, editing is not enabled on hosted feature layers, but you can enable editing from ArcGIS Pro when you initially publish or overwrite an existing feature layer. Alternatively, you can edit the feature layer properties in the portal website to allow editing.

Also note that web browsers cannot display some of the more complex cartographic symbols you might have originally used when you authored the map. Most symbol types are available, but in some cases the symbols may be downgraded when you publish them. See Author feature services (https://enterprise.arcgis.com/en/server/10.5/publish-services/windows/author-feature-services.htm) in the ArcGIS Server help for more details about what symbols are supported and make any required changes to your map symbology prior to publishing.

1. Start ArcGIS Pro and open the project that contains the map or scene with the data you want to publish.
2. Be sure your portal connection is active in the project and that you are signed in to the portal using an account that has privileges (https://enterprise.arcgis.com/en/portal/10.5/use/roles.htm) to create content and publish hosted feature layers.
3. To publish a hosted feature layer, do one of the following:
   - Select the layers in the **Contents** pane. Right-click the selection set and click **Share As Web Layer**.
   - To publish all the layers in the map, click **Web Layer** in the **Share As** group of the **Share** tab and click **Publish Web Layer**.

   Tip: If the **Share As Web Layer** menu option is not active, it could be due to one of the following:
   - The account you signed in with does not have privileges to publish hosted feature layers.
   - Your portal is not configured with a hosting server, which is required to host web layers.
   - You're trying to publish a multipatch layer, which is not supported.
4. Type a name for the feature layer. The layer is saved to **My Content** by default. You can save to a folder within **My Content** by either typing the folder name or browsing to an existing folder.
5. Choose to **Copy all data**.
6. For **Layer Type**, check **Feature**.
   This automatically unchecks other **Layer Type** options, as only one can be checked at a time when copying data.
7. Provide a summary and tags for the feature layer.
8. Specify how the feature layer will be shared. All layers you publish are automatically shared to your personal workspace in your organization (**My Content**). Your content is inaccessible to others until you share it with one or more of the following:

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- **Portal for ArcGIS**—Selecting this option allows the layer to be shared with all authenticated users in the organization.
- **Everyone**—Selecting this option makes the layer available to anyone who can access your portal.
- **Groups**—You can share the layer with members of groups to which you belong.

9. Click the **Content** tab to confirm your feature layer will include the data layers you intended.
10. Click **Analyze** to check for any errors or issues.
    If any issues are discovered, they will be listed in the **Messages** tab. Right-click each message to get more information, read help for the error or warning, and access suggested fixes. You must fix the errors before you can publish. Optionally, you can fix the warnings to further improve the performance and appearance of your hosted feature layer.

    Tip: If you opened the **Share Web Layer** dialog box from the **Share** ribbon, you will receive a warning that the layer's data source is not supported. This usually refers to the base map layer, which cannot be published.

11. Once you've fixed the errors and optionally any warnings, click **Publish**.

    Note: Your data is copied to the hosting server's relational data store or managed database at this point. The size of the data and your network speed and bandwidth will impact the time it takes to publish.

When publishing completes, you can click **Manage the web layer** to open the portal website.

View your data in Insights

To see your published data in Insights, access the **Add to Page** window.

1. From the portal website, do one of the following to open Insights:
   - Append `/apps/insights` to your portal URL. For example, `http://myserver.mycompany.com/portal/apps/insights`.
   - Access the gallery of apps on your Portal for ArcGIS site (https://enterprise.arcgis.com/en/portal/10.5/use/get-started-portal.htm), search for Insights for ArcGIS, and click **View Application**.
2. Provide your portal account user name and password to sign in when prompted.
3. Do one of the following:
   - Click an existing workbook from **My Workbooks** to open it, and click **Add Data** from the data pane.
   - Click **Start new workbook**.
4. From the **Add to Page** window, click **My Content**.
   Search for the name of the feature layers you added, or sort the feature layers from **Newest to oldest** to locate them in the list.

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Quick exercise: Get started with Insights for ArcGIS

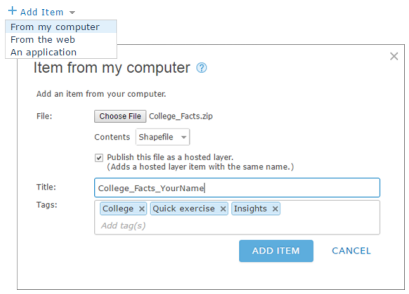
In this exercise, you are a business analyst for a consortium of colleges that wants to run a marketing campaign in states with high-value colleges. It's up to you to find states with colleges that have a good return on investment for students. You'll use Insights for ArcGIS to analyze United States Department of Education College Scorecard data in the form of a feature layer to find relationships between the cost of college and earnings by graduates. In 20 minutes or less, you will do the following:

- Visualize the data and results through interactive maps, charts, and tables.
- Interact, sort, filter, and update the visualizations on your page to ask more questions and find answers.
- Apply spatial analytics, such as spatial aggregation, to summarize data using area features.
- Share your page results and models with your colleagues so they can work on their campaigns.

Before you begin

The data for this analysis has been provided publicly on the ArcGIS website, where it can be downloaded onto your machine. If you are not able to access the Internet from the same machine as your portal, you can download the data on a different machine and then transfer it to your portal machine. Use the following steps to access and load the data onto your portal:

1. Follow the link to the `College_Facts` item (http://www.arcgis.com/home/item.html?id=66240b6544444c04a9a531fbda725c7f).
2. Click the **Download** button to download the item onto your machine.
3. Sign in to your portal.
4. Add the zipped shapefile to your portal using the **Add Item** drop-down menu. Include your name in the title so that the item will be unique in the organization. Add tags and click **Add Item**.



5. Open Insights and sign in to your account if necessary.

   Tip: You can access Insights through the gallery of apps on your Portal for ArcGIS site or by appending `/apps/insights` to your portal URL (for example, `http://myserver.mycompany.com/portal/apps/insights`).

After you log in, the **Workbooks** page appears.

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Create a workbook and add data

1. From **Workbooks**, click **New workbook**. From your content, choose **College_Facts_YourName** and click **Add**.

   The dataset you added appears under **My Data**, and a card appears on your page that shows United States colleges as points on a map.

2. Click **Untitled Workbook** and replace it with a unique and useful title, such as `College_Rankings_YourName`. Including your name in the title will make your workbook easier to find if you share your work. Click **Save**.

Questions

How are costs distributed across United States regions?

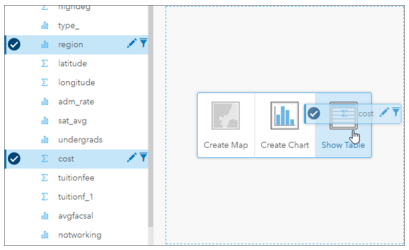
As an analyst, you may want to start with the big picture. The map shows many points. It may be helpful to get a summary of costs by region to start.

1. Under **My Data**, expand the **College_Facts** dataset.

   Fields from the dataset are listed. Each field has an icon that indicates the field's role, which is based on the type of data the field contains. The fields that will help answer the question above are the following:
   - `region`, which represents the part of the United States where the college is located, and is a string field
   - `cost`, which represents the average annual cost of attendance, and is a number field

2. Hover over the `region` field in your dataset and click the circle that appears. Do the same for the `cost` field. Blue checkmarks indicate selected fields.

3. Drag your selections onto the **Show Table** drop zone that appears on your page.



Note: If you prefer buttons to dragging fields, click **Table** above **My Data** after you select your fields.

   A summary table appears as a card on your page.

4. Now, switch the table to a chart. Click the **Visualization type** button on the card and choose **Bar Chart**.

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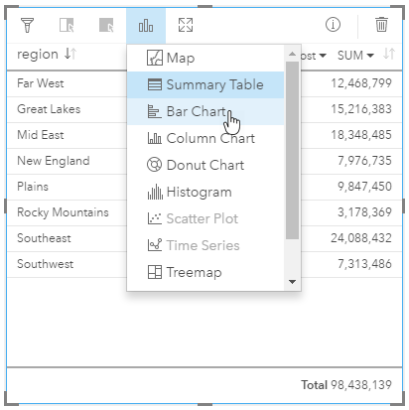
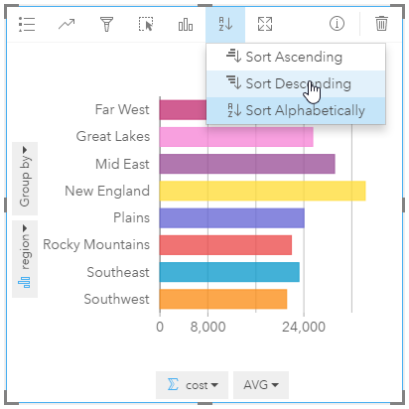


5. Instead of a sum of costs, average costs would be more helpful to know. On the `cost` axis, click the arrow next to **SUM** and choose **AVG**. On the card toolbar, click **Sort Descending**.



When you run analysis tools in Insights, the results are added to **My Data**. Results are indicated with this icon: . There is now a result dataset in **My Data** for the bar chart you created.

6. Save your workbook.

Snap quiz

- Which region has the highest average school cost?
- Which region has the lowest average school cost?
- What is the average school cost across all regions?

Answers

What's the relationship between the cost of college and mean earnings after graduation?

Creating and interacting with a scatter plot is one way to see the relationships in your numeric data. The `mean_earnings` field represents average earnings of independent students working and not enrolled in college 10 years after entry.

1. From **My Data**, choose `cost` and `mean_earnings`. Drag your selections onto the **Create Chart** drop zone that appears on your page.

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`cost` is on the x-axis (horizontal) and `mean_earnings` is on the y-axis (vertical).

Tip: If `cost` is not on the x-axis, click the **Flip fields** button at the lower left corner of the card. `cost` then moves to the x-axis and `mean_earnings` moves to the y-axis.

2. On the scatter plot, click **Color by** and choose `type`. Click the **Legend** button to show the chart legend.

   Colors indicate college types: `Private For-Profit`, `Private Nonprofit`, and `Public`.

3. Hover over a couple of points that show high cost and high mean earnings.

   Tip: These points are at the upper right.

4. Hover over a couple of points that show low cost and low mean earnings. Continue exploring the points in the chart.
5. From the chart legend, click **Private For-Profit**. Next, click **Private Nonprofit**, and then **Public**. The category you select on the Legend is reflected on the card.
6. Save your workbook.

Snap quiz

- Which type of college has the highest cost and the highest mean earnings?
- Overall, which type of college tends to have the lowest cost and the lowest mean earnings?
- What happens to your scatter plot when you click a legend item?
- What happens to the rest of your cards on the page when you click a legend item?

Answers

How are the average costs for public colleges distributed across the data?

Filter your data to reduce the scope of your analysis. Maps paired with charts are an effective way to see how and where your data is distributed.

1. From **My Data**, hover over the `type` field in your dataset.
2. Click the **Dataset filter** button that appears.
3. Uncheck **Select All** to clear selections, check **Public**, and click **Apply**.

   The cards on your page are updated to reflect your filtered dataset.

4. Drag the `cost` field onto your map (Card 1).

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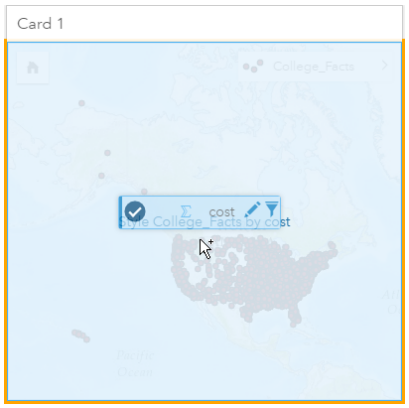


The map updates to show `cost` by proportional symbols. This is hard to interpret. Changing the map style will improve clarity.

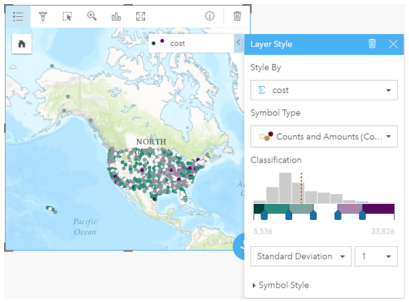
5. Click the arrow next to `cost` in the legend.

   The **Layer Style** pane appears.

6. Under **Symbol Type**, choose **Counts and Amounts (Color)**.

   The map updates to show shaded points instead of proportional symbols.

7. Under the **Classification** histogram, click the field showing **Natural Breaks**, and choose **Standard Deviation** to show schools above or below the average cost. Change the color ramp under **Symbol Style** so that it displays below-average cost and above-average cost with different colors.



There are many points on your map, so hovering over points to see pop-ups is difficult. Interacting with a map using selections can reveal spatial patterns. From the **Layer Style** properties, you can use the classes in the histogram to make selections on the map.

8. Click the class to the right of the last slider on the histogram to see where the high-cost colleges are located. Click each class to see the number and locations of points in each range.

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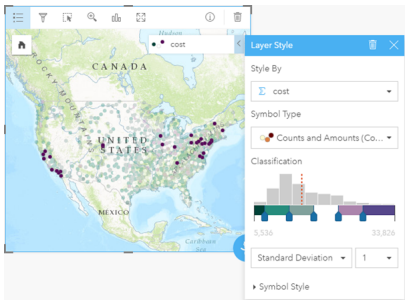

9. Click the **Info** button ⓘ.

   The card flips over to show statistics. Summary statistics provide at-a-glance information. Among the colleges represented (almost 1,600), the minimum cost is $5,536. The maximum is $33,826, and the mean (average) is $15,014. Knowing the average range would be helpful in this analysis.

10. Click the arrow to flip the card back.
11. Click the **Action** button to open the **Analytics** pane, and then click the **Find answers** tab.
12. Click **How is it distributed?** and click **View Histogram**.
13. Under **Choose a number field**, choose `cost` and click **Run**.

    A histogram appears. Examine the histogram to answer the question below.

Snap quiz

- What is the most common cost range among public colleges?

Answers

Note: You do not need the histogram anymore, so delete it by clicking **Delete** at the top right of the card. You can also remove the filter on the `type` field by re-opening the dataset filter and clicking the **Remove filter** button.

How are costs and mean earnings distributed by state?

Filtering allows you to narrow your scope. In this workflow, you will also see how spatial aggregation can summarize key indicators by geography, and how interacting with more than one map allows you to see patterns with more than one variable.

1. Filter the dataset to show average cost range. In this case, colleges in the $10,000–$20,000 range will be the focus. Under **My Data**, click the `cost` field, and click the **Dataset filter** button. Do one of the following:
   - Adjust the left slider to 10,000 and the right slider to 20,000.
   - Click the left slider and type `10,000` in the field, and then click the right slider and type `20,000` in the field.
2. Click **Apply**.

   Your cards update to reflect your filtering. Next, perform spatial aggregation using a standard boundary available in **Geographies**.

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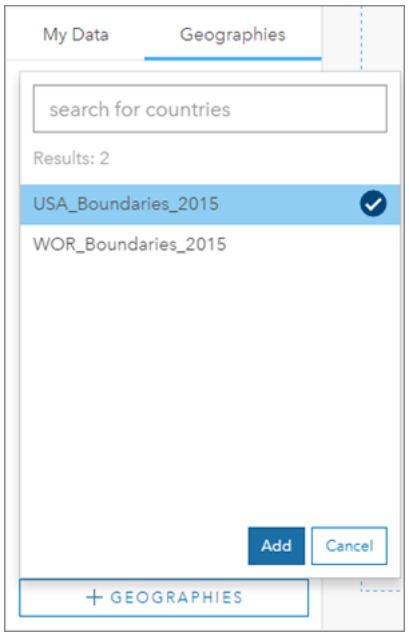
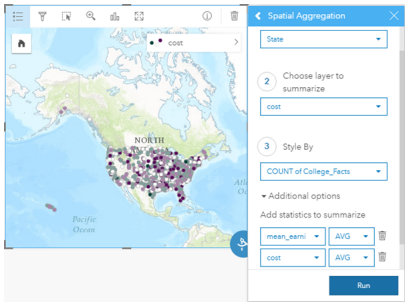
3. In the data pane, click **Geographies** (next to **My Data**). If you don't see **USA_Boundaries_2015** in the data pane, you'll need to add these boundaries. If you do see the USA boundaries, you can skip to step 6.

   Note: The year of your standard geographies will be dependent on how often they are updated by your administrator. You may use the most recent boundaries available in your portal for this exercise.

4. Click **+ Geographies** at the bottom of the pane. Choose **USA_Boundaries_2015** and click **Add**. The administrator installs and configures boundary layers from your portal (https://enterprise.arcgis.com/en/portal/10.5/administer/windows/configure-boundary-layers.htm). You can work directly with these location fields, or use them to enable datasets with location. In this case, you will use the `State` location field to perform spatial aggregation.



5. Drag `State` to the existing map and onto the **Spatial aggregation** drop zone. By default, spatial aggregation provides a feature count, but you can calculate additional statistics.
6. Click to expand **Additional options**. Choose `mean_earnings`, and change to **AVG** from **SUM**. Then, choose `cost`, and change to **AVG** from **SUM**.



7. **Run** and return to the **My Data** tab.

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A result dataset named `College_Facts-State` is added to **My Data**.

8. Click the arrow next to the **Count of College_Facts** layer in the map legend to expand the **Layer Style** properties. Under **Style By**, choose `Avg cost`.
9. Under **Symbol Type**, choose **Counts and Amounts (Color)**. Change the color ramp and classification to match the one used in your first map.

   Dive-in: Counts and Amounts (Color) should only be used on area features when the data is relative (for example, averages or proportions). If you do not have relative data, it is best practice to divide your field by another field, such as total population or total area, to make your data relative. A **Divide by** field can be entered under **Symbol Style**.

10. If necessary, move the region-by-cost bar chart away from the map of `Avg cost`.
11. In **My Data**, expand `College_Facts-State`. From your results, choose **Avg mean_earnings**, and drag it onto the **Create Map** drop zone next to the map of `Avg cost`.
12. Click the arrow next to the **Avg mean_earnings** layer in the legend. Under **Symbol Type**, choose **Counts and Amounts (Color)** and change the classification and color ramp to match the map of `Avg cost`.
13. Turn on **Sync Maps**.

14. Zoom in and pan around your maps to see which states have low costs and high mean earnings. Hover over states of interest for pop-up information. The pop-up will tell you whether the states are above or below average for costs or mean earnings.
15. Save your workbook.

Snap quiz

- Name at least three states that have below-average cost and above-average mean earnings.

Answers

In which three states do colleges deliver the highest return on investment?

Exploring maps side-by-side allows you to compare low and high values of different variables at the same time. An easier way to determine the top three states is to calculate a return on investment variable based on average cost and average mean earnings.

1. Click the map you made in the previous section, and click the **Action** button to open the **Analytics** pane.
2. Go to the **Find answers** tab, and **How is it related?**.
3. Open the **Calculate Ratio** tool. For the numerator, choose `Avg mean_earnings`, and for the denominator, choose `Avg cost`. Name the result field `ROI` (return on investment) and click **Run**.

   A data table appears, providing a view of your raw data. The `ROI` field is the last column on the right.

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4. Close the data table.
5. Create a new map using the `ROI` field.
6. From the results dataset, choose `STATE` and `ROI` and drag them onto the **Show Table** drop zone. A summary table is created showing `STATE` and `ROI`.
7. Use the **Sort** button ↓↑ for the `ROI` field to sort the summary table so that the states with the highest `ROI` are at the top.
8. Save your workbook.

Snap quiz

- Which states are tied for first?
- Which states have the highest ROI?

Answers

Share your workflow and results

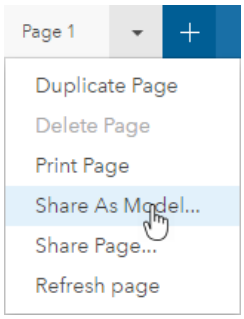
Share your workflow

While you work, Insights captures each step of your analysis. To see the model for your analysis, do the following:

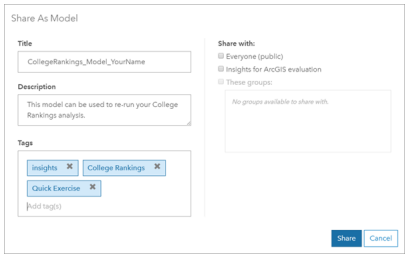
1. Switch to **Analysis view** using the button at the upper right of your page.

   Your model appears. This model can be shared with your team to automate the analysis. For example, they could instantly reproduce the analysis by updating the shared model with more recent data.

2. Open the **Page options** drop-down menu and click **Share As Model**.



3. Give your model a **Title**, **Description**, and **Tags**. You can also choose to share your model with your organization or the public. Click **Share**.



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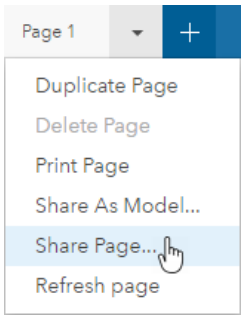
4. Click the **Page view** button to return to your cards.

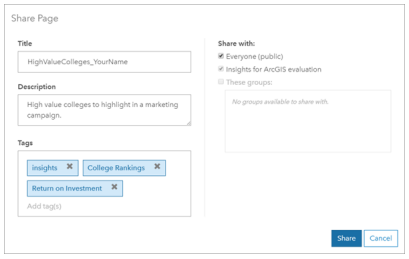
Share your results

Now that you have answers to your questions, it's time to share your results as a read-only page view with stakeholders.

1. Delete the scatter plot, bar chart, `Avg mean_earnings` map, and `Avg cost` map from your page. These cards helped you with your analysis, but they're not helpful for your audience. Clearing unnecessary cards will reduce visual clutter from your results.
2. Give your remaining cards descriptive titles.
3. Save your workbook.
4. Open the **Page options** drop-down menu and choose **Share Page**.



5. Provide a concise **Title**, **Description**, and **Tags**. Choose to share your page with **Everyone (public)**. Click **Share**.



Note: Your data must also be shared in order for the data on the page to be viewed. You can share your datasets from Insights by choosing the **Dataset options** button ⋮ and **Share Data**.

You can view your shared page, access the item you just created in your portal, or just use the embed code to embed your page results into a web page.

6. Under **View your shared page**, click **Go**.

   You see the cards that you created. This read-only view allows users with the Viewer role or higher (https://enterprise.arcgis.com/en/portal/10.5/use/roles.htm) to interact with your results by making selections. Shared pages cannot be edited.

7. Close the tab for the viewer and return to your workbook.

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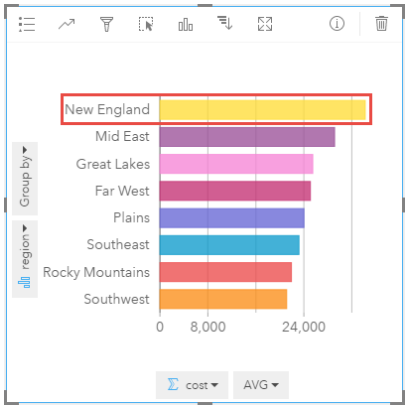
Your work is done. If you haven't already, compare your answers with those provided below.

Quiz answers

How are costs distributed across United States regions?

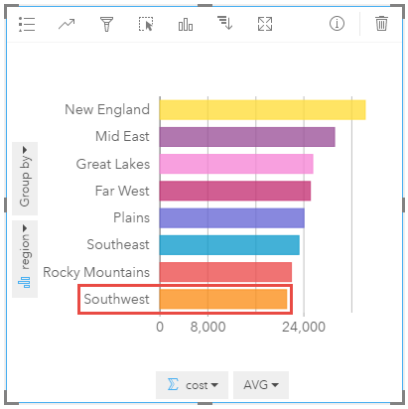
- Question: Which region has the highest average school cost?

  Answer: New England



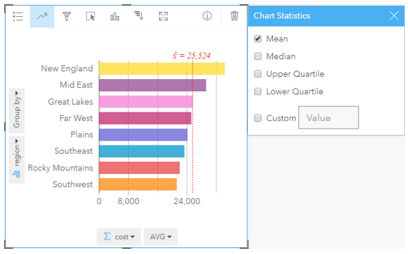
- Question: Which region has the lowest average school cost?

  Answer: Southwest



- Question: What is the average school cost across all regions?

  Answer: $25,524



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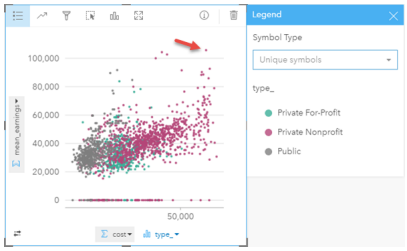
What's the relationship between the cost of college and mean earnings after graduation?

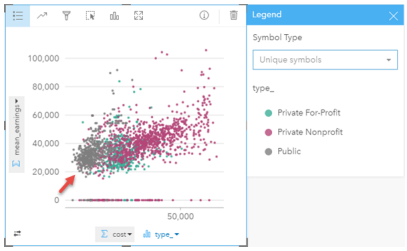
- Question: Which type of college has the highest cost and the highest mean earnings?

  Answer: Private Nonprofit



- Question: Overall, which type of college tends to have the lowest costs and the lowest mean earnings?

  Answer: Public



- Question: What happens to your scatter plot when you click a legend item?

  Answer: All the points for the legend item are selected, for example, all red points.

- Question: What happens to the rest of your cards on the page when you click a legend item?

  Answer: The map highlights only colleges of the selected type. The bar chart is unchanged because colleges of all types are in all regions.

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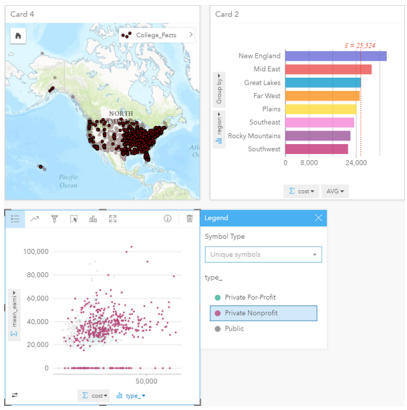
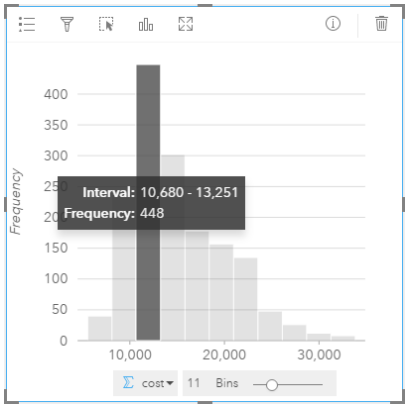


How are the average costs for public colleges distributed across the data?

- Question: What is the most common cost range among public colleges?

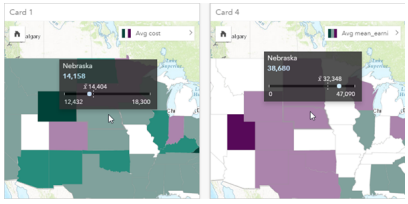
  Answer: $10,680–13,251



How are costs and mean earnings distributed by state?

- Question: Name at least three states that have below-average cost and above-average mean earnings.

  Answer: Any three of Washington, California, Wyoming, North Dakota, Nebraska, Kansas, Oklahoma, Texas, Maryland, Connecticut, Rhode Island, and Massachusetts



In which three states do colleges deliver the highest return on investment?

- Question: Which states are tied for first?

  Answer: Utah and Wyoming

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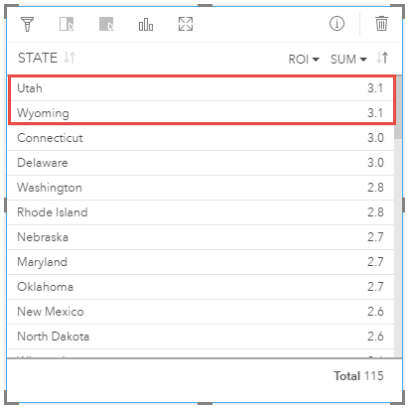
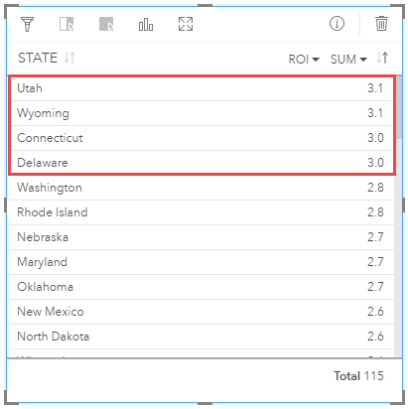


- Question: Which states have the highest ROI?

  Answer: Utah and Wyoming (tied), Connecticut and Delaware (tied)



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Add and manage data

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Add data to your page

You can add data to your workbook page from various data sources.

Supported data

You can add data from the following sources:

- Excel files (`.xlsx`)
- Connections to supported databases you've created in Insights for ArcGIS or that have been shared with you
- Hosted or registered feature layers (https://enterprise.arcgis.com/en/portal/10.5/use/layers.htm) you've created or that have been shared with you from your portal, including the following:
  - Feature layers published from geodatabases (https://desktop.arcgis.com/en/arcmap/10.5/manage-data/geodatabases/types-of-geodatabases.htm) in ArcGIS Desktop (https://enterprise.arcgis.com/en/portal/10.5/use/use-with-desktop.htm)
  - Result layers from big data analysis using ArcGIS GeoAnalytics Server (https://enterprise.arcgis.com/en/server/10.5/get-started/windows/perform-big-data-analysis.htm)
  - Living Atlas of the World feature layers (https://enterprise.arcgis.com/en/portal/10.5/administer/windows/configure-living-atlas-content.htm)

Note: Insights does not support the following:

- Multipoint geometries
- Adding data from a secured service (https://enterprise.arcgis.com/en/portal/10.5/use/arcgis-server-services.htm) if the credentials (username and password) were not stored when the item was registered.

Add data to your page

To add data to your workbook page, complete the following steps.

Note: In addition to data, you can also add a model to your page if you created a model or a model has been shared with you.

1. Access Insights for ArcGIS.
2. Access the **Add to Page** window by doing one of the following:
   - Click **New workbook** from the **Workbooks** page
   - From an open workbook, click **+ Add Data**
3. In the **Add to Page** window, click one of the following:

My Content	Add feature layers you created in Portal for ArcGIS.
My Organization	Add feature layers that have been shared with you in your portal.

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Excel	Add Excel (`.xlsx`) files.
Database	Add tables from a database connection that you created or from a connection that was shared with you.

Tip: Not seeing the feature layers you expect to see from **My Content** or **My Organization**? See Publish data from ArcGIS Pro.

4. Click to choose data from the middle pane.
   Your selections are displayed in **Selected Data**. A counter at the upper right next to **Selected Data** keeps a running total of the number of datasets you selected.

   If you selected a spatial table from a database connection, a location field icon appears beside the table under **Selected Data**. To ensure the accurate and consistent analysis of spatial data from database connections, Insights requires that spatial tables have either a primary key or a unique index. An exclamation mark next to the location icon indicates that neither a primary key nor a unique index is detected. You can choose which fields will be used as the Location or the ID fields by clicking the location field icon and choosing from the list of spatial and nonspatial fields.

   Note: If an ID field is not specified either automatically or manually, the table will be added to Insights as a nonspatial dataset. Only one spatial field is supported for each spatial table from a database connection, where features must meet the following requirements:
   - Features must have a valid geometry/geography (null or invalid features are not supported).
   - Features must have a Spatial Reference Identifier (SRID).
   - All features in the field must have the same SRID.
   - All features in the field must have the same geometry type.

   Tip: You can remove datasets from **Selected Data** by doing one of the following:
   - Uncheck individual datasets.
   - Click the **x** next to the name of the feature layer, Excel file, or database connection to remove all datasets from the data source.

5. Click **Add**.

What you see on your page depends on where your data is from, and whether it contains a location field. See the table below:

Data source	Location field	Result
Portal for ArcGIS (My Content, My Organization, Groups, or Living Atlas)	✓	A map card

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Excel	✗	A card with two drop zones: **Create Chart** and **Show Table**. You need to enable location in your dataset to create a map.
A database connection	✗	A card with two drop zones: **Create Chart** and **Show Table**. You need to enable location in your dataset to create a map.
A database connection	✓	A card with three drop zones: **Create Map**, **Create Chart**, and **Show Table**.

You can now optionally do the following with your workbook and data:

- Add standard boundaries to your workbook.
- Create maps, charts, and tables.
- Apply spatial analytics.

Add data from your portal

Feature layers in your portal are categorized to make them easier for you to find. Depending on who created the layers, and how they are shared, you can find data in **My Content**, and **My Organization**.

1. Locate the feature layers or feature services you want to add. You can do the following:
   - Search for feature layers.
   - View content in **List view** or **Thumbnail view** .
   - Sort content by one of the following:
     - Relevance (most viewed items in your organization)
     - Chronology (Newest to Oldest or Oldest to Newest)
     - Alphabet (A to Z or Z to A)
2. From the middle pane, click the feature layers or feature services you want to add.
   The **Selected Data** pane (right), lists each selected feature layer. If you selected a feature service with more than one layer, all the layers are listed under the feature service name.
3. Optionally click **View details** to see descriptive information about a feature layer in under **Selected Data**.
4. Return to Add data to your page.

Add data from Excel

When you click **Excel**, a file drop zone and the **Browse my computer** button are displayed in the middle pane of the **Add to Page** window.

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1. Do one of the following:
   - Drag and drop Excel files onto the drop zone.
   - Browse to files on your computer.

   Tip: Add multiple Excel files at once by pressing Shift+click or Ctrl+click.

   The **Selected Data** pane updates to display the name of each Excel file you added, and lists one or more datasets for each file. For more information, see Prepare your Excel data.
2. Return to Add data to your page.

Add data from a database

When you click **Database**, the **New Connection** button appears in the middle pane. Below the button, one or more database connections will be listed if database connections have been created by you or shared with you.

1. Do one or both of the following:
   - Click **New Connection** to create a new database connection.

     Note: If the **New connections are not configured. Please contact your administrator.** message appears, it means your administrator has not registered any relational data store types (https://developers.arcgis.com/rest/enterprise-administration/server/register-relational-data-store-type.htm).

   - Locate and choose the database connection with the data you want to add. You can search or sort connections. You can also see descriptive details about a database connection by clicking **View Details**.

     Note: If you see the following message, **Something went wrong with this database connection. Check to see if the connection properties need to be updated**, it means that a connection property, such as the database user name or password has changed since the database connection was created. You can update the connection if you created it. Otherwise, contact your ArcGIS Server administrator.

   After you create or choose a database connection, the middle pane displays a list of datasets to choose from.
2. Return to Add data to your page.

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Prepare your Excel data

Spreadsheets are one of the most common data sources, whether it's an Excel workbook you created to track client visits, or a comma-separate value (CSV) file you downloaded from an open data portal. Insights for ArcGIS allows you to add data from an Excel spreadsheet whether your data is captured in Excel tables, named ranges, or a flat format. With a small amount of preparation you can edit that CSV file to make the data usable as an Excel data source in Insights.

A single Excel file can add multiple datasets to work with or a single dataset, depending on the format of your data in Excel.

When adding data to your workbook page, each occurrence of an Excel table, or a named range is added as a single dataset. If there are multiple Excel tables or multiple named ranges on a single Excel sheet, then you will see multiple datasets for each sheet in Insights. On the other hand, if your data is in a flat format, then each sheet containing data is captured as a single dataset.

If you're having trouble adding an Excel file to your workbook page and the data is not already in an Excel table, insert or format the data as an Excel table, and try adding the file again. See the Excel table example provided below.

Supported Excel versions and file formats

- Excel 2007 and later
- `XLSX` files only
- Pivot tables are not supported

Excel formatting best practices

Whether your data is in an Excel table, a named range, or a flat format, keep the following in mind:

- Remove rows that provide an aggregated total (for example, `GrandTotal`). Otherwise, the aggregated total is imported as a data record that will lead to inaccurate analysis results.

  Note: #VALUE! errors in calculated fields are assigned null values when added to Insights.

- Remove unnecessary text and empty rows above your headers.
- Avoid merged cells in your headers, and limit headers to a single row.
- If your Excel file has more than one sheet, provide a unique name for each sheet. If your sheet has more than one Excel table, name each table. This will help you recognize your data more easily in Insights. If you don't name your sheets and tables, datasets are provided with a default name indicating the sheet number and table number. For example, `Sheet1.Table1`
- Make sure your columns have headers. Otherwise, default headers will be used, making it difficult to recognize fields in Insights.
- Apply the appropriate cell formatting to columns to ensure that Insights appropriately recognizes numbers, percentages, strings, and date/time fields. For example, a column formatted as a percentage in Excel is identified as arate/ratio field in Insights.
- Make sure the records in a column are valid for the cell formatting you apply in Excel. Otherwise, Insights may assign the wrong field role. For example, if you applied the Date format to a column in Excel, but the cells in the column contain invalid date format values, the field likely will be assigned the string field role.

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Excel tables

A single page in your Excel workbook can contain more than one Excel table. Each table on an Excel workbook page is a separate dataset in Insights for ArcGIS. To create an Excel table, either select a cell range or select all, and choose **Insert** > **Table**.

Note: Make sure that when you select your data to insert into an Excel table, only rows and columns containing data are selected. Otherwise, many empty rows may be included in your Excel table, causing inaccurate summaries. If your Excel table includes hundreds of empty rows, an error will occur when you try to add data.

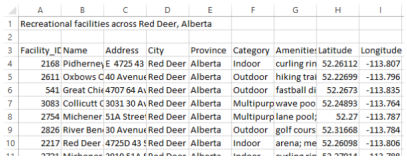
Ensure the following:

If the top row of your selected range in Excel has data that you want to use as table headers, leave the **My table has headers** option checked. If you don't check this option, default headers are created (Column1, Column2, and so on). Rename the default headers, so that you can recognize field names in Insights.

- The first row in the table is not blank.
- The table does not contain calculated columns or rows. If your table has calculated columns or rows, you must remove them.
- Each column header is a single row (merged rows are not supported).

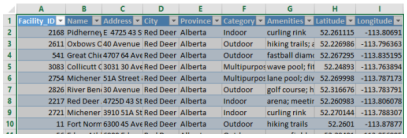
Example: Format data as an Excel table

The following screen shot shows a downloaded CSV file before being formatted to be readable by Insights:



	A	B	C	D	E	F	G	H	I
1	Recreational facilities across Red Deer, Alberta								
2									
3	Facility_ID	Name	Address	City	Province	Category	Amenities	Latitude	Longitude
4	2168	Pidherney	4725 43	Red Deer	Alberta	Indoor	curling rin	52.26112	-113.807
5	2611	Oxbows C	40 Avenue	Red Deer	Alberta	Outdoor	hiking trai	52.22699	-113.796
6	541	Great Chir	4707 64 Av	Red Deer	Alberta	Outdoor	fastball di	52.2673	-113.835
7	3083	Collicutt C	3031 30 Av	Red Deer	Alberta	Multipurp	wave poo	52.24893	-113.764
8	2754	Michener	51A Stree	Red Deer	Alberta	Multipurp	lane pool;	52.27	-113.787
9	2826	River Ben	30 Avenue	Red Deer	Alberta	Outdoor	golf cours	52.31668	-113.784
10	2217	Red Deer	4725D 43	Red Deer	Alberta	Indoor	arena; me	52.26098	-113.806

The following screen shot is of the file after it has been formatted as an Excel table:



	A	B	C	D	E	F	G	H	I
1	Facility_ID	Name	Address	City	Province	Category	Amenities	Latitude	Longitude
2	2168	Pidherney	4725 43 S	Red Deer	Alberta	Indoor	curling rink	52.261115	-113.80691
3	2611	Oxbows C	40 Avenue	Red Deer	Alberta	Outdoor	hiking trails;	52.226986	-113.796363
4	541	Great Chir	4707 64 Ave	Red Deer	Alberta	Outdoor	fastball diam	52.267295	-113.835195
5	3083	Collicutt C	3031 30 Ave	Red Deer	Alberta	Multipurpos	wave pool; fit	52.24893	-113.763894
6	2754	Michener	51A Street	Red Deer	Alberta	Multipurpos	lane pool; div	52.269998	-113.787173
7	2826	River Beni	30 Avenue	Red Deer	Alberta	Outdoor	golf course; h	52.316676	-113.783791
8	2217	Red Deer	4725D 43 St	Red Deer	Alberta	Indoor	arena; meetir	52.260983	-113.806078
9	2721	Michener	3910 51A St	Red Deer	Alberta	Indoor	curling rink	52.270144	-113.788307
10	11	Fort Norri	6300 45 Ave	Red Deer	Alberta	Outdoor	hiking trails	52.2601	-113.87877

The formatting included the following:

- Save the CSV file as an `XLSX` file
- Remove the title row and blank rows
- Insert entire cell range into an Excel table

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Note: Make sure that when you select your data to insert into an Excel table, only rows and columns containing data are selected. Otherwise, many empty rows may be included in your Excel table, causing inaccurate summaries. If your Excel table includes hundreds of empty rows, an error will occur when you try to add data.

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Create a database connection

A database connection allows you to add data from a supported database. Available database connections are listed in the **Add to Page** window when you click the **Database** option. For more information about using database data in Insights, see Understanding data in relational databases.

Prerequisites

Note: Before data from a supported database can be added to a workbook page, your portal administrator must register the appropriate relational data store type for your organization. For more information, see Register Relational Data Store Type in the ArcGIS REST API help (https://developers.arcgis.com/rest/enterprise-administration/server/register-relational-data-store-type.htm).

Before you create a database connection, the following prerequisites must be met:

- You must have appropriate privileges to the database you want to connect to. If you do not have database privileges, contact the database administrator.
- Include your database login information (username and password) when you create the connection.

Note: For information about how Insights handles data types, see Supported types from databases.

Create a new database connection

When you have the database privileges you need, complete the following steps to create a new database connection:

1. Access Insights for ArcGIS.
2. Access the **Add to Page** window by doing one of the following:
   - Click **New workbook** from the **Workbooks** page
   - From an open workbook, click **+ Add Data**
3. In the **Add to Page** window, click **Database**.
4. Under **Select a Connection**, click the **New Connection** button.

   Note: If you see the following message, **New connections are not configured. Please contact your administrator**, it means the administrator has not registered any relational data store types.

5. Provide the required connection information (properties).

   Note:
   - Connection properties, such as **Port Number**, and **Instance Name** vary by database type.
   - You must provide the port number to create a connection to an SAP HANA database.

6. Click **OK** to create the database connection. If you create a connection without specifying the port, the connection will not work.

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Insights will use the connection properties to try to connect to the database. If connecting to the database is possible, the connection is created, and datasets from the database are listed in the middle pane. You can choose datasets from your new connection to add to your workbook page.

If Insights can't connect to the database the following message appears above the middle pane, **We couldn't connect to the database. Verify your connection properties**. See Troubleshoot a database connection for more information about the reasons why a connection could not be established.

When you create a database connection in Insights, an item called a Relational Database Connection is created in Portal for ArcGIS in **My Content**.

As the owner of this database connection, you can share this item with team members, so that they can use the data from the database connection in their analysis.

Each relational database connection item has a corresponding relational catalog service, which resides in the **Hosted** folder on your portal's hosting server. This service can be updated either manually or by writing a script.

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Troubleshoot a database connection

When creating a new database connection or trying to access an existing database connection, Insights for ArcGIS may not be able to establish a connection to the database.

When a connection problem occurs, one of the following messages appears:

- **We couldn't connect to the database. Verify your connection properties** indicates that a connection couldn't be established for a new database connection.
- **Something went wrong with this database connection. Check to see if the connection properties need to be updated** indicates that Insights could not establish a connection to an existing database connection.

The following list provides common causes of database connection problems that can be investigated:

- The connection properties, such as **User Name**, **Password**, and **Port Number** are invalid. Verify that the connection properties for the database connection are correct. If changes are required for an existing database connection, you can edit these properties by updating the database connection.
- You don't have the database privileges required to create the connection.
- Database driver files are not present or are improperly configured on your organization's hosting server site (https://enterprise.arcgis.com/en/server/10.5/administer/windows/configure-hosting-server-for-portal.htm). To establish a connection, your portal's hosting server must have Java Database Connectivity (JDBC) files uploaded and registered. See Register Relational Data Store Type in the ArcGIS REST API help (https://developers.arcgis.com/rest/enterprise-administration/server/register-relational-data-store-type.htm).
- The database is not configured to accept connections. Some databases require additional configuration to allow remote clients to connect. For example, for Microsoft SQL Server databases, you must enable the server network protocol to accept connections over the network.
- Connections have been blocked. Database administrators can prevent users from connecting to a database while they perform certain database maintenance tasks, such as backup and recovery, and upgrades.
- The database has a geodatabase defined (https://desktop.arcgis.com/en/arcmap/10.5/manage-data/geodatabases/what-is-a-geodatabase.htm). Insights 1.2.1 does not support database connections with a database that has a geodatabase defined. This affects Microsoft SQL Server databases only because SAP HANA and Teradata do not support geodatabase functionality.

⚠ **Caution:** If you are having trouble using a database connection item that previously worked in Insights, you may need to update the connection. Do not delete it from **My Content**. When Insights creates a dataset from a database table (or multiple database tables in the case of a joined dataset), a database connection is required. Deleting the database connection will cause any dependent datasets to be inoperable. This caution is especially important if the database connection has been shared with others. Only when you are sure no datasets are dependent, or you purposefully want to disable upstream datasets, should you delete a relational database connection.

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Update a database connection

Occasionally, you may need to update the connection properties in a database connection. For example, perhaps your database user name or password has changed, or the database is accessed from a different port number.

Note: You can only update a database connection that you created. ArcGIS Server administrators can update any database connection.

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If Insights for ArcGIS is unable to connect to an existing database connection, the following message appears, **Something went wrong with this database connection. Check to see if the connection properties need to be updated**. This could indicate that the connection properties need to be updated. See Troubleshoot a database connection for other reasons why a database connection may not work.

You can update the following properties for a database connection:

- Database name
- User name
- Password
- Instance
- Port

Note: You should not change the database **Type** property. For example, changing to **SAP HANA** from **Microsoft SQL Server** is not supported.

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When you create a database connection in Insights, an item called a Relational Database Connection is created in Portal for ArcGIS in **My Content**.

Each relational database connection item has a corresponding relational catalog service, which resides in the **Hosted** folder on your portal's hosting server. This service can be updated either manually or by writing a script.

Property names for a connection vary by database type. It may be helpful to look at the JSON representation of the service using the ArcGIS Server Administrator Directory to identify the property names specific to the database connection you want to edit. To view the JSON representation of the service, do the following:

1. Identify the name of the Relational Catalog Service.
2. Follow steps 1-5 in **Update connection properties** (see below), and append `?f=json`. For example: http://server.esri.com:6080/arcgis/admin/services/Hosted/a35f85b0?f=json

   The JSON representation of the service appears.

Manually update connection properties

The names of the properties for a database connection are specific to the connection's database type. To edit the relational catalog service manually you must find the relational catalog service corresponding to your database connection, and update the user defined properties in the service JSON.

Identify the name of the Relational Catalog Service

1. If you have a workbook open, save it.
2. Access your portal by using the URL in the format `http://webadaptor.domain.com/arcgis`. For example, `http://myserver.mycompany.com/portal`. Or from Insights do the following:
   a. Click the Insights logo in the banner.
   b. Click the **Home** drop-down list.
   c. Click **ArcGIS** to access the portal home page.
3. From the portal home page, click one of the following:
   - **My Content** to access items you created
   - **Groups** to access items shared with groups you belong to
   - **Gallery**, and click **My Organization's Featured Content** to access items created by others and shared with your portal
4. Click the relational database connection item to open **Item details**.
5. Locate the URL for the item (under the **Share** button).
6. From the URL, identify the path to the relational catalog service on ArcGIS Server. The path is in the format: `Hosted/<service-name>/RelationalCatalogServer`. For example, `Hosted/a35f85b0/RelationalCatalogServer`.
7. Copy and paste the name of the service into a text editor of your choice, for example, `a35f85b0`. You'll use the name to find the service in the ArcGIS Server Administrator Directory. See below.

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Update connection properties

1. Navigate to the ArcGIS Server Administrator Directory, and sign in using **Primary Site Administrator Login** credentials, or a **Portal Token**. The URL is in the following formats:
   `http://gisserver.domain.com:6080/arcgis/admin`

   or

   `https://gisserver.domain.com:6443/arcgis/admin`

   For more information, see Components of ArcGIS URLs (https://enterprise.arcgis.com/en/server/10.5/administer/windows/components-of-arcgis-urls.htm) in the ArcGIS Server help.
2. Next to **Resources**, click **services**.
3. Under **Folders**, click **Hosted**.
   It may take a moment for the list of services to appear.
4. Locate the relational catalog service in the list using the name of the service you identified in step 7 above, for example, `a35f85b0`.
5. Click the service in the list.
   The service opens and the list of service properties appears at the top.
6. Next to **Supported Operations**, click **edit**.
   The breadcrumbs in the admin directory are in the format:

   Home > services > Hosted > <service-name>.RelationalCatalogServer > edit

   Service properties appear in JSON format.
7. Find `"userDefinedProperties"`, and edit the appropriate values.

   Note: The names of properties for a database connection are specific to the connection's database type.

   For example, to change the username that is used to connect to the database, change the value that corresponds to`"username"`:

   Before editing:

```
{
 “name”: “username”,
 “value”: “jlee”
}
```

   After editing:

```
{
 “name”: “username”,
 “value”: “jeanlee”
}
```

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Note: Leave the text in JSON format. Invalid JSON will cause the edit operation to fail.

8. Click **Save Edits** to apply the changes.

Update connection properties using a script

You can also use a script to edit the properties of a relational catalog service. This is demonstrated in the sample script below, which edits the username and password of a relational catalog service for a Microsoft SQL Server database.

In the REST API, the service's edit operation requires that you pass in a JSON definition of all the service properties as you desire them to remain following the edit. The easiest way to do this is to make an initial call to the service to get its current properties, modify the properties you want, then send the modified set of properties back as a parameter to the edit operation.

In this example, the initial call is made to the service, then the JSON response is deserialized into a Python object. The script then modifies the desired properties and serializes the Python object back into JSON. This edited JSON is then passed into the edit operation.

This pattern could be followed to edit any service properties, not just the username and password. Be sure you verify the names of the JSON properties for the specific database connection, such as ‘username’ and ‘password’, which are used in the example below.

To run the script, you must have the following information:

- The URL for the Relational Database Connection item you would like to edit
- The portal credentials of the user who created the database connection
- The new credentials for the database connection

Identify the item URL for the Relational Database Connection

1. Access your portal by using the URL in the format `http://webadaptor.domain.com/arcgis`. For example, `http://myserver.mycompany.com/portal`. Or from Insights do the following:
   a. Click the Insights logo in the banner.
   b. Click the **Home** drop-down list.
   c. Click **ArcGIS** to access the portal home page.
2. From the portal home page, click one of the following:
   - **My Content** to access items you created
   - **Groups** to access items shared with groups you belong to
   - **Gallery** to access items created by others and shared outside your groups
3. Click the Relational Database Connection item to open **Item details**.
4. Copy and paste the URL into a text editor of your choice. The URL will be used to identify the Relational Database Connection item you will update.

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Sample script: Update the credentials used to access a Microsoft SQL Server database

```
# Demonstrates how to modify the username and password for a relational catalog service

# For Http calls
import urllib, urllib2, ssl, json

# For system tools
import sys

# For reading passwords without echoing
import getpass
# Defines the entry point into the script
def main(argv=None):
    # Print some info
    print
    print "This tool is a sample script that resets the username and password for a
relational catalog service."
    print


    # Ask for Portal Item URL
    portalItemUrl = raw_input("Enter the item URL for the Relational Database
Connection. \nFor example http://myportal.esri.com/portal/home/
item.html?id=e34f10f0563c4f12ad799c0c2726c948: ")

    # Ask for admin/publisher user name and password
    username = raw_input("Enter Portal for ArcGIS user name: ")
    password = getpass.getpass("Enter Portal for ArcGIS password: ")

    # Ask for the new database credentials
    dbUsername = raw_input("Enter the database username: ")
    dbPassword = raw_input("Enter the database password: ")

    # Added the following line to disable certificate verification
    ssl._create_default_https_context = ssl._create_unverified_context

    # Parse the Portal item URL
    portalUrl = portalItemUrl.split(r'/home')[0] if "https" in portalItemUrl else
portalItemUrl.split(r'/home')[0].replace("http","https")
    itemId = portalItemUrl.split(r'id=')[-1]

    # Get a token
    token = getToken(portalUrl, username, password)
    if token == "":
        print "Could not generate a token with the username and password provided."
        return

    # Connect to item to get service url.
    # Portal Item URL is typically in the format https://portal.domain.com/sharing/rest/
content/users/<username>/items/<item id>
    itemUrl = portalUrl + r'/sharing/rest/content/users/' + username + '/items/' +
itemId + '?'

    try:
        # This request only needs the token and the response formatting parameter
        params = urllib.urlencode({'token': token, 'f': 'json'})
        req = urllib2.Request(itemUrl,params)

        # Read response
        response = urllib2.urlopen(req)
        if (response.getcode() != 200):
            print "Could not read item information."
```

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```
            return
        else:
            data = response.read()

        # Check that data returned is not an error object
        if not assertJsonSuccess(data):
            return

        # Deserialize response into Python object
        jsonoutput = json.loads(data)

        # Locate the Portal item's service Url.
        serviceUrl = jsonoutput["item"]["privateUrl"]
    except:
        print "Failed to read Portal item."

    # Connect to service's Admin endpoint to get its current JSON definition
    # The service's edit operation is accessed at https://server.domain.com/arcgis/
admin/<service name>.RelationalCatalogServer/edit
    serviceUrl = '.'.join(serviceUrl.rsplit(r"/", 1)).replace("rest","admin")

    # This request only needs the token and the response formatting parameter
    serviceParams = urllib.urlencode({'token': token, 'f': 'json'})
    serviceRequest = urllib2.Request(serviceUrl,serviceParams)

    # Read response
    serviceResponse = urllib2.urlopen(serviceRequest)
    if (serviceResponse.getcode() != 200):
        print "Could not read service information."
        return
    else:
        serviceData = serviceResponse.read()

        # Check that data returned is not an error object
        if not assertJsonSuccess(serviceData):
            print "Error when reading service information. " + str(serviceData)
        else:
            print "Service information read successfully. Now changing properties..."

        # Deserialize response into Python object
        dataObj = json.loads(serviceData)

        # Edit desired properties of the service
        connectionProperties =
dataObj["jsonProperties"]["connectionProperties"]["userDefinedProperties"]

        for item in connectionProperties:
            # verify the property name as it may be specific to the database type
            if item["name"] == "username":
                    item["value"] = dbUsername
            # verify the property name as it may be specific to the database type
            if item["name"] == "password":
                    item["value"] = dbPassword

        # Serialize back into JSON
        updatedSvcJson = json.dumps(dataObj)

        # Call the edit operation on the service. Pass in modified JSON.
        editSvcUrl = serviceUrl + "/edit"
        params = urllib.urlencode({'token': token, 'f': 'json', 'service':
updatedSvcJson})

        req = urllib2.Request(editSvcUrl, params)
```

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```
        # Read service edit response
        editResponse = urllib2.urlopen(req)
        if (editResponse.getcode() != 200):
            print "Error while executing edit."
            return
        else:
            editData = editResponse.read()

            # Check that data returned is not an error object
            if not assertJsonSuccess(editData):
                print "Error returned while editing service" + str(editData)
            else:
                print "Service edited successfully."

        return

# A function to generate a token given username, password and the portalURL.

def getToken(portalUrl, username, password):
    # Token URL is typically https://portal.domain.com/sharing/generateToken
    tokenUrl = portalUrl + '/sharing/rest/generateToken'

    try:
        values = {'username' : username,
                  'password' : password,
                  'client' : 'referer',
                  'ip' : '',
                  'referer': portalUrl,
                  'expiration' : 60,
                  'f' : 'json'}
        data = urllib.urlencode(values)
        req = urllib2.Request(tokenUrl, data)

        # Connect to portal to request a token.
        response = urllib2.urlopen(req)

        # Read response
        if (response.getcode() != 200):
            print "Error generating token."
            return
        else:
            data = response.read()

        # Check that data returned is not an error object
        if not assertJsonSuccess(data):
                return

        # Deserialize response into Python object
        jsonoutput = json.loads(data)
        token = jsonoutput["token"]
        del tokenUrl
        del values
        del response
        del req
        del data
        return token
    except:
        print "Failed to generate ArcGIS token."


# A function that checks that the input JSON object
#  is not an error object.
```

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```
def assertJsonSuccess(data):
    obj = json.loads(data)
    if 'status' in obj and obj['status'] == "error":
        print "Error: JSON object returns an error. " + str(obj)
        return False
    else:
        return True


# Script start
if __name__ == "__main__":
    sys.exit(main(sys.argv[1:]))
```

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Create and manage workbooks

A Workbook is the mechanism for tracking projects in Insights for ArcGIS.

A workbook is just one item type you can create. For more information about Insights item types, see Share your work. To create a workbook, you must belong to the Publisher role in Portal for ArcGIS (https://enterprise.arcgis.com/en/portal/10.5/use/roles.htm).

Note: Simultaneous editing is not supported. If you open the same workbook in two different browser sessions, and changes are saved in one workbook, cards on the page—such as a bar chart or a map—will break. Close the browser session with the broken cards.

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Create a workbook

To create a workbook in Insights for ArcGIS, complete the following steps:

1. Go to **Workbooks** by doing one of the following:
   - From a current workbook, click the Insights logo above the data pane.
   - Access Insights from Portal for ArcGIS.

   Note: **Workbooks** is the landing page when you first sign in.
2. Click **New workbook**.
   The **Add to Page** window appears.
3. Add data to the current workbook page.

   Tip: The data you add is page specific. Each page in your workbook has its own data, allowing you to explore different themes and scenarios on each page. You can drag datasets to add data to a new page.
4. Name and save your workbook.
   A workbook item is created in Portal for ArcGIS. If you don't add a name and save your workbook, it will be identified as **Untitled workbook** in **Workbooks** and in Portal for ArcGIS.
5. Choose and visualize your data as maps, charts, and tables.

   You can now optionally do the following with your workbook:
   - Automate your analysis.
   - Add geographies to your workbook.
   - Share your workbook (see below).

Access workbook options

Workbook options is where you can view details, share your workbook, duplicate your workbook, or delete it.

1. If you have a workbook open and want to keep your work, save your changes.
2. Click the Insights logo in the banner to access **Workbooks**.
   This page lists the workbooks you created.
3. Click the workbook of interest in the list.
4. Click the **Options** button ⋮.
5. Click one of the following workbook options:

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Settings	Access item details in Portal for ArcGIS where you can add and view information about the workbook. Item details is also where you can click the **Share** button to share your workbook (https://enterprise.arcgis.com/en/portal/10.5/use/share-items.htm) with others in your portal.
Duplicate	Duplicate a workbook. Rename and save the workbook.
Delete	Delete a workbook. You can only delete one workbook at a time from **Workbooks**. To delete multiple workbooks, go to **My Content** in Portal for ArcGIS.

Add geographies to your workbook

Geographies (boundary layers) are helpful when your data doesn't contain any location fields, such as postal codes or census areas.

Geographies in the **data** pane are boundaries such as states, counties, tracts, ZIP Codes, block groups, census tracts, core-based statistical areas (CBSA), designated market areas (DMA), or places.

When you enable geographies for one or more countries, you can use these feature layers to enable location for any dataset, create maps, and apply spatial analytics.

1. From the **data** pane, click **Geographies** (next to **My Data**).
   If your administrator has set up a specific country as your default region, you will see that country and its boundaries in the list. You can add boundaries for other countries you select from the list.
2. Click **Geographies** at the bottom of the data pane, and select the countries you want to have available.
   If no geographies are listed, it means that geographies have not been configured. See Configure boundary layers in the Portal Administrator Guide for more information (https://enterprise.arcgis.com/en/portal/10.5/administer/windows/configure-boundary-layers.htm).

Use existing workbooks

Existing workbooks can be opened within Insights or Portal for ArcGIS. The **Workbooks** page in Insights lists the workbooks that are available to open, including workbooks from other members of your organization that have been shared.

Note: The **Workbooks** page can show up to 100 workbooks at a time. You can use the **Search** box to find workbooks that do not appear on the page.

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The workbooks that you created are saved in **My Content** in Portal for ArcGIS. A workbook can be opened from **My Content** using the down arrow next to the workbook name and choosing **Open in Insights** or by clicking **Open in Insights** on the **Item Details** page. Shared workbooks from other members of your organization can be opened from the **Gallery** in your portal.

Note: If you have Administrator privileges (https://enterprise.arcgis.com/en/portal/10.5/use/roles.htm) in your portal organization, you can access workbooks created by other members even if they are not shared.

Shared workbooks

The **Workbooks** page lists all of the workbooks you can access. Blue thumbnails represent your own workbooks, and orange thumbnails represent workbooks created by other members of your organization.

Workbooks that have been shared include a watermark with the word **Shared**. This watermark is useful for keeping track of which workbooks you have shared, or, if you are an Administrator, keeping track of which workbooks have been shared with your organization or the public.

Find the correct workbook

By default, the **Workbooks** page is organized with your workbooks listed first, from newest to oldest, and the other workbooks accessible to you listed after those. You can display only your own workbooks by changing the **All workbooks** option to **My workbooks**. You can also sort the workbooks on your page using the sort options **Date: Newest**, **Date: Oldest**, **Title: A - Z**, or **Title: Z - A**. A **Search** box can also be used to find workbooks based on keywords. You can also use keywords to search for workbooks that are not listed.

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Calculate a field

You can add new fields to your dataset using the **View Data Table** window. **View Data Table** allows you to add new fields, such as growth rates, percent loss, and change over time, by choosing fields from your dataset and applying simple operators (addition, subtraction, division, and brackets).

Note:

- The data table provides a representative view of your data, and has a limit of 2,000 rows. Sorting your table in ascending and descending order allows you to view the top 2,000 rows, and the bottom 2,000 rows.
- The new calculated field only appears in your workbook, not in the original dataset. For example, after adding a calculated field of `percentchange` to a CommodityPrices dataset added from Excel, the `percentchange` field is available in your workbook but is not added to the original Excel file.
- You can also calculate fields from a map using the **Calculate % Change** and **Calculate Ratio** tools in Find Answers.
- Calculating a field based on fields from the results of a spatial aggregation on database datasets is not supported

Tip: Use **View Data Table** to add normalized data to your dataset for maps, charts, and tables. After the data is calculated and added your dataset, change the field role to identify it as a percentage ($^{A}/_{B}$ rate/ratio).

Add a field to your dataset

1. From the **data** pane, click the **Dataset options** button ⋮ next to the dataset where you want to add a calculated field.
2. Click **View Data Table**.
3. Click **+ Field**.
   A column called **New Field** is appended to the table.

   Note: You can resize and re-order the columns, but these changes are not saved.
4. Click the heading of the new column and provide a more descriptive name.
5. Click one of the following:

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fx	To choose a string, number, or date function, such as `CONCATENATE()`. **Note:** • The `VALUE()` function is not supported for database datasets. • The `DATEVALUE()` function only supports the format YYYY-MM-DD for database datasets. • 10 extra spaces are prepended to numbers when using the `CONCATENATE()` function on a dataset from a Teradata database.
Enter calculate function	To choose one or more fields from your dataset
An operator, such as **+** or **x**	To build your formula

Repeat the above as often as required to complete your calculation.

6. Click **Run**.

   The new calculated field appears at the bottom of your dataset.

7. Do one of the following:
   - Close the window and return to your workbook page.
   - Click **Delete** to remove the field from your dataset.

Functions

Functions can be accessed using the **fx** button in the Data Table. There are four types of functions: string, numeric, and date.

String functions

Most string functions use string inputs to produce string outputs. The two exceptions are the `VALUE()` function and the `FIND()` function, which both use string inputs to produce numeric outputs.

Input text in string functions can be either literal (text surrounded by quotation marks) or category field values. The following table uses category fields for its examples, along with example values that could be found in those fields. Quotation marks are used in the field values to demonstrate that the fields have categorical data.

Syntax	Description	Example

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`CONCATENATE(text1, [text2], ... )`	Concatenates two or more string values.	A data table of schools in California contains fields for street address, city, and ZIP Code. A single field of mailing addresses can be created using the `CONCATENATE()` function: • Function syntax: `CONCATENATE(Address,", ", City," , CA, ",ZIP)` • Example field values: ▪ `Address` = "380 New York St" ▪ `City` = "Redlands" ▪ `ZIP` = "92373" • Result text: "380 New York St, Redlands, CA, 92373"
`MID(text, start_num, num_chars)`	Returns part of a text field. • `start_num`: specifies the position of the first character (starting at 1). The `start_num` must be an integer. • `num_chars`: specifies how many characters of the expression will be returned and should be an integer. No empty characters are returned if the `num_chars` value is greater than the length of the string.	A data table of schools in California contains fields for street address, city, and ZIP Code. The street name can be isolated from the street address using the `MID()` function: • Function syntax: `MID(Address, 5, 20)` • Example field values: ▪ `Address` = "380 New York St" • Result text: "New York St"

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`LEFT(text, num_chars)`	Returns part of a text field. • `num_chars`: specifies how many characters of the expression will be returned and should be an integer. The number of characters will be counted from left to right, starting in the first position.	A dataset of traffic accidents includes a category field with the day of the accident, including the day of the week, date, and year. In order to study the accidents by the day of the week, a new field can be calculated to show the first three characters of the field (starting with day of the week) using the `LEFT()` function: • Function syntax: `LEFT(Accident_Date, 3)` • Example field values: ▪ `Accident_Date` = "Monday, November 14, 2016" • Result text: "Mon"
`RIGHT(text, num_chars)`	Returns part of a text field. • `num_chars`: specifies how many characters of the expression will be returned and should be an integer. The number of characters will be counted from right to left, starting in the last position	A dataset of national parks includes a field with the name of the park and the two digit state code. To symbolize the parks by state, a new field can be added and calculated using the `RIGHT()` function: • Function syntax: `RIGHT(Park, 2)` • Example field values: ▪ `Park` = "Hawai'i Volcanoes National Park, HI" • Result text: "HI"
`TRIM(text)`	Returns the string with extra spaces removed from the ends.	A feature service contains text fields with extra spaces at the beginning and end of their values. The extra spaces can be removed using the `TRIM()` function: • Function syntax: `TRIM(City)` • Example field values: ▪ `City` = " Redlands " • Result text: "Redlands"

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`UPPER(text)`	Returns a character expression with all data converted to uppercase.	A dataset with locations of NGO headquarters contains a field with the organizations' full names and their acronyms when applicable. The acronyms can be standardized to have all capital letters using the `UPPER()` function: • Function syntax: `UPPER(Org)` • Example field values: ▪ `Org` = "Spew" • Result text: "SPEW"
`LOWER(text)`	Returns a character expression with all data converted to lowercase.	A public works department is compiling a list of street signs that need to be replaced. As new entries are added to the list, the format of the `Status` field has become unstandardized, making it difficult to display the signs with unique values. The `Status` field can be standardized to have all lowercase letters using the `LOWER()` function: • Function syntax: `LOWER(Status)` • Example field values: ▪ `Status` = "Installed" • Result text: "installed"

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`VALUE(text, [format])`	Converts text to a number • `format`: specifies the character used as a decimal separator in the number. The `format` may be either a comma (`","`) or dot (`"."`). If a `format` is not provided, the default separator will be a dot. **Note:** Nested functions within the `VALUE()` function may output unexpected results if a `format` is not provided. Therefore, it is recommended that you specify a `format` when using the `VALUE()` function. The `VALUE()` function does not currently support converting text to negative numbers.	A dataset of retail stores has a category field with the revenue amounts. The `Revenue` field can be converted to numerical values using the `VALUE()` function. • Function syntax: `VALUE(Revenue, ".")` • Example field values: ▪ `Revenue` = "1,000.00" • Result number: 1000.00
`FIND(find_text, within_text, [start_num])`	Gives the position of the specified text (character or characters) within a string or text field. The `FIND()` function may be most useful when used in conjunction with other functions, such as `MID()`, `LEFT()`, or `RIGHT()`.	A dataset contains a field with street addresses (including number and street name). In order to classify the data by street, the street name has to be removed from the rest of the address using the `MID()` function. However, each number is a different length, so the `start_num` will be different for each row. The `start_num` can be found using the `FIND()` function: • Function syntax: `FIND(" ", Address)` • Example field values: ▪ `Address` = "380 New York St" • Result number: 4

Numeric functions

Numeric functions use number inputs to produce number outputs. Number functions are most likely to be used in conjunction with other functions or as a method of transforming data.

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Input numbers can be either literal numbers or number fields. The examples below use numbers as input rather than fields to better display the usage of each function.

Syntax	Description	Example
`ABS(number)`	Returns the absolute value.	• Function syntax: `ABS(-350)` • Result number: 350

`COS(number)`	The trigonometric cosine of the specified angle, in radians.
	The following formula can be used to convert degrees to radians:
	`radians = θπ/180`
	`where:`
	`θ = the angle in degrees`
	`π ≈ 3.14`
		• Function syntax: `COS(0.35)`
		• Result number: 0.94

`LN(number)`	The natural logarithm of the specified float expression. The natural logarithm uses the constant e as the base value (approximately 2.72)	• Function syntax: `LN(16)` • Result number: 2.77
`LOG(number)`	The logarithm of a number to a specific base. The default is base 10.	• Function syntax: `LOG(16, 2)` • Result number: 4
`POWER(number, power)`	The value of the expression raised to the specified power.	• Function syntax: `POWER(2, 4)` • Result number: 16

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`ROUND(number, num_digits)`	Rounds numeric values to the specified number of digits. • `num_digits` = the number of decimal places in the output ▪ If `num_digits` is positive, the number is rounded to the corresponding number of decimal places ▪ If `num_digits` is zero, the number is rounded to the nearest integer ▪ If `num_digits` is negative, the number is rounded to the specified number of digits left of the decimal point	• Function syntax: `ROUND(54.854827, 2)` • Result number: 54.85 • Function syntax: `ROUND(54.854827, -1)` • Result number: 50

`SIN(number)`	The trigonometric sine of the specified angle, in radians.
	The following formula can be used to convert degrees to radians:
	`radians = θπ/180`
	`where:`
	`θ = the angle in degrees`
	`π ≈ 3.14`
		• Function syntax: `SIN(0.79)`
		• Result number: 0.71

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`TAN(number)`	Returns the tangent of the input expression.
	The following formula can be used to convert degrees to radians:
	`radians = θπ/180`
	`where:`
	`θ = the angle in degrees`
	`π ≈ 3.14`
		• Function syntax: `TAN(1.05)`
		• Result number: 1.74

Date functions

Date functions may use date fields, text, or no input, depending on which function is being used. The `DATEVALUE()` function can be used to replace a date field in the `DATEDIF()` function.

Syntax	Description	Example
`DATEDIF(start_date, end_date, [unit])`	Calculates the elapsed time between two dates. The `start_date` must take place before the `end_date`, otherwise the output will be a negative value. • `start_date` and `end_date` can be date fields or a `DATEVALUE()` function. • `unit`: the unit of time to be returned. The supported unit values include: ▪ `"ss"` = seconds (default) ▪ `"mm"` = minutes ▪ `"h"` = hours ▪ `"D"` = days ▪ `"M"` = months ▪ `"Y"` = years	A dataset of restaurants includes the dates of their most recent health inspections. The number of days elapsed between health inspections can be calculated using the `DATEDIF()` function: • Function syntax: `DATEDIF(Inspection1, Inspection2, "D")` • Example field values: ▪ `Inspection1` = 8/15/2016, 11:30:00 AM ▪ `Inspection2` = 10/31/2016 2:30:00 PM • Result number: 77

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`DATEVALUE(date_text, [format])`	Converts text to a date. • `date_text` can be a string field or text entered inside quotation marks. • `format` (optional) - The format of the date entered. The `format` is entered as text surrounded by quotation marks. The `format` can be entered using the following unit specifications: ▪ `"MM"` - Month (1-12) ▪ `"DD"` - Day of the month (1-31) ▪ `"YY"` - Two digit year ▪ `"YYYY"` - Four digit year ▪ `"HH"` - Hour (0-23) ▪ `"hh"` - Hour (1-12) ▪ `"mm"` - Minutes (0-59) ▪ `"ss"` - Seconds (0-59) ▪ `"AM"/"PM"` - Not case sensitive	A dataset of restaurants includes the dates of their most recent health inspections. The number of days elapsed since the last inspection can be calculated using the `DATEVALUE()` function to specify the current date: • Function syntax: `DATEDIF(Inspection_date, DATEVALUE("10/31/2016", "DD/MM/YYYY"), "D")` • Example field values: ▪ `Inspection_date` = 8/15/2016, 11:30:00 AM • Result number: 77 Dates and times can be formatted in several ways. The following examples are some of the ways you can format text into dates: • `DATEVALUE("12/25/2016 12:30:25 pm", "MM/DD/YYYY hh:mm:ss pm")` • `DATEVALUE("12/25/2016 14:23:45 pm", "MM/DD/YYYY HH:mm:ss AM")` • `DATEVALUE("25-08-2008 08:40:13 am", "DD/MM/YYYY hh:mm:ss PM")`

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	Note: Nested functions within the `DATEVALUE()` function may output unexpected results if a `format` is not provided. Therefore, it is recommended that you specify a `format` when nesting functions within `DATEVALUE()`. Dates specified without separators (for example, "10312016") will be treated as milliseconds if no `format` is provided. Therefore, it is recommended that you specify a format when entering dates without separators. For dates specified with separators but without a `format`, the format will be guessed. If the format cannot be guessed, the default `"MM-DD-YY"` will be applied. Except for `"AM"/"PM"`, letters cannot be used to specify dates. Therefore, dates such as `"31 Oct 2016"` will not be supported. The `DATEVALUE()` function can only read text entered inside quotation marks or string fields. A date/time field cannot be used as input to the `DATEVALUE()` function.	

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`NOW()`	Returns the current date and time in date/time format. The time is recorded based on Coordinated Universal Time (UTC).	A dataset of restaurants includes the dates of their most recent health inspections. The number of days elapsed since the last inspection can be calculated using the `NOW()` function to specify the current date: • Function syntax: `DATEDIF(Inspection_date, NOW(), "D")` • Example field values: ▪ `Inspection_date`= 8/15/2016, 11:30:00 AM • Result number: 77

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Enable locations for your data

If your dataset does not contain a location (or geography) field, you can enable location with these location types: coordinates, addresses, or geographies. After you enable location, a new location field is added to your dataset. With a location field, you can create maps and perform spatial analysis with your data.

About location types

Coordinates

Use the Coordinates location type if your dataset contains X,Y coordinates. Insights for ArcGIS can usually detect the X (longitude) and Y (latitude) fields in your dataset. You can override the suggested fields, and specify other fields.

For example, if your data contains two sets of coordinates, you might want to specify which coordinates you want to add location to. The default spatial reference is World Geodetic System (WGS) 1984 (4326). You can specify a different spatial reference. If you are unsure as to the correct coordinate system to use, check with the person who created the spreadsheet or collected the data.

If your latitude (Y) values fall between -90 and 90 and the longitude (X) values fall between -180 and 180, use WGS84. If your latitude and longitude values are in meters and have 6, 7, or 8 digits before (to the left of) the decimal point, use Web Mercator.

Address

Note: To enable location by address (a transaction called geocoding), your portal must be configured with the Geocoding utility service, and you must have the Geocoding privilege (https://enterprise.arcgis.com/en/portal/10.5/use/roles.htm).
Credits are consumed for transactions such as enabling location for your data by address (geocoding) if your portal is configured with Esri World Geocoding Service, and applying certain spatial analytics, such as buffer (by travel mode) and GeoEnrichment, that consume ArcGIS Online utility services configured with your portal.

Use the Address location type to enable location using the following:

- One field when location descriptions are contained in a single field. Example:

StreetAddress
200 Brady St., Sudbury

  Each row in the above column generates a single point feature. You can choose a less descriptive field, such as `PostalCode` if you want to see each postal code as a point on a map. For area features, it's best practice to use the Geography location type (below).

- Multiple fields when address information is separated across multiple fields. Example:

StreetNumber	StreetName	City
200	Brady St.	Sudbury

  Each row across the selected fields generates a single point feature.

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Geography

Use the **Geography** location type to enable location for area features, such as a postal code boundary layer from **Geographies** in the **data** pane (see Add geographies to your analysis) or custom boundaries from other datasets on your page, such as police districts.

When you use the **Geography** location type, a join is performed behind the scenes between the current dataset and a boundary layer from **Geographies** or between the current dataset and a custom geography from the data pane that you specify. If you want to add location using a custom geography, add the dataset to your workbook page first.

Enable location for your dataset

1. From the **data** pane, click the **Dataset options** button ⋮.
2. Click **Enable Location**.
3. Choose a **Location type**.

   Note: Enabling location using the coordinates and address location types is not supported for joined database datasets.

Coordinates	Choose one of the following: • A field from the **x (longitude)** and **y (latitude)** lists • A different spatial reference if desired
Address	Choose one of the following: • A **Geocoding service** if there's more than one. • A **Country** for the address. • Under **Address fields**, choose **One** if the location description is in one field. Choose **Multiple** if the location description is separated across multiple fields. • Match the fields that correspond to the address field or fields in your dataset.

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Geography	By default, one **Location field** is chosen, along with a **Matching geography level**. The estimated match accuracy between the fields is indicated with a sliding scale that ranges between **No match** and **Best**. You can do one of the following: • Choose a different **Location field**. • Choose a different **Matching geography level**. **Note:** Values in **Matching geography level** are pulled from boundary layers under **Geographies** in the data pane, or a custom boundary, such as `SalesTerritory` from your available datasets. If no geography levels are listed, you must add geographies to your workbook, add data that contains a location field , or both. • Click **Multiple** to apply the same geography level to multiple fields.

4. Click **Run**.
   A new location field is added to the dataset.

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Change dataset and field properties

Change a field role

If you're unable to create the visualization you want using your chosen data, take a look at the fields in your dataset.

Do the field roles in your data accurately reflect the values in each field? You might need to change the role for a specific field to get the visualization you want. Changing a field role in Insights for ArcGIS does not change the underlying data.

For example, you can't create a bar chart with two numbers because bar charts use string fields to group data along the category axis by default. If you want to use this field to group data on a consistent basis in visualizations that support aggregation, then change the field to a string.

You can change a numeric field to a string, or rate/ratio. If you change your mind, you can always change the field role back.

1. From your dataset in **My Data**, click the field role icon. For the example above, this would be .
   Available field roles are listed below. You can change a number to a string or a rate/ratio.
2. Choose the field role from the list.
   Visualizations you create will reflect the field's new role. However, existing visualizations using the field in its previous role won't update.

Change the alias for a field or a dataset

An alias is an alternative name for a field—a more user-friendly description of the content of the field. Unlike true names, aliases do not have to adhere to the limitations of the database, so they can contain special characters such as spaces. By specifying an alias, you can give names to fields that are more descriptive than their actual field name.

When you specify different aliases, the underlying data is not changed—only how that field or dataset appears in Insights for ArcGIS.

Change a dataset alias

1. From the data pane, click the **Dataset options** button next to the dataset alias you want to change.
2. Click **Rename Dataset**.
3. Type the new alias.

Change a field alias

1. From the data pane, under **My Data**, click the field alias you want to change.
   A pencil icon appears next to the field or dataset you want to rename.
2. Click the pencil icon.
3. Type the new name.

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Remove a dataset

1. Click the **Dataset options** button ⋮ next to the dataset you want to remove.
2. Click **Remove Dataset**.
   If there are cards on your page that contain data from the dataset you are about to remove, the following message appears: **Are you sure? You are about to remove <dataset-name> from the page. <#> card(s) will be affected**. If you choose **Yes, Remove**, the dataset and all cards containing data from the dataset are removed.

Hide or show fields in your dataset

If your dataset contains numerous fields, and you don't have any use for one or more fields, you can hide them from view.

1. From the data pane, choose one or more fields you want to hide in your dataset.
2. From the data pane, click **Dataset options** ⋮ next to the dataset alias you want to change.
3. Click Hide Selected Fields.
   If you want to show those fields again, click **Dataset options** ⋮, and choose **Show Hidden Fields**.

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Create relationships to join datasets

Prerequisites

The following are required before you can create a relationship to join datasets:

- A workbook page containing more than one dataset from the same source (for example, two datasets from hosted feature layers). For more information, see Add data to your page.
- A common field in two or more datasets

About relationships

Insights for ArcGIS allows you to associate rows from two or more datasets in the **Create Relationships** window. For example, you can associate a dataset of sales transactions with a dataset containing zip code area features by identifying a common field (column) that's called a key. The common field identifies how the datasets are related to each other (for example `StoreName`), and the relationship type determines which records (rows) are kept in the joined dataset.

The four types of relationships you can use to join your datasets are as follows:

- Intersect (inner join)
- All (full outer join)
- Left (left outer join)
- Right (right outer join)

The result is referred to as a joined dataset, and is indicated with the results icon ( ) in **My Data**. The joined dataset allows you to expand your analysis by using the ZIP Code area feature to perform spatial analytics or aggregate data in bar charts or summary tables.

In the context of a joined dataset, cardinality refers to the relationships between datasets. In the **Create Relationships** window, take the time to consider the cardinality between the datasets, which can be one-to-one, many-to-one, or many-to-many. Cardinality does not affect the type of relationship you create, but it does have implications for the fields (columns) you might want to aggregate in the joined dataset, or the field you choose to show on your map.

Note: This topic discusses joins based on a common attribute; it does not cover spatial joins.

You can join the following:

- Excel datasets to other Excel datasets, as well as to hosted feature layers (and vice versa)
- Database datasets to other database datasets, provided they're from the same database connection
- Existing joined datasets (indicated with the results icon) to other eligible datasets

Note: You can't join registered feature layers (https://enterprise.arcgis.com/en/portal/10.5/use/layers.htm) stored outside ArcGIS Data Store on the hosting server (https://enterprise.arcgis.com/en/server/10.5/administer/windows/configure-hosting-server-for-portal.htm).

Don't worry if you can't remember which datasets can be joined to which datasets. When you choose a dataset from **My Data** in the **Create Relationships** window, only the eligible datasets are enabled in the view.

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Insights for ArcGIS also suggests a common field when you choose the datasets you want to join. If no field is suggested, you can select the fields you want to use for the relationship.

Create a relationship

To learn how to create a relationship to join datasets, you can complete the steps below, or follow a sample use case to walk you through the process, including descriptions and results for each type of relationship.

1. Click the **Relationship view** button .
   The **Create Relationships** window appears and displays a list of datasets for your current page under **My Data**.

   Note: If you plan to use the Left or Right relationship types, make sure the dataset that should be on the left or the right is in the desired place. The dataset you choose first will appear on the left after you add it to the page.

   Tip: It's best practice to place the dataset that has the finest level of detail (the most granular) on the left. For the sample use case described below, the `StoreTransactions` dataset should be on the left.

2. Under **My Data**, click one or more datasets you want to join.
   When you select the first dataset, the view updates to show only those datasets that are eligible for a relationship.

   Insights analyzes the datasets you added and suggests a field to use for the join based on the type of data the field contains and the name of the field. If a field is suggested, thumbnails that represent each dataset are joined using a line, and the suggested field appears on each thumbnail as shown in the following screen shot:

3. Do one of the following:
   - If the suggested field is acceptable, and you want to use the default relationship type (Intersect), proceed to the step 8.
   - If you want to use a different field, add another field to join, or choose a different type of relationship, proceed to the next step.
   - If a common field could not be detected, a line appears between your dataset thumbnails, and the **Edit Relationship** window opens where you can choose the common fields. Proceed to step 6.
4. To edit relationship properties, such as choosing a different field, adding other fields to join, or changing the relationship type, click the **Edit relationship** button on the relationship line that connects the dataset thumbnails.
5. Choose a different field in one or more datasets, or choose a different relationship type, and close or click outside of the relationship properties dialog box.
6. Optional: If the relationship requires a composite key, you can add additional fields using the **Add fields** button under **Choose Fields**.
   For example, if you are joining `CityName` to `CityName`, you might also have to specify county, state, and country because values in `CityName` are duplicated in the dataset.
7. Do one of the following:

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- Click **Finish** (at the lower right) to proceed with the relationship.
- Click **Cancel** to undo the current relationship.

When you click **Finish**, the **Create Relationships** window closes. Your joined dataset appears as the uppermost dataset under **My Data** and is indicated with the result icon .

Sample use case

This section describes a sample use case that shows how you can create a relationship between two datasets to answer specific questions, and how each relationship type affects the data in the joined dataset.

The questions are as follows:

- What is sales revenue by store?
- Where is my highest grossing store located in the city?

There are two datasets on the workbook page that can help answer this question. The first is the following Excel table showing store transactions from three stores:

OrderID	StoreID	TotalAmount	PaymentMethod
1204	1	$91.48	Mastercard
1295	1	$103.86	Visa
1316	3	$97.81	Mastercard
1406	2	$103.24	Visa
1421	2	$44.95	Mastercard
1426	2	$153.71	Mastercard
1454	3	$168.95	Mastercard

The StoreTransactions dataset alone could provide a summary of `TotalAmt` by `StoreID` (if you change StoreID to a string field, and create a bar chart), but a report showing `TotalAmt` by a store name is preferred for the sake of clarity when it's time to share the analysis results with teams across the organization.

In addition, the StoreTransactions dataset cannot show the store locations on a map.

The second is a feature layer from portal showing the following six store locations:

StoreID	StoreName
1	Rock'n Veg Signature
2	Rock'n Veg II
3	Rock'n Veg The Third
4	Rock'n Veg Village Green
5	Rock'n Veg Valley
6	Rock'n Veg Town Square

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These datasets track data at two different levels of detail. The first dataset tracks data at the transaction level, which is a more detailed level than the second table, which tracks data at the store level.

As a result, you see duplicate records (rows) in the StoreID column in StoreTransactions, while StoreLocations has only unique records in its StoreID column. There are many transactions per store. This is what's referred to as a many-to-one relationship, a particular type of cardinality between the datasets.

Looking at these datasets, it's apparent that `StoreID` is the best field to use to create a relationship between these datasets.

To answer the questions for this use case, you need to do the following:

1. Consider the effect that each relationship type has on the resulting joined dataset.
2. Follow the instructions in Create a relationship (above) to create the relationship that works best for the input datasets.
3. Visualize the joined data to answer the questions.
   a. Using the `StoreName` and `TotalAmount` fields from the joined dataset, create a bar chart or a summary table to aggregate the fields.
      Sales are aggregated by each store name.
   b. Click the `TotalAmount` field, and create a proportional symbol map.

Relationship type considerations

The relationship type you use, along with the common field you choose, determines the records (rows) that you keep in the joined dataset. The following subsections provide a look at what the joined dataset looks like by relationship type.

Intersect relationship type

If you used the default relationship type while following the steps in Create a relationship (above), the joined dataset uses the Intersect relationship type (inner join).

Intersect keeps only the records that match both datasets. Null records are not added.

OrderID	StoreID	TotalAmount	PaymentMethod	StoreID	StoreName
1204	1	$91.48	Mastercard	1	Rock'n Veg Signature
1295	1	$103.86	Visa	1	Rock'n Veg Signature
1316	3	$97.81	Debit	3	Rock'n Veg The Third
1406	2	$103.24	Visa	2	Rock'n Veg II
1421	2	$44.95	Mastercard	2	Rock'n Veg II
1426	2	$153.71	Mastercard	2	Rock'n Veg II
1454	3	$168.95	Debit	3	Rock'n Veg The Third

The records that were excluded were records for StoreID 4 through 6 from the StoreLocations dataset.

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Using the default relationship type is a good choice to help answer the sample use case questions above. The Intersect relationship type provides data that will not show null values when you visualize your data.

All relationship type

The All relation type (full outer join) keeps all records from both datasets and treats records containing no matches as null values.

OrderID	StoreID	TotalAmount	PaymentMethod	StoreID	StoreName
1204	1	$91.48	Mastercard	1	Rock'n Veg Signature
1295	1	$103.86	Visa	1	Rock'n Veg Signature
1316	3	$97.81	Debit	3	Rock'n Veg The Third
1406	2	$103.24	Visa	2	Rock'n Veg II
1421	2	$44.95	Mastercard	2	Rock'n Veg II
1426	2	$153.71	Mastercard	2	Rock'n Veg II
1454	3	$168.95	Debit	3	Rock'n Veg The Third
				5	Rock'n Veg Valley
				6	Rock'n Veg Town Square
				4	Rock'n Veg Village Green

The resulting dataset contains null values in the columns originating from the left dataset (StoreTransactions) for records corresponding to `StoreIDs` 4, 5, and 6 from the right dataset (StoreLocations). This is because there are no matching records for those store IDs in the left dataset.

Left relationship type

When using the Left relationship type (left outer join), you must ensure that the dataset you want to retain the records from is on the left side of the **Create Relationships** window by selecting this dataset first. See Create a relationship for more information.

Records that match those from the dataset on the left (StoreTransactions) are retained, along with matching records from the dataset on the right (StoreLocations). If no match on the right is found, the right side contains null values.

OrderID	StoreID	TotalAmount	PaymentMethod	StoreID	StoreName
1204	1	$91.48	Mastercard	1	Rock'n Veg Signature
1295	1	$103.86	Visa	1	Rock'n Veg Signature

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1316	3	$97.81	Debit	3	Rock'n Veg The Third
1406	2	$103.24	Visa	2	Rock'n Veg II
1421	2	$44.95	Mastercard	2	Rock'n Veg II
1426	2	$153.71	Mastercard	2	Rock'n Veg II
1454	3	$168.95	Debit	3	Rock'n Veg The Third

This joined dataset looks exactly like the Intersect relationship type. To answer the sample use case questions, you can use either the Left or Intersect relationship type to create a relationship between the two tables, and then create a bar chart, which won't show null values.

If the left side (StoreTransactions) contained a record for `StoreID 7`, which is not in the StoreLocations dataset on the right, a Left join would have null records on the right.

OrderID	StoreID	TotalAmount	PaymentMethod	StoreID	StoreName
1204	1	$91.48	Mastercard	1	Rock'n Veg Signature
1295	1	$103.86	Visa	1	Rock'n Veg Signature
1316	3	$97.81	Debit	3	Rock'n Veg The Third
1406	2	$103.24	Visa	2	Rock'n Veg II
1421	2	$44.95	Mastercard	2	Rock'n Veg II
1426	2	$153.71	Mastercard	2	Rock'n Veg II
1454	3	$168.95	Debit	3	Rock'n Veg The Third
1502	7	$112.65	Cash		

Right relationship type

When using the Right relationship type (right outer join), you must ensure that the dataset you want to retain the records from is on the right side of the **Create Relationships** window by selecting the left dataset first, and the right dataset next. See Create a relationship for more information.

Records that match those from the dataset on the right (StoreLocations) are retained, along with matching records from the dataset on the left (StoreTransactions). If no match on the left is found, the left side contains null values.

OrderID	StoreID	TotalAmount	PaymentMethod	StoreID	StoreName
1204	1	$91.48	Mastercard	1	Rock'n Veg Signature
1295	1	$103.86	Visa	1	Rock'n Veg Signature
1316	3	$97.81	Debit	3	Rock'n Veg The Third

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1406	2	$103.24	Visa	2	Rock'n Veg II
1421	2	$44.95	Mastercard	2	Rock'n Veg II
1426	2	$153.71	Mastercard	2	Rock'n Veg II
1454	3	$168.95	Debit	3	Rock'n Veg The Third
				5	Rock'n Veg Valley
				6	Rock'n Veg Town Square
				4	Rock'n Veg Village Green

The resulting bar chart from the above right-joined dataset would contain null values.

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Map and visualize

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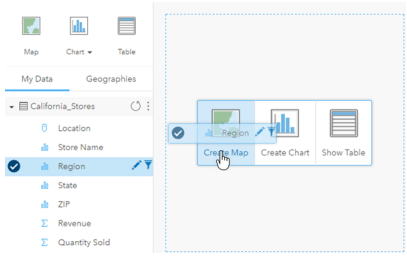
Create maps

To create a map, you must have added data to your page. If you added data from Portal for ArcGIS, a map card is created by default. If the dataset you added doesn't contain a Location field, you must enable location before you can create a map.

To create interactive maps, select a location, string, number, or rate/ratio field, or a complete dataset, from under **My Data** and drag it onto the page, or use the **Map** button at the top of the data pane.



Drag a layer or field to the Create Map drop zone to create a map. You can also create a map by selecting a field and clicking Map above My Data.

The role of the field that you select determines the type of map you create. You can also switch to a map from an existing chart or table. The type of map you switch to depends on the data inputs from the existing card. For example, a bar chart switches to a category map. A histogram switches to a proportional symbol map.

To learn more about the data requirements for each visualization type, see the Visualization catalog. From the catalog, you can see examples, and learn more about card properties you can change and interact with.

After you have a map on your page, you can begin exploring your data using spatial analysis tools or change the style of your map.

An icon showing an exclamation point indicates that the map is not displaying all of the features from the dataset.

Add or remove a layer

Maps represent data from different datasets as separate layers. A new layer can be added to the map by dragging a field from a different dataset to the **Add new layer** drop zone on an existing map.

A layer can be deleted from a map by expanding the **Layer Style** properties › and clicking the **Delete** symbol 🗑. You can also temporarily turn off a layer on a map by clicking the layer symbol next to the layer name in the **Legend**.

Change the Layer Style properties

The **Layer Style** properties can be accessed by clicking the arrow › next to a layer on a map. The options in the **Layer Style** pane are dependent on the type of data being mapped.

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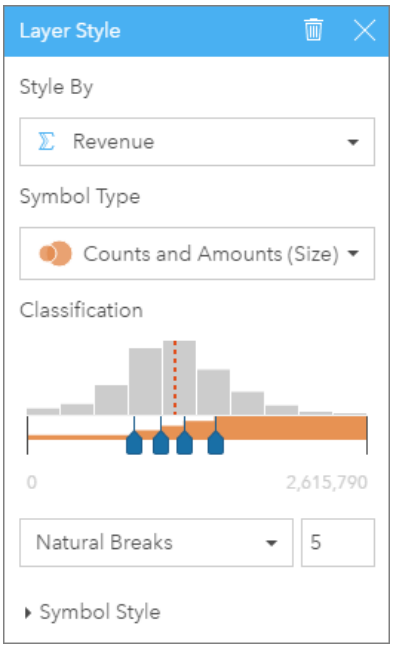

The Layer Style pane includes the Style By, Symbol Type, Classification, and Symbol Style properties.

The following table summarizes all of the potential properties for all types of data.

Property	Description
Style By	The **Style By** parameter depicts which field is being used to display the data on the map. This property is available for all features with location, string, number, or rate/ratio field roles.
Symbol Type	The **Symbol Type** parameter determines how the points, lines, or areas appear on the map. **Symbol Type** options depend on the type of features and field role being mapped. This property is available for all features.

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Classification	**Classification** is the method of grouping numeric data into ranges. The classification methods include **Natural Breaks**, **Equal Interval**, **Quantile**, **Standard Deviation**, **Unclassed**, and **Manual**. This property is available when using the **Counts and Amounts (Color)** or **Counts and Amounts (Size)** symbol type.
Symbol Style	The **Symbol Style** parameter is used to change the appearance of the features on a map. This property is available for all features. The style options available in this parameter depend on the type of features being mapped.

Style By

The **Style By** parameter depicts which field is being used to display the data on the map. You can use the drop-down menu to change the **Style By** parameter to a different field. You can also select a field from the layer being mapped in **My Data** and drag the layer to the map to change the style.

Any field with a location, string, number, or rate/ratio field role can be used to style a layer. Date/Time fields cannot be styled on a map.

Symbol Type

Symbol types determine how symbols are rendered on your map. Options in **Symbol Type** reflect the supported map renderers in Insights. Smart mapping defines how symbol types are shown on a map based on the role of the field you're showing. The following table lists smart mapping symbol types supported by Insights, as well as the applicable field roles, and the maps they produce:

Symbol Type	Features	Description

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Counts and Amounts (Color)	Feature types: Points, lines, and areas Field roles: Number and rate/ratio	The **Counts and Amounts (Color)** symbol type uses graduated colors to style numeric values. The color ramp used can be either sequential or diverging: • Sequential—A single color that ranges from light to dark is used to display data. Usually the data that has a more neutral meaning will be light, while higher values or values with more meaning will be dark. • Diverging—Two colors are used to display data with important meaning at both the low and high extremes. The colors have dark shades at the lower and upper extremes and neutral colors in the middle. Using **Counts and Amounts (Color)** as the symbol type results in a choropleth map. This is the default symbol type for rate/ratio fields.

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Counts and Amounts (Size)	Feature types: Points, lines, and areas Field roles: Number and rate/ratio	The **Counts and Amounts (Size)** symbol type uses graduated symbols to style numeric values. The symbol size will reflect the size of the numbers, with the smallest numbers being styled with the smallest symbols and the largest numbers being styled with the largest symbols. Using **Counts and Amounts (Size)** as the symbol type results in a proportional symbol map. This is the default symbol type for number fields.
Heat Map	Feature types: Points Field roles: Location, string, number, and rate/ratio	The Heat Map symbol type uses points in the layer to calculate and display the relative density of points on the map as smoothly varying sets of colors ranging from cool (low density of points) to hot (many points).
Location (Single Symbol)	Feature types: Points, lines, and areas Field roles: Location	The **Location (Single Symbol)** symbol type uses uniform symbols for all features. Styling features by location only helps you to focus on the distribution of features, rather than field values. Using **Location (Single Symbol)** as the symbol type results in a location map. This is the default symbol type for location fields.

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Types (Unique Symbols)	Field roles: Location, string, number, and rate/ratio	The **Types (Unique Symbols)** symbol type uses a different color for every unique value in the field being symbolized. It is most common to use **Types (Unique Symbols)** when mapping categorical data (string fields) with relatively few unique field values. Using **Types (Unique Symbols)** as the symbol type results in a category map. This is the default symbol type for string fields.

While smart mapping symbol types provide effective maps right away, sometimes you may want your map to use a predefined symbol type from an ArcGIS dataset (for example, an ArcGIS feature layer that shows crime incidents as point data in red). If your dataset originated from Portal for ArcGIS, you'll see the **Original** symbol type. This option allows you to revert to the original symbol settings for symbol color, shape, size, and transparency.

Legend

The **Layer Style** pane for layers styled by the **Counts and Amounts (Size)**, **Counts and Amounts (Color)**, and **Types (Unique Symbols)** symbol types also includes an interactive legend.

For layers styled with **Counts and Amounts (Size)** and **Counts and Amounts (Color)**, the legend displays a histogram of the field being displayed, the location of the mean, the minimum and maximum values, and the location of each break. For **Counts and Amounts (Size)**, the relative size of each bin is also displayed, whereas for **Counts and Amounts (Color)**, the color of each bin is given. You can select bins in the legend and your selection will be reflected on the map.

For layers styled with **Types (Unique Symbols)**, the legend displays each unique value, its symbol color, and the count of features with each value. You can select values in the legend and your selection will be reflected on the map.

Classification

When you map numeric data using **Counts and Amounts (Size)** or **Counts and Amounts (Color)**, numbers are automatically grouped into classes using the natural breaks classification method. Classification allocates observations into each class and uses graduated symbol size or color to represent the classes.

Classification method	Description

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Natural Breaks	Classes are based on natural groupings inherent in the data. This is the default classification. The default number of bins is 5.
Equal Interval	Divides the range of attribute values into equal-sized subranges. The default number of bins is 5.
Quantile	Divides the attributes into bins with equal numbers of features. The default number of bins is 5.
Standard Deviation	Classifies a feature based on how much the feature's attributes vary from the mean. The number of bins used will depend on your data.
Unclassed	Numeric data is displayed on a continuous scale, rather than in discrete classes. There are no bins used in the **Unclassed** method.
Manual	Manually add class breaks that are appropriate for your data. There are no bins used in the **Manual** method.

Symbol Style

After you choose your data and symbol type, you can adjust **Symbol Style** properties, such as color, shape, and transparency. The **Symbol Style** options will vary based on the symbol type and type of features.

Symbol Type	Features	Properties
Counts and Amounts (Color)	Points, lines, and areas	Color ramp, **Divide by**, **Transparency (%)**
Counts and Amounts (Size)	Points, lines, and areas	Color, **Divide by**, **Transparency (%)**
Heat Map	Points	**Transparency (%)**

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Location (Single Symbol)	Points	Color, Shape, **Symbol Size (px)**, **Transparency (%)**
	Lines	Color, **Line Thickness (px)**, **Transparency (%)**
	Areas	Color, **Transparency (%)**
Types (Unique Symbols)	Points	**Symbol Size (px)**, **Transparency (%)**
	Lines	**Line Thickness (px)**, **Transparency (%)**
	Areas	**Transparency (%)**

Divide by calculates a rate/ratio by dividing the number field you used to style your map by the number field you select from the list. This allows you to calculate a rate/ratio on the fly if your dataset doesn't already contain normalized data.

Note:
- If you used a rate/ratio field, **Divide by** is not available because the field is already identified as a normalized field.
- An error will occur if an aggregated field is used to normalize database data using the **Divide by** property. Normalizing an aggregated field from a database dataset will also cause an error.

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Create charts

To create interactive charts, select one or more string, number, rate/ratio, or date fields from under **My Data** and drag them onto the page, or use the **Chart** button at the top of the data pane.

You can also switch to different supported visualization types from existing cards.

Change variables

As the data story emerges from your visualizations, you can show different data and adjust properties such as grouping your data, as well as change chart styling. Editable fields on charts are shown in gray drop-down boxes. You can choose a different field to show on one axis or both axes. Click an editable field on your chart, and choose a different field from the list.

Visualizations that summarize data, such as bar charts, time series graphs, line graphs, and summary tables allow you to choose a different statistic type. For example, you can switch from displaying the sum of sales per region to the average sales per region by using the statistic type drop-down menu.

Use the chart toolbar

Every card has a toolbar that can be used to find more information or improve the appearance of your data.

Tool	Description	Applicable charts
Legend	The **Legend** button can be used to change the display color or make selections on the graph. Some charts may also have the option to switch between single symbol and unique symbols.	All
Chart statistics	The **Chart statistics** button can be used to display relevant statistical calculations about your data. The following statistics can be displayed: • **Mean** • **Median** • **Upper Quartile** • **Lower Quartile** • **Custom**	Bar chart, column chart, scatter plot, time series, line graph

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Card filter	The **Card filter** button can be used to remove any unwanted data from your chart. Filters can be applied to all string, number, rate/ratio, and date fields. A card filter does not affect other cards using the same dataset.	All
Selection tools	Selections can be used to highlight important features. Selections on one card are reflected on any other card using the same data. The following selection tools may be available on your chart: • **Select** • **Box select** • **Invert selection**	Bar chart, column chart, histogram, scatter plot, time series, treemap, bubble chart, line graph, combo chart
Visualization type	The **Visualization type** drop-down menu shows all available card types. The drop-down list can be used to quickly change your card to a map, summary table, or another type of card. The availability of visualizations depends on what type of data is being displayed on your card.	All
Sort	The **Sort** option is available for most charts that use a string field. The following sort options are available: • **Sort Ascending** • **Sort Descending** • **Sort Alphabetically**	Bar chart, column chart, line graph

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Info ⓘ	The **Info** button flips the card to display information about your chart, such as a description of your analysis and a time stamp for when your data was last updated, if applicable.	All
Delete 🗑	The **Delete** button removes the card from your page. If you did not mean to delete your card, you can retrieve it using the **Undo** button.	All

Create a bar chart

You can create a bar or column chart in the following ways:

- From selected data in the data pane
- From an existing card using the **Visualization type** button
- From a map layer

Create a new bar chart card

1. From **My Data**, choose one string field.
   Bar charts use the selected string field to group data along the category axis.
2. Optionally, you can also choose one or both of the following fields:
   - Click to select one numeric or rate/ratio field. This additional field will show a sum statistic type for each category in the chart. If you don't choose a number or rate/ratio field, the chart will provide a default count of the number of times that each string value occurs in the dataset.
   - Click to select a second string to divide your categories into subgroups. The additional string you select will appear in the chart's **Group By** field.
3. Do one of the following:
   - Drag your selections onto the **Create Chart** drop zone.
   - Click the **Chart** button above **My Data**.

   A bar chart appears on your page.

Note: You can switch to a column chart from a related visualization type, such as a bar chart.

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Create a bar chart from an existing card

Switch to a bar chart

You can switch to a bar chart from a related visualization type. Related visualizations use the same data inputs.

1. Click one of the following cards on your page to see the card toolbar:
   - Bubble chart
   - Category map
   - Column chart
   - Pie chart
   - Line graph
   - Summary table
   - Treemap
2. Click the **Visualization type** button .
3. Click **Bar chart**.

Create a bar chart from a map card

1. Click a category map on your page.
2. Click the layer in the map legend to select it.
3. Drag a map layer from the legend onto the **Create Chart** drop zone on your page.

Create a bubble chart

There are two kinds of bubble charts. One type represents a category and a statistic for unique categorical values, and the other shows the relationship among three number or rate/ratio fields.

Create a bubble chart from a related visualization

You can switch to a bubble chart from a related visualization type that calculates statistics for unique category values. Related visualizations use the same data inputs.

1. Click one of these related visualization types on your page:
   - Bar chart
   - Category map
   - Column chart
   - Pie chart
   - Line graph
   - Summary table
   - Treemap

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2. Click the **Visualization type** button .
3. Click **Bubble chart**.
   The bubble chart appears on your page.

Create a bubble chart from a scatter plot

You can change a scatter plot to a bubble chart by adding a third number or rate/ratio field.

1. From the data pane, click to select the third number or rate/ratio field you want to add to the scatter plot.
2. Drag the selected field onto the scatter plot.
   The scatter plot changes to a bubble chart. The number or rate/ratio field you added is used to size the proportional symbols on the chart.

Create a combo chart

You can create a combo chart (column chart and line graph combination) using data from two different datasets, provided that you choose the same string field common to both datasets. This chart allows you to visualize two numbers for the same categories. For example, you could visualize temperature and precipitation readings for cities.

1. From the data pane, click to select one string field, and one number or rate/ratio field for the columns or line.
2. Do one of the following:
   - Drag your selections onto the **Create Chart** drop zone on your page.
   - Click the **Chart** button above **My Data**.

   A bar chart appears on your page.
3. Click the **Visualization type** button , and choose either **Column chart** or **Line chart**.
4. Choose the same string field from step 1 and choose a different number or rate/ratio field.
5. Drag the data onto the column chart.
   A combo chart appears on your page.

Create a histogram

You can create a histogram in the following ways:

- From a number or rate/ratio field you select in the data pane
- From an existing card using the **Visualization type** button
- From a map layer by dragging, or using the **Action** button

Create a new histogram card

1. From the data pane, click to select one number or rate/ratio field.
2. Do one of the following:
   - Drag your selection onto the **Create Chart** drop zone on your page.

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- Click the **Chart** button above **My Data**.

A histogram appears on your page.

Create a histogram from an existing card

Switch to a histogram

You can switch to a histogram from a related visualization type. Related visualizations use the same data inputs.

1. Click one of the following cards on your page to see the card toolbar:
   - Map (proportional symbol or choropleth)
   - Summary table
2. Click the **Visualization type** button .
3. Click **Histogram**.

Create a histogram from a map card

You can drag a map layer from a proportional symbol map or a choropleth map.

1. Click a proportional map or a choropleth map on your page.
2. Click the layer in the map legend to select it.
3. Drag a map layer from the legend onto the **Create Chart** drop zone.

You can also create a histogram from any map using the **Action** button .

1. Click a map card to see the card toolbar.
2. Click the **Action** button .
3. Click the **Find answers** tab.
4. Click the **How is it distributed?** option.
5. Click **View histogram**.
6. Choose a map layer, if your map has more than one layer.
7. Choose a number or rate/ratio field.
8. Click **Run**.
   A histogram card appears as a separate card on your page. You can move the histogram anywhere you like on your page.

Create a line graph

You can switch to a line graph from a related visualization type. Related visualizations use the same data inputs.

1. Click one of these related visualization types on your page:
   - Bar chart
   - Bubble chart

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- Category map
- Column chart
- Donut chart
- Summary table
- Treemap

2. Click the **Visualization type** button .
3. Click **Line Chart**.
   The line chart appears on your page.

Create a donut chart

You can switch to a donut chart from a related visualization type. Related visualizations use the same data inputs.

1. Click one of these related visualization types on your page:
   - Bar chart
   - Category map
   - Column chart
   - Line graph
   - Summary table
   - Treemap
2. Click the **Visualization type** button .
3. Click **Donut chart**.
   The donut chart appears on your page.

Create a scatter plot

You can create a scatter plot from data you choose in the data pane, or from an existing map card.

Create a new scatter plot card

Scatter plots visualize the relationship between two numeric variables.

1. From the data pane, click to select two number or rate/ratio fields.
2. Optionally, click to select a string field to color points in your scatter plot by unique categories.
3. Do one of the following:
   - Drag your selections onto the **Create Chart** drop zone on your page.
   - Click the **Chart** button above **My Data**.

   A scatter plot appears on your page. The values from the first numeric field that occurs in your dataset appear along the x-axis. Values for the second numeric field in your dataset appear along the y-axis.

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Create a scatter plot from any map on your page.

1. Click a map card to see the card tool bar.
2. Click the **Action** button .
3. Click the **Find answers** tab.
4. Click the **How is it related?** option.
5. Click **View Scatter Plot**.
6. Choose a map layer, if your map has more than one layer.
7. Click to select two number or rate/ratio fields.
8. Click **Run**.
   A scatter plot appears as a separate card on your page. You can move the scatter plot anywhere you like on your page.

Create a time series graph

You can create a time series graph in the following ways:

- From selected data in the data pane
- From a map layer

Create a new time series card

1. From **My Data**, choose one date/time field.
   Time series charts use the selected date/time field on the category axis.
2. Optionally, you can also choose one or both of the following fields:
   - Click to select one number or rate/ratio field. This additional field will show a sum statistic type for each category in the chart. If you don't choose a number or rate/ratio field, the chart will provide a default count.
   - Click to select a string field to divide your time series into categorical groups represented with additional lines, each shown with a different color. The string you select will appear in the graph's **Group By** field.
3. Do one of the following:
   - Drag your selection onto the **Create Chart** drop zone on your page.
   - Click the **Chart** button above **My Data**.

   A time series graph appears on your page.

Create a time series graph from an existing card

1. Click a map card to see the card tool bar.
2. Click the **Action** button .
3. Click the **Find answers** tab.
4. Click the **How has it changed?** option.
5. Click **Line graph**.

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6. Choose a map layer, if your map has more than one layer.
7. Choose one date/time field.
8. Choose one number or rate/ratio field.
9. Click **Run**.
   A time series graph appears as a separate card on your page. You can move the time series graph anywhere you like on your page.

Create a treemap

You can switch to a treemap from a related visualization type. Related visualizations use the same data inputs.

1. Click one of these related visualization types on your page:
   - Bar chart
   - Bubble chart
   - Category map
   - Column chart
   - Donut chart
   - Line graph
   - Summary table
2. Click the **Visualization type** button .
3. Click **Treemap**.
   The treemap appears on your page.

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Summary tables

A summary table can be used to show statistics—including sum, average, minimum, and maximum—for unique categorical groups, or numeric totals if you choose only number or rate/ratios fields to create the table. A summary table can provide multiple statistics—one for each numeric column.

Note: A summary table can only have one category column. You can choose either a string or location field to provide unique categorical values for the column.

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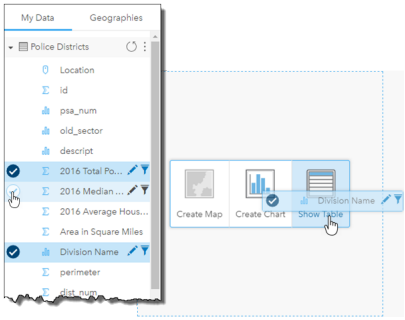
Create a summary table

You can create a summary table by selecting fields from **My Data** or by changing the visualization type of an existing card.

To create a new summary table, select one or more fields and drag them to the **Show Table** drop zone or click **Table** in the data pane.



A summary table can be created by selecting one or more fields and dragging them to the Show Table drop zone.

Note: A summary table can contain only one category column. Either one string or one location field can be selected to provide unique categories in the category column. You can select two or more numeric or rate/ratio fields to be summarized.

Organize data

Data in a summary table can be organized using **Sort Fields** and by re-ordering column orders. You can sort a single column, or sort multiple columns in the table using Shift+click on multiple fields. Columns can be re-ordered by clicking and dragging a column to a new position.

Filter data

You can apply a card-level filter to your summary table if you want to remove unnecessary text, number, or date values. To apply a filter, click **Card Filter** on the summary table and choose the field you want to filter. You can apply multiple filters to the same table. Only data that meets the criteria for all filters will be displayed in the summary table.

Applying a card filter will not affect other cards using the same dataset.

Make selections

Features in summary tables can be selected by clicking a single feature, or by clicking and dragging the pointer over the desired features, using Shift+click, or using Ctrl+click. The selected features will be represented in the summary table as well as other maps, charts, or tables displaying the same data. Once a selection has been made on a summary table, the following options will be available:

- Invert a selection—Click the **Invert selection** button to switch your selected features. The inverted selection will be reflected in all other cards displaying the same data.
- Show a selection—Click the **Show selection** button to show only your selected features in the summary table. The features that are not selected are temporarily removed from the summary table. The selected features will remain selected on all other cards displaying the same data, but no other changes will take place on those cards. You can show the

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unselected features again by clicking **Show selection** a second time. The selected features will remain selected until you click the scroll bar in the summary table or in another card.

Making a selection is different from applying a filter, because selections are more temporary and are reflected on all cards using the same dataset.

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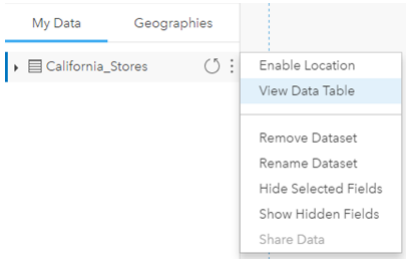
Use data tables

Data tables can be an important resource for your analysis. A data table displays your raw data and gives you the ability to sort, select, and make calculations using that data.

Open a data table

A data table can be opened using the **Dataset options** button ⋮ next to a dataset in **My Data**.



Add and calculate fields

Use the **+ Field** button to add a new field to your data table. You can click a field name to rename the field. The field will be saved in Insights unless you delete it, but it will not be added to the source data.

Once a field has been added and that field is selected, the option to calculate the field will appear. Click in the **Enter calculate function** box for a drop-down menu with field names and simple mathematical operations. More complex calculations can be performed using functions. Insights supports string, number, and date functions, which can be accessed using the **fx** button.

When a calculation is complete, a green checkmark will appear and the **Run** button will be enabled.

Sort fields

You can sort a field in a data table by clicking the arrows next to a field name. Clicking once will activate the down arrow, which sorts the field in ascending order; clicking a second time will activate the up arrow, which sorts the field in descending order; clicking a third time will deactivate all arrows and reset the field to its original order.

A data table can also be sorted by more than one field. Press Shift+click to choose more than one field to sort.

Make selections

Features in a data table can be selected by clicking a single feature or clicking and dragging the pointer over the desired features, pressing Shift+click, or pressing Ctrl+click. The features will be selected in the data table as well as any maps, charts, or other tables displaying the same data. Once a selection has been made in a data table, the following options will be available:

- Invert a selection—Click the **Invert selection** button to switch your selected features. The inverted selection will be reflected in all other cards displaying the same data.
- Show a selection—Click the **Show selection** button to show only your selected features in the data table. The features that are not selected will be temporarily removed from table. The selected features will remain selected on all cards displaying the same data, but no other changes will take place to those cards. You can show the unselected features again by clicking **Show selection** a second time. The selected features will remain selected until you select a different set of features or click away from the selected features.

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Note: Unlike filtering, selections on data are temporary. While selections do not change the source data, they do affect the results of an analysis or statistical summary because these functions only use the current selection. However, selections do not update previously executed spatial analytics.

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Interact with cards

The key to fully understanding your data is to interact with two or more visualizations from the same dataset. Cards created from fields from the same dataset are linked, allowing you to make selections on one card and see related cards update to highlight your selections.

When you have different types of cards on the page, making selections, filtering, accessing statistics, and other interactions can reveal spatial, temporal, numeric, and categorical patterns that may not have been apparent in a single visualization. To see the variety of ways you can visualize your data, see the Visualization catalog.

Make selections

Selections allow you to temporarily target areas of interest, such as unusual highs or lows in your data, and highlight those data points in related maps, charts, and tables. Unlike filtering, selections on cards are temporary. While selections do not change the source data, they do affect the results of an analysis or statistical summary because these functions only use the current selection. However, selections won't update previously executed spatial analytics.

Map and chart cards

This example involves the number of crimes committed over a span of time in a time-series chart grouped by `CrimeType`, and a category map styled by `CrimeType`. Is there a pattern evident among factors, such as the type of crime, the number of crimes, and where the crimes are committed?

1. Click the point of interest on the card. For example, click a peak in the number of aggravated assaults in the grouped line chart.
   The card toolbar appears, and related cards update to reflect your selection.
2. To make multiple selections, do one of the following:
   - Click a category from the expanded legend on a category map, or the legend from a grouped bar or line chart, to select all data from the chosen category.
   - Press Ctrl + click or Shift + click before clicking your selections
   - Click **Selection tools** to access other tools, such as the **Lasso**, **Box select**, or **Invert Selection** tools.

     Tip: Inverting your selections is a quick way to exclude outliers from your map selections. Select a single feature or multiple features that you want to exclude, and click the **Invert Selection** button. All features except the ones you selected are highlighted.

   Related maps, charts, and tables update to show applicable selections. For example, when the time-series line is selected, the category map highlights where these crimes occurred. The map can show you whether the incidents are concentrated in a certain location or spread across a number of districts. The map may also reveal clusters of other crime types in the area during this spike.
3. To zoom to selected features on a map, click **Zoom to selection**.
4. To clear selections on a card, click a blank area on your card (outside your selections).

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Tip: Selections can be used to spatially filter data and to create other maps, charts, or tables by dragging and dropping selections onto the map, chart, or table drop zone on your page.

Summary tables

Features in summary tables can be selected by clicking and dragging your mouse over the desired features, using Shift + click, or using Ctrl + click. The selected features will be represented in the summary table as well as any other maps, charts, or tables displaying the same data. Once a selection has been made on a summary table, the following options will be available:

- Invert a selection: Click the **Invert selection** button to switch your selected features. The inverted selection will be reflected in all other cards displaying the same data.
- Show a selection: Click the **Show selection** button to show only your selected features in the summary table. The features that are not selected will be temporarily removed from the summary table. The selected features will remain selected on all other cards displaying the same data, but no other changes will take place to those cards. You can show the unselected features again by clicking **Show selection** a second time. The selected features will remain selected until you click the scrollbar in the summary table or inside another card.

Navigate maps

- To zoom, use the **Zoom in** and **Zoom out** buttons, or the scroll wheel on your mouse.

  Note: Features stored in Microsoft SQL Server using the `geography` data type may not appear in maps at all zoom levels. This occurs when Microsoft SQL Server cannot process the map extent that is being requested by Insights. This is because the features stored in SQL Server contain anti-podal edges, and consequently they don't have a determinate path. Click the **Zoom in** or **Zoom out** button to see features on your map.

- To pan, use your mouse or the arrow keys on your keyboard.

  Note: While the map's full extent covers the world, the data doesn't wrap around when you pan on a map.

- After panning and zooming on a map, use the **Home** button to return to the maps's default extent.

  Tip: If you want all of the maps on your page to display the same spatial extent when you zoom and pan, turn on **Sync Maps**. It's helpful to have all the maps on your page update to reflect the location and zoom level for your area of interest.

Filter data to target your analysis

Filters help reduce the scope of the data you work with, but they don't change the underlying data. Filters limit what you see on the page or card from one session to another session until you change or reset the filters. You can filter dates, numbers, rate/ratios, and string fields at the dataset level or for an individual card.

One or more filters can be:

- Applied to a single card

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- Applied to all cards from the same dataset
- Cumulative so you can filter at both the dataset and card level

Note:
- Filtering a calculated field from a database dataset is not supported for both dataset and card filters.
- If you adjust your card filters to the point where no results are returned, a card error appears. Filter settings that show no values display a blank map, chart, or table. Try readjusting your filters.

Filter types (sliders versus check boxes)

Insights field roles determine the type of filter you see when you access a filter from the dataset or the card. When the field contains continuous data—expressed as a range—you see a slider. Continuous data can be the following:

- A number Σ, such as `Revenue`
- A rate/ratio, such as `EmploymentRate`
- A date/time field, such as `ReportDate`

When a field contains discrete data, each value has a distinct label and an associated check box. A string field, such as `DominantTapestryName`, contains discrete values, such as `Old and Newcomers`, `Golden Years`, and `Professional Pride`. Each of these values has its own check box in the card or dataset filter.

Number and rate/ratio filter

When you filter a number or a rate/ratio, you see a histogram with a slider along the bottom. The histogram shows you the frequency with which numeric values occur in the field. This allows you to see how much data you're including or excluding with your filter.

Adjust the slider at the lower and upper end of the range, or type the upper and lower limits in the field provided.

Date/time filter

When you filter a date/time field, you can adjust start and end dates or times using a slider.

Adjust the slider, or type the upper and lower limits in the field provided to filter values.

String filter

When you filter a string field, you can clear specific values, or clear all values and choose only those you want.

Do one of the following:

- Uncheck values from the list, and leave checked values to show in your visualization(s)
- Click **Select All** to clear all values, and add a check to only those values you want to show

Filter at the dataset level

After you filter one or more fields at the dataset level, existing cards update to reflect the filter settings, and any card you create automatically includes or excludes the data from the filter. Use one or more dataset filters when most of your questions are

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aimed at a specific subset in your dataset. For example, What is the rate of home ownership among the retired population in Illinois?

To target the analysis across the dataset, apply a filter to the following fields:

- `Age` field to see only numbers for those 65 or older
- `State` field to limit the scope to Illinois
- `Income` field to see only income levels $30,000 and higher

1. Under **My Data**, click the name of the field you want to filter.
2. Click the **Dataset filter** button next to the field.
3. Adjust the filter to include the data you want to show on your cards.
4. Click **Apply**.

   All of the cards from the same dataset update to reflect the filter settings.

Filter at the card level

At times, you may want to pursue a focused scenario on just one card, such as an outlier in your data. For example, neighborhoods in a city with higher levels of home ownership than surrounding neighborhoods. For this example, you could filter the `CensusTract` field to include only neighborhoods of interest.

1. Click the card you want to filter.
2. Click the **Card filter** button .
3. If there's already a filter for this card, click **+ New Filter**. If this is the first filter for the card, skip to the next step.
4. From the list, choose the field you want to filter.
5. Adjust the filter to include the data you want to show on your cards.
6. Click **Apply**.
   Only the current card updates to reflect your filter settings.

Remove or update your filter

Dataset filters

If there are filters for your dataset, you see a filter button next to each filtered field.

1. Click the **Dataset filter** button next to the field.
2. Click the **Remove filter** button .
   The filter is removed.

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Card filters

1. Click the card you want to filter.
2. Click the **Card filter** button .
3. Under **Card Filters**, do one of the following:
   - Click the filtered field to change your filter setting.
   - Click the **Remove filter** button to delete your filter.

Maximize a card

When you interact with a card, you may want to enlarge the card to get a better view of the data. Maximizing the card creates a filmstrip view of the cards on your page, with the maximized card at the top, and thumbnails of the remaining cards arranged below.

Note: You can also interact with the cards in the filmstrip view. However, the card thumbnails won't display pop-ups because of the size constraints on the minimized cards.

Click **Maximize** to expand your card.

Click **Restore down** to return to the previous page view of your cards.

View pop-ups

Pop-ups provide a quick overview of a single feature on a map or an aspect of a chart, such as a bar or point.

To see a pop-up on a map, click a point, line, or polygon. The pop-up displays on the map.

To see a pop-up on a chart, click a point, bar, or slice.

See card statistics

Summary statistics provide a quick overview of your data. Statistics vary based on the type of chart or map you're interacting with.

Summary statistics on maps include count, minimum, maximum and mean, but vary depending on the type of data you're mapping. Maps made from datasets that are editable at the data source will also have a timestamp, which will tell you the time that the version being viewed was last updated. If the data is not up-to-date, then the dataset or workbook can be refreshed to show the latest copy of the data.

Chart statistics also vary by chart type. For example, bar chart statistics include count, mean, median, and upper or lower quartiles.

Statistics on summary tables include sum, average, minimum, and maximum. The statistics are calculated on number or rate/ratio fields for each unique value in the category column. Summary tables also include a footer statistic, which displays an overall statistic for the number or rate/ratio field.

Access chart statistics

Click the **Chart Statistics** button to see available statistics.

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Access map statistics

Click the **Info** button ⓘ to turn the map card over and see summary statistics.

Hide or show a legend on a card

By default, all map cards list one or more layers as a collapsed legend.

Legends on maps

1. Click the map to show the toolbar.
2. Do one of the following:
   - Expand the legend for a layer to see Layer Style properties.
   - Hide the legend by clicking the **Legend** button.

Legends on cards

1. Click the chart to show the toolbar.
2. Click the **Legend** button to show the legend.

Change the visualization type

You get a different perspective on your data when you change to a related visualization type. For example, if you change from a choropleth map to a histogram, you can see how your numeric data is distributed, such as which numeric ranges are the most or least concentrated, or whether or not the data is skewed.

Related visualization types are determined by the data in your visualization. To see which visualization types are supported by your card, see the Visualization catalog.

1. Click the card to see the toolbar.
2. Click the **Visualization type** button.
   Applicable visualization types can be chosen in the list. If all the visualization types are unavailable, you can't change the visualization type.
3. Click a visualization type in the list.
   The card changes to the chosen visualization type, for example, a histogram.
4. To return to the previous visualization, click the **Visualization type** button, and choose the visualization from the list.

Change the title of the card

By default, cards are assigned a title based on the order in which they are created, for example Card 1, Card 2, and so on. You can provide a more meaningful title if you wish. You can see a card title when the card is not selected.

1. If you have selected the card, click outside the card to unselect it.
   You can see the card title. For example, **Card 1**.
2. Click the card title.

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The title field turns gray.

3. Enter a new title, and click **Enter** (or click off the card).

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Find answers with analytics

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Apply spatial analytics

To apply spatial analytics, you must have at least one map on your page.

Performing spatial analytics generates a dataset of your results under **My Data**. You can visualize data from your results as other maps, charts, and tables.

If you're unhappy with your results, you can rerun your spatial analytics using different parameters from the **Analysis view**.

If you think your results may be useful to others, you can share your data as a feature layer.

Note: The administrator of your organization needs to grant you certain privileges (https://enterprise.arcgis.com/en/portal/10.5/use/roles.htm) for you to perform analysis.
To use any of the analysis tools, you need the following privileges:

- **Create, update, and delete** content
- **Publish hosted feature layers**
- **Standard Feature Analysis**

Certain tools need additional privileges, such as the Network Analysis and GeoEnrichment tools. See the table below for more information.
Credits are consumed for transactions such as enabling location for your data by address (geocoding) if your portal is configured with Esri World Geocoding Service, and applying certain spatial analytics, such as buffer by travel mode and GeoEnrichment, that consume ArcGIS Online utility services configured with your portal.

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Spatial analytics overview

The following table provides an overview of each type of spatial tool:

Tool	Description	Example questions
Create Buffer/Drive Times	This tool creates a zone around a point or line feature measured in units of distance or time. You can use the resulting buffer layer to perform spatial aggregation on point features and to calculate statistics such as a sum of revenue. **Note:** To use the **Dissolve** buffer style, your portal must have the Geometry utility service configured. Also, to specify buffer distances, such as walking time or trucking distance, your portal must also have travel modes configured. See Important portal settings for Insights features. Inputs: One point, line, or area layer	What's nearby? How many crimes occurred within one kilometer of each police station? Which land parcels are within a quarter mile of a light rail stop?
Spatial Aggregation	This tool works with a layer of point features and a layer of area features. It first figures out which points fall within each area. After determining this point-in-area spatial relationship, statistics about all points in the area are calculated and assigned to the area. The most basic statistic is the count of the number of points within the area, but you can get other statistics as well. Inputs: • One point, line, or area layer • One area layer	How is it distributed? How many crimes occurred within one kilometer of each police station? Which counties have the most damage caused by tornadoes?

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Spatial Filter	This tool filters points based on a single area feature or an area layer you select. Only points contained in the specified area feature or layer will show in the resulting map layer. Inputs: • One point layer • One area layer	What's nearby? How many crimes occurred in District 13?
Enrich Data	This tool enriches your point or area data by getting facts about the people, places, and businesses that surround your data locations. Enrich Data enables you to answer new questions about locations that you cannot answer with maps alone, for example, What kind of people live here? What do people like to do in this area? What are their habits and lifestyles? What kind of businesses are there in this area? To use Enrich Data, your portal must have the GeoEnrichment utility service configured, and you must have the GeoEnrichment privilege (https://enterprise.arcgis.com/en/portal/10.5/use/roles.htm). Inputs: One point, line, or area layer	How is it related? Do neighborhoods with higher income levels experience more break and enters? What is the median age in the neighborhood surrounding each library branch?
Calculate Density	The Calculate Density tool creates a density map from point or line features by spreading known quantities of some phenomenon (represented as attributes of the points or lines) across the map. The result is a layer of areas classified from least dense to most dense. Inputs: One point or line layer	How is it distributed? What is the number of drug crimes in a police district per square mile compared to different parts of the city? What is the density of a bird species across North America?

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Find Nearest	This tool finds the nearest features and, optionally, reports and ranks the distance to the nearby features. To find what's nearby, the tool can either measure straight-line distance or a selected travel mode. There are options to limit the number of nearest features to find or the search range in which to find them. **Note:** To use the Find Nearest tool, your portal must have the Routing utility service configured, and you must have the Network Analysis privilege (https://enterprise.arcgis.com/en/portal/10.5/use/roles.htm). Inputs: Two point, line, or area layers	What's nearby? What is the proximity of drug crimes to elementary and high schools? Which fire stations should be the primary and secondary responders for each school?

Note: You can use boundary layers from the **Geographies** section of the **data** pane for your spatial analytics. Geographies are helpful when your data does not include area locations. For example, if you want to summarize the number of votes for an electoral district, you can use the electoral district geography in your analysis. You can also use custom boundaries, such as police districts, if you've added custom boundaries to your workbook.

Create a buffer or drive time area

Buffers allow you to get summary information about the features contained within them. For example, creating a buffer layer is the first step in answering the question: How many crimes occurred within one kilometer of each police station?

Note: A buffer layer created for non-projected features (a map layer with a geographic coordinate system) does not align with the input features.

1. Click the map you want to analyze.
2. Click the **Action** button .
3. Do one of the following:
   - From the **All tools** tab, click the **Create Buffer/Drive Times** tool.
   - From the **Find answers** tab, choose **What's nearby?** and click **Create Buffer/Drive Times**.

   The **Create Buffer/Drive Times** pane appears. The topmost point layer on the map is chosen by default. You can choose a different buffer layer if your map has more than one point layer.

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4. Choose the distance and units. By default, **Fixed Distance** is chosen.
   a. Enter a number.
   b. Enter the unit for distance buffers or amount of time.
5. Choose the buffer style from the following:

Option	Description
Overlap	Creates circular buffers with distinct boundaries that can overlap each other. This option is the default.
Dissolve	Creates buffers that may appear irregular in shape. Adjacent buffer boundaries dissolve rather than overlap, combining into irregular-looking areas

6. Optionally, click **Preview buffer** to see if your buffers exclude or include important features on your map, such as medians. If you don't see this option, use the scroll bar in the **Create Buffer/Drive Times** pane, and click **Preview buffer**.
   The map zooms into a buffered feature and allows you to adjust the buffer size directly by dragging the handles or by specifying different distance and units using **Set distance and units** in the pane.
7. Click **Run**.
   A buffer layer is added to the map, and results from your buffer are added to the **data** pane.

   In the example involving police stations, a layer of one-kilometer buffers is created on top of the police station point layer.

Perform spatial aggregation

You can perform spatial aggregation using any area layer (buffer, boundary layers from the **Geographies** section of the data pane, or custom geography from **My Data**), and a point layer. After you create a buffer layer, spatial aggregation is the final step in answering the question: How many crimes occurred within one kilometer of each police station?

Note: When you perform spatial aggregation or spatial filtering on data from the same database connection, you must ensure that all the data is stored in the same spatial reference system. For datasets from SQL Server, the data must also have the same data type (geography or geometry).

Note: Spatial aggregation replaces the area layer on your map, with proportional symbols providing a total per area. You might want to make a copy of your map before you run spatial aggregation, so you can compare the result with the input. To copy the original map layer, either drag the legend onto the **Create Map** drop zone, or choose the same fields shown in the layer from the data pane to re-create the map.

1. Do one of the following to perform spatial aggregation:

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- Click and drag either a layer from a map legend or a single area feature (polygon), such as a single police district, onto the map that has a point layer you want to aggregate. Drop the selected feature onto the **Spatial Aggregation** drop zone.
- From **My Data**, choose a number or rate/ratio field, and drag and drop the field onto the **Spatial Aggregation** drop zone on the target map (that has at least one area layer).
- Select multiple area features by pressing Shift + click.
- Click the map that has at least one point layer and one area layer to select it, click the **Action** button, and do one of the following:
  - From the **All tools** tab, click the **Spatial Aggregation** tool.
  - From the **Find answers** tab, click **How is it distributed?** and choose **Spatial Aggregation**.

  Tip: If you want to perform spatial aggregation, but your map only has one layer, it's easy to add another layer to your map. If the data you want to use for the additional layer is not currently in your workbook, add more data.

The **Spatial Aggregation** pane appears and is automatically populated with suggested layers to aggregate and a suggested field to style the resulting layer.

2. Click **Choose an area layer** if you want to select a different area layer than is suggested to aggregate the points, for example, Police Districts.
3. Click **Choose a layer to summarize** if you want to select a different point layer (than suggested) that will be aggregated into the areas.
4. From **Style by**, leave the default count of point features, or choose a different field and/or statistic type.
5. Expand **Additional options** to choose other fields and statistic types you want calculated as part of the spatial aggregation. These additional statistics will appear in the results () in the data pane but will not be shown on the map. You can use these calculated statistics to further your analysis.
6. Click **Run**.
   The spatially aggregated layer is styled using proportional symbols to show totals for each aggregated area, and your results are added to the data pane.
7. Optionally, view aggregated statistics in a bar chart, summary table, scatter plot, and more.

Apply a spatial filter

To limit the scope of your analysis to either a standard geography—such as a ZIP Code—or a custom geography—such as a police district—you can apply a spatial filter. For example, as the officer in charge of a specific police district, you might want to determine which police districts are experiencing high and low rates of crime. You can use areas for an entire layer to spatially filter point features, or you can choose a single polygon from an area layer.

Spatial filtering replaces the original point layer, with the filtered point layer. You might want to make a copy of your map before you run spatial filtering, so you can compare the result with the input. To copy the original map layer, either drag the legend onto the **Create Map** drop zone, or choose the same fields show in the layer from the data pane to re-create the map.

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Note:
- Spatial filters do not support joined datasets. A spatial filter can be run on a joined dataset but only fields from one dataset will be returned. A new join must be created after filtering.
- When you apply a spatial filter, and subsequently use the results in other cards, all cards will erroneously indicate that an attribute filter is in place.
- When you perform spatial aggregation or spatial filtering on data from the same database connection, you must ensure that all the data is stored in the same spatial reference system. For datasets from SQL Server, the data must also have the same data type (geography or geometry).
- SAP HANA does not support ST_Contains for geographic ('round-earth') coordinate systems. Spatial filtering using the **Contains** and **Doesn't Contain** filter types will fail for SAP HANA datasets with a geographic coordinate system.

1. Do one of the following:
   - Click and drag either a layer from a map legend or a single area feature (polygon), such as a single police district, onto the map that has a point layer you want to spatially filter. Drop the selected feature onto the **Filter by selected feature** drop zone.
   - On a map that has at least one point layer and one area layer, click the **Action** button, and do one of the following:
     - From the **All tools** tab, click the **Spatial Filter** tool.
     - From the **Find answers** tab, choose **How is it distributed?** and click **Spatial Filter**.

     Tip: If you want to perform spatial filtering, but your map only has one layer, it's easy to add another layer to your map. If the data you want to use for the additional layer is not currently in your workbook, add more data.

   The **Spatial Filter** pane appears and is automatically populated with suggested layers to filter and the default filter type (`Intersects`).
2. From **Choose layer to filter**, choose the point layer you want to filter.
3. From **Choose layer to filter by**, choose the area layer you want to use as the spatial filter.
4. From **Choose type of filter**, choose a different filter type than the default (`Intersects`) if desired.
5. Click **Run**.
   The map updates to show only point features contained within the area layer or area feature you used to filter by. Spatially-filtered results are added to the **data** pane.
6. Optionally, visualize your filtered results as another layer on your map, create additional maps, or create charts and tables to answer other questions about areas of interest.

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Enrich your data with Esri demographics

If you want to know demographic information about neighborhoods as part of your site location analysis for a new store, for example, the Enrich Data tool accesses Esri demographic information and allows you to choose the variables you want to add to your dataset.

Note: The Enrich Data tool doesn't work when Portal for ArcGIS is installed on Windows, and configured with Security Assertion Markup Language (SAML) authentication. This is an issue for environments that deploy the portal in disconnected mode (https://enterprise.arcgis.com/en/portal/10.5/administer/windows/configure-a-disconnected-deployment.htm). Enrich data requires ArcGIS Online utility services to be configured (https://enterprise.arcgis.com/en/portal/10.5/administer/windows/configure-arcgis-online-utility-services.htm).

1. From a map, click the **Action** button .
2. Do one of the following:
   - From the **All tools** tab, click the **Enrich Data** tool.
   - Click the **Find answers** tab, choose **How is it related?**, and click **Enrich data**.

   The **Enrich Data** pane appears.
3. Click **Choose a layer to enrich** if your map has more than one layer.
4. Click **Open data browser**.
5. In the **Data Browser** window, a region is automatically selected based on your data. You can choose a different region if your data covers more than one country. For information about supported countries, see the Esri Demographics help (http://doc.arcgis.com/en/esri-demographics/).
6. Search or choose a category to browse data by, such as **Population** or **Tapestry**. You can also search for a variable, such as Household income.
   The enrichment variables are organized into data collections for easy access. When you select a data collection, the browser shows a few of the most popular enrichment variables in that collection. Under **Keep Browsing**, it also shows categories within the collection. Within each category, you can select entire subcategories or drill into a subcategory and select individual enrichment variables. You can also use the search box to find a specific variable within a category.

   As you select variables to include for enrichment, they are added to the shopping cart located in the corner of the **Data Browser** window. Use this shopping cart to keep track of the number of variables you have selected.

   Each selected variable will be added as a field in your results.
7. When you have finished choosing variables from one or more categories, click **Apply**.
   The **Data Browser** window closes.
8. In the **Enrich Data** pane, enter a distance in **Set a distance value to expand the search area**.
   The distance value defines the area around your input points or lines that will be enriched using a straight-line distance.

   Note: The distance value applies only to point or line features, not area features.
9. Click **Run**.

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The enriched layer is added to the map, and results from your data enrichment are added to the **data** pane. The results contain fields from the input data, as well as the enrichment variables you added from the data browser.

10. Optionally, visualize your value-added results data on other maps, or create charts and tables to answer other questions about the people who live in places of interest to you.

Calculate density to see concentrations of features

When you have too many points or lines on a map to make sense of it, calculating density shows concentrations of phenomena, such as drug crimes across the city. This provides a measurement of density per area, so that you can see distribution. The density map layer provides a quick view of density patterns allowing, in this example, city officials, the public, and police commanders to quickly identify problem areas that could benefit from more effective resource allocation.

1. From a map showing point features, click the **Action** button .
2. Do one of the following:
   - From the **All tools** tab, click the **Calculate Density tool**.
   - Click the **Find answers** tab, choose **How is it distributed?** and click **Calculate Density**.

   The **Calculate Density** pane appears.
3. Click **Choose a point layer** if you want to change to a different point layer than is suggested (if your map contains more than one point layer).
4. Optionally, choose a field to show totals if each point represents more than one event. For example, if your input features are business locations, but you wanted the map to sum the number of employees for those businesses per area, you'd choose the **EmployeeTotal** field.
   If the default choice of **None** is used, each point will be assumed to represent a total of one.
5. To change other options, expand **Additional options**, and proceed to steps 6–8. Otherwise, if you've accepted the defaults, click **Run**.
6. Enter a value in **Search distance**.

   Note: The default search radius applies an algorithm to your data that's based on both the extent of your data and the density of the points. The **Search distance** field appears blank because the default radius is not calculated until the tool runs. When you leave the **Search distance** field blank, the default search radius is applied. For more information, see Default search radius (bandwidth) algorithm (https://desktop.arcgis.com/en/arcmap/10.5/tools/spatial-analyst-toolbox/how-kernel-density-works.htm).

   If you prefer to specify your own search radius, consider the following:
   - The larger the search radius, the more generalized the pattern. A smaller search radius shows more local variation but may miss the broader picture.
   - The search distance units and the density units (in the results) do not have to be the same. You can specify the search distance in feet but calculate density per square mile.
7. Choose how density values will be classified into areas.

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- **Equal interval** (default)—Areas are created such that the range of density values is equal for each area.
- **Geometrical interval**—Areas are based on class intervals that have a geometrical series. This method ensures that each class range has approximately the same number of values within each class and that the change between intervals is consistent.
- **Natural breaks**—Class intervals for areas are based on natural groupings of the data. Class break values are identified that best group similar values and that maximize the differences between classes.
- **Equal area**—Areas are created such that the size of each area is equal. For example, if the result layer has more high density values than low density values, more areas will be created for high densities.
- **Standard deviation**—Areas are created based on the standard deviation of the predicted density values.

8. Change the number of classes to a value other than the default. This value specifies the number of classes (range of predicted values) in the result layer. Each class defines the boundary of areas. The values of these classes will be determined by the **Classify by** parameter above.
9. Click **Run**.
   The map updates to show where features are most concentrated on your map.

Find nearest locations

Use Find Nearest to discover what's occurring within a set distance of a feature, helping you identify features that may be affected by an incident. For example, a crime analyst may want to know the proximity of schools to drug crime incidents. A map with two layers is required—one layer containing features to search near (from), and a second layer with features you want to find. The layers can have point, line, or area features.

1. Click the **Action** button .
2. Do one of the following:
   - From the **All tools** tab, click **Find Nearest**.
   - From the **Find answers** tab, choose **What's nearby?** and click **Find Nearest**.

   The **Find Nearest** pane appears.
3. Click **Choose the layer containing features to search near**.
   Features from the layer you choose in the list are your starting points. For example, to search from `DrugCrimeIncidents` to `SchoolLocations`, choose the `DrugCrimeIncidents` layer.
4. Click **Choose the layer with features you wish to find**, for example `SchoolLocations`.
   Features from the layer you choose in this list are your destination points.
5. Optionally, for each location in the input layer (the layer you selected first), you can specify the following parameters:
   - Specify a different number for **Limit the number of nearest locations**.
     This limits the maximum number of nearest locations to find per start location. The default is 1.
   - Add a check to **Limit the search range**.
     With this option, you limit the maximum search range to a distance you specify. The default search range is 100 miles.

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Note: If you uncheck one or both of these options, or specify numerous nearest locations, or a large search range, then you may need to wait a very long time for results. It's a good idea to stick with the defaults, or use caution when increasing the number of features or range.

6. Click **Run**.
   A new layer showing line features between point features is added to your map. Results are added to **My Data** that filter locations based on their proximity to the input layer.
7. Optionally, create a summary table from your results using a field that represents the destination points, for example `SchoolName` (a string field), and the `distance` field (a numeric field).

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Use the Find answers tab

The **Find answers** tab organizes your analytical activity based on key questions that involve mapping, spatial analysis, and other visualizations. You access **Find Answers** from the **Action** button on any map.

If you don't see the button, click a map on your page to select it. The **Action** button appears.

Find answers quick reference

In the following table, choose a question, and choose the analysis tool you want to apply:

Question	Sample questions	Analysis tool
How is it distributed?	Where are the largest camps of internally displaced people?	Spatial aggregation
	Where are asthma hospitalizations most concentrated in the city?	Calculate density
	Do obesity rates among adolescents show a normal distribution?	View histogram
	How should proportional symbols or choropleth map features be distributed on the map?	Classification
How is it related?	What are the habits and lifestyles of people who live in this area?	Enrich data
	What is the relationship between the sales of men's apparel and the total sales for the year?	View scatter plot
	How do obesity rates differ between urban and rural residents?	Calculate ratio
What's nearby?	Which rivers are within 10 miles of a pipeline?	Create buffer/Drive times
	What is the median household income for neighborhood residents over the age of 65?	Create attribute filter
	Which lakes in the region have the highest fish counts?	Spatial filter
	What is the proximity of drug crimes to elementary and high schools?	Find nearest

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How has it changed?	Does the number of traffic accidents increase or decrease over time?	Time series
	What is the percentage of losses or gains for each commodity?	Calculate % change

Calculate a ratio to normalize data

When you calculate a ratio, you are normalizing data so that you can effectively compare places that vary in area or population. For example, you may want to calculate an obesity rate instead of using obesity totals when comparing sparsely-populated rural areas to densely-populated urban areas.

When you use the **Calculate ratio** tool, a rate/ratio field is added to your dataset.

Note: You can also calculate a ratio using the **View Data Table** window.

1. Click the map you want to analyze.
2. Click the **Action** button.
3. Click the **Find answers** tab.
4. Click **How is it related?**
5. Click **Calculate ratio**.
6. Choose a layer (if your map has more than one layer).
7. Choose a numerator. For example, to calculate an obesity rate, choose **ObesityTotalRural**.
8. Choose a denominator. For example, choose **PopulationTotalRural**.
9. Provide a name for the field, for example, `RuralObesityRate`.
10. Click **Run**.
    The new rate/ratio field is appended to the bottom of your dataset. As a next step for this scenario, you may want to use **Calculate Ratio** again to calculate an obesity rate for urban areas.
11. Optionally, use the new rate/ratio field to create a choropleth map, bar chart, summary table, scatter plot, and more.

Calculate percent change

When you calculate percent change, you are calculating change over time. For example, you may want to calculate and map a field that shows changes over time in a contractor's selling prices of new residential homes.

Note: You can also calculate percent change using the **View Data Table** window.

1. Click the map you want to analyze.
2. Click the **Action** button.
3. Click the **Find answers** tab.
4. Click **How has it changed?**

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5. Click **Calculate % change**.
6. Choose a layer (if your map has more than one layer).
7. Choose an initial value, for example, **2014SalePrice**.
8. Choose a final value, for example, **2016SalePrice**.
9. Provide a name for the field, for example, `PriceChange`.
10. Click **Run**.
    The new rate/ratio field is appended to the bottom of your dataset.
11. Optionally, use the new rate/ratio field to create a choropleth map, bar chart, summary table, scatter plot, and more.

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Automate your analysis with models

Insights for ArcGIS automatically captures every step of your analysis in the analysis view for your workbook page. Every page view has a corresponding analysis view. Save and share the steps to rerun the analysis, and allow others to automatically run the analysis with their own data.

Save and share the model

If you feel that the analysis you performed would be useful for others in your organization, you can share the model from your page.

Note: You can share your model from the analysis view or the page view by clicking the **Analysis view** button or the **Page view** button.

1. If you have a workbook open, save it.
2. From your page tab, click **Page options**.
3. Click **Share As Model**.
4. Provide a title, description, and tags for your model, and click **Save**.
5. Under **Share with**, choose one or more of the following:
   - **Everyone**
   - **Portal for ArcGIS**
   - **One or more groups**
6. Click **Share**.

A model item is created in Portal for ArcGIS. You can use the model to automate your analysis. For information about sharing items in the portal, see Share items (https://enterprise.arcgis.com/en/portal/10.5/use/share-items.htm).

Add a model to your page

Note:
- Models do not share data. You must add data to your page in addition to adding the model. You can add data and models to your page at the same time.
- If you did not create the model, the owner of a model must share the model item with you before you can use it.

1. Click **Add Data** to open the **Add to Page** window.
2. If your page does not have any datasets, choose your data.
3. Under **Add to Page**, click **Model**.
4. If this is a model you created, choose **My Contents**. If you're not the model owner, choose **My Organization**. Available models are listed in the contents pane.
5. Optional: If you want more information about a model in the list, such as a description, click **View details**.

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6. Choose the model and click **Add**.

Next step: Update the model with your data (see below).

Update the model to run analysis automatically

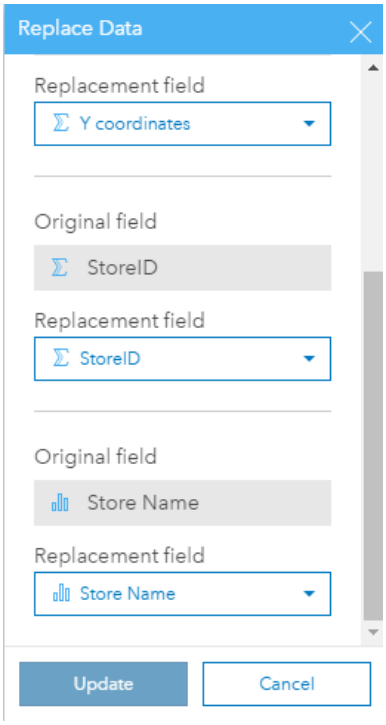
If you want to use a model that has been shared with you (or a model that you created before), add the model to your page, as well as the data you want to use for your analysis.

If you have already run an analysis on your page, you can rerun the analysis from the analysis view by updating the data in the model, or by changing the spatial tool parameters.

Rerun the analysis with different data

1. Click the **Analysis view** button .
2. Click **Update** in the dataset bubble you want to update.
   The **Dataset** panel appears.

   The available fields to choose for the analysis steps, such as aggregation, change to reflect the fields from your chosen dataset. The model is flexible enough to use any field, provided it has the same field role as the field that was used to create the model. The **Replacement field** list contains fields with the same field role as the field chosen for **Original field**. For example, if **Original field** contained a string field , called `StoreName`, the only fields available in the **Replacement field** list are string fields.



3. Choose different fields to rerun the analysis with different data.
   For example, if you created a bar chart aggregating `SalesAmount` by `StoreName`, you can choose a different field to use as a category, such as `PaymentMethod`.

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Tip: If you don't see the field you expect to see in the list, choose a different dataset from the **Choose Dataset** list.

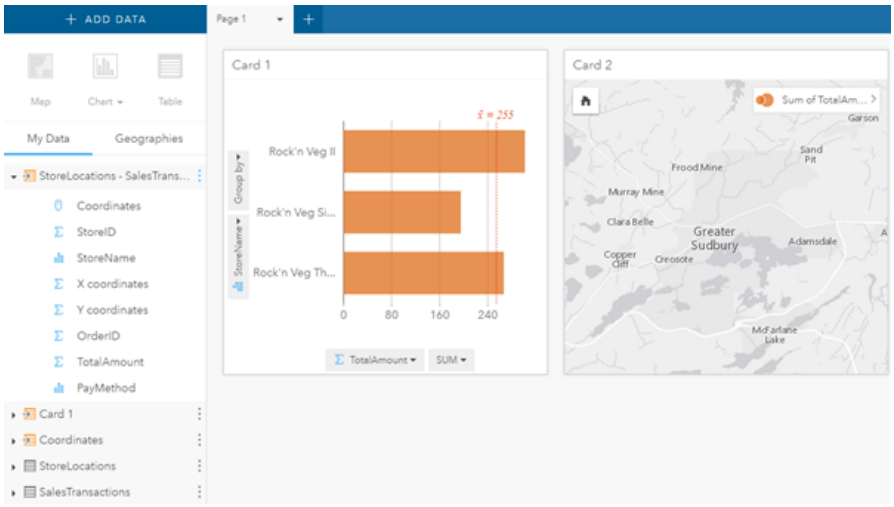
4. Click **Update**.
   The model is applied to the updated data, and you see the analysis results, in the form of cards, on your page.
5. Click the **Page view** button to see the cards on your page.
6. You can also rerun your spatial tools by choosing different parameters.

Update your spatial tool parameters to rerun the analysis

1. Click the **Analysis view** button, if you're not already in the analysis view.
2. Click a step in the model that represents a spatial tool, such as **Calculate Density**.
3. Click **Edit**.
   The tool panel appears. You can't choose a different map layer for the spatial tool, but you can adjust other parameters. For example, you may want to rerun the Calculate Density tool with a different search distance from the default, or use a different classification method for your results.
4. Change the parameters.
5. Click **Update**.
   The tool runs and overwrites the previous results in the data pane.
6. Click the **Page view** button to see the updated map on your page.

Model example

Below is the page view of a weekly sales-by-store analysis that visualizes results as a bar chart and a proportional symbol map.



Below is the model of that analysis in the analysis view.

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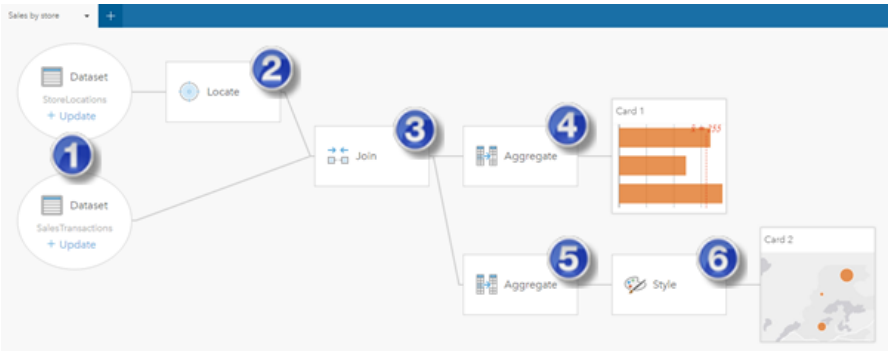

This model shows the steps that were involved in creating the results shown in the page view:

1. Add two datasets.
2. Add location to the first dataset.
3. Create a relationship to join the two datasets.
4. Aggregate data (for the bar chart).
5. Aggregate data (for the proportional symbol map).
6. Style the map according to the chosen field.

Note: Although the model indicates that a join (step 3) was performed on the two datasets, it shows them as separate dataset bubbles. You can switch between the datasets to select the fields from either dataset to rerun the analysis.

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Share and collaborate

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Share your work

You can share processes, data, and discoveries with others in your organization. When you explore your data in Insights, items are created in Portal for ArcGIS that are accessible only to you. Depending on your sharing privileges, you can share these portal items with others.

The following table provides a description of Insights item types that you can create and share:

Item type	Description	How to create or share
Workbook	A workbook collects or associates all data and analytical activity for a project in a single place, capturing and maintaining relationships such as data locations, and storing result layers, models, pages, and cards. **Note:** • When you share a workbook, you are providing read-only access to those you share it with. • If you share your workbook, it's a good idea to share your data as well.	Create a workbook.
Model	A model records your analysis steps on a workbook page, including adding and joining datasets, spatial analytics (such as spatial filtering), data analytics (such as attribute aggregation), and styling. You can edit, use, and share a model to automate common analytical tasks.	Share a model from your workbook page.
Relational Database Connection	A relational database connection allows you to view, query, and analyze the contents of databases in Insights.	Create a database connection.
Feature Layer	Sharing your data as a feature layer allows others to use your value-added data in their own analysis process. For example, you may want to share data you added from Excel, or results from analytical operations, such as spatial aggregation.	Share your data from **Dataset options** ⋮.

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Page	Sharing your page allows others to interact with the cards on your page in a separate read-only Insights viewer. **Note:** If you share your page, it's a good idea to share your data as well.	Share your page.

View and share Insights item types

Browse to Portal for ArcGIS to see Insights item types you created or that were shared with you.

1. If you have a workbook open, save it.
2. Access your portal by using the URL in the format `http://webadaptor.domain.com/arcgis` (example: `http://myserver.mycompany.com/portal`), or do the following:
   a. Click the Insights logo in the banner.
   b. Click the **Home** drop-down list.
   c. Click one of the following:
      - **ArcGIS** to go to your portal home page, and click **Gallery** to locate items that have been shared with you
      - **My Content** to access items you created.
3. Click the item to open **Item details**.
4. Do one of the following:
   - View item details for more information or, if you are the item creator, change item details (https://enterprise.arcgis.com/en/portal/10.5/use/item-details.htm).
   - Click **Share** to share the item with others (https://enterprise.arcgis.com/en/portal/10.5/use/share-items.htm).
5. Access Insights.

Share your data as a feature layer

After you add data to your workbook page from Excel, extend your data by adding location or demographic information, or generate a dataset of your results with your analysis. You can also share your data as a feature layer in Portal for ArcGIS.

Note: You can't share data as feature layers (**Share Data** is disabled) for the following:

- A dataset that has more than one location field
- A database dataset
- A dataset with location enabled on a field that contains more than one record per location (duplicate locations).
- When Portal for ArcGIS is installed on Linux, and configured with either built-in or public key infrastructure (PKI) authentication.

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1. From **My Data**, next to the dataset you want to share, click the **Dataset options** button ⋮.
2. Click **Share Data**.
   The **Share Data** window appears with the **Title** field populated with the dataset name.
3. Add a description and additional tags if desired.
4. Choose the groups you will share your item with. For more information about the different sharing options listed here (everyone, your organization, and groups), see Share items in the Portal for ArcGIS help (https://enterprise.arcgis.com/en/portal/10.5/use/share-items.htm).
5. Click **Share**.
   A feature layer of your data is created in Portal for ArcGIS.

Share or print your page

After you have found answers in your data using maps, charts, and tables, and applying spatial analytics, you can print your page results or share them with others in your organization as a page item.

Tip: Organize your cards on the page by resizing or changing card placement before you share or print the page.

Share your page

When you share a page, a page item is created in Portal for ArcGIS. When accessed, the page item opens a separate read-only viewer that allows others to interact with cards by making selections and viewing pop-ups.

When you share a page, you have the option of copying the embed code and pasting it into the source code for a web page or blog.

1. Click the **Page options** button ▾ on the tab for the page you want to share.
2. Click **Share Page**.
   The **Share Page** window appears with the **Title** field populated with the name of the workbook and the name of the page.
3. Add a description and additional tags if desired.
4. Choose with what groups you will share your item. For more information about the different sharing options listed here (everyone, your organization, and groups), see Share items in the Portal for ArcGIS help (https://enterprise.arcgis.com/en/portal/10.5/use/share-items.htm).
5. Click **Share**.
6. Optionally, do one of the following:
   - Under **View your shared page**, click **Go** to view the shared page in the read-only viewer.
   - Under **Access your page item**, click **Go** to view item details for your shared page.
   - Under **Embed**, copy the `iframe` code and paste it into the source code of your website or blog.

Print your page

1. Click the **Page options** button ▾ on the tab for the page you want to share.

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2. Click **Print Page**.
3. From the **Print** window, choose the print destination, and layout options that you want, such as landscape layout, color or black and white, and so on.

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Install and configure

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Install Insights

Installation prerequisites

To install and configure Insights for ArcGIS, you require elevated privileges in a deployment environment.

At minimum, to run the installation, you must have installed the following ArcGIS Enterprise 10.5 components, either on the same machine or separately in a distributed environment:

- Portal for ArcGIS (https://enterprise.arcgis.com/en/portal/10.5/install/windows/steps-to-get-portal-for-arcgis-up-and-running.htm)
- ArcGIS Server (https://enterprise.arcgis.com/en/server/10.5/install/windows/steps-to-get-arcgis-for-server-up-and-running.htm)

Note: ArcGIS Server must be licensed as ArcGIS GIS Server. For more information about ArcGIS Server licensing roles, see ArcGIS Enterprise licensing (https://enterprise.arcgis.com/en/get-started/10.5/windows/what-is-arcgis-enterprise-.htm) in the Portal for ArcGIS Administrator Guide or ArcGIS Server Help.

The Insights setup program has two installation features:

- Insights client application on Portal for ArcGIS
- ArcGIS Server component of Insights

The setup program detects whether Portal for ArcGIS or ArcGIS Server is installed on your machine, and then installs the appropriate Insights feature. On a single-machine deployment, you only need to run the setup once. If your Portal for ArcGIS is configured in high availability, you need to run the setup program in both portal machines. If your hosting server is a multi-machine site, you need to run the setup program on all of the machines in the hosting server site.

If neither Portal for ArcGIS nor ArcGIS Server is detected, the program exits.

Download the setup package

Windows setup package

1. Log in to the My Esri (https://my.esri.com/) site with your Esri Account that is tied to your customer number.
2. Go to **My Organization**, and select **Downloads**.
   All the software downloads that are available to you (based on your customer number) display.
3. Locate ArcGIS Enterprise (Windows) among the products, and click **View Downloads**.
4. Expand the **Additional Products** section.
5. Click **Download** for the Insights setup program.

Linux setup package

1. Log in to the My Esri (https://my.esri.com/) site with your Esri Account that is tied to your customer number.
2. Go to **My Organization**, and select **Downloads**.
   All the software downloads that are available to you (based on your customer number) display.

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3. Locate ArcGIS Enterprise (Linux) among the products, and click **View Downloads**.
4. Expand the **Additional Products** section.
5. Click **Download** for the Insights setup program.

Run the setup program

Windows setup

1. Browse to the location of the downloaded installation file, and double-click the `setup.exe` file.
2. During the installation, read the license agreement and accept it, or exit if you do not agree with the terms.
   The setup program detects the ArcGIS Enterprise component on your machine—Portal for ArcGIS, ArcGIS Server, or both—and installs the appropriate feature(s).

   The default installation directories are the following:
   - `C:\Program Files\ArcGIS\Portal\apps` for the portal client application
   - `C:\Program Files\ArcGIS\Server` for the server component
3. If you're working in a distributed environment, repeat the setup until the client is installed on your portal machine (or two machines in high availability deployment), and the server component (containing Insights services) is installed on each ArcGIS Server machine in your hosting server site.
4. After you are finished running the setup program, configure the portal to support Insights.

Linux setup

1. Log in to your machine as a user with administrative privileges.

   Note: Installing Insights as a root user is not supported.
2. Run the setup command. Sample syntax is as follows: `Insights-Setup.sh`.
3. If you're working in a distributed environment, repeat the setup until the client is installed on your portal machine (or two machines in high availability deployment), and the server component (containing Insights services) is installed on each ArcGIS Server machine in your hosting server site.
4. After you are finished running the setup program, configure the portal to support Insights.

Upgrade Insights for ArcGIS

If you have an earlier version of Insights for ArcGIS installed and would like to upgrade to a new version, there is no need to uninstall the previous version. Running the Insights for ArcGIS installer will upgrade the software to the new version.

Uninstall Insights

Uninstall Windows

1. Open the **Control Panel** and click **Programs and Features**.
2. From the **Programs** list, select the Insights for ArcGIS version you have installed on your machine.

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3. Select **Uninstall/Change** to uninstall Insights.
4. If you are working in a distributed environment you will need to repeat the uninstall steps on all Portal for ArcGIS and ArcGIS Server machines.

Uninstall Linux

To uninstall Insights, run the following scripts from the command line:

```
${HOME}/arcgis/portal/uninstall_Insights
${HOME}/arcgis/server/uninstall_Insights
```

If you are working in a distributed environment you will need to run the uninstall scripts on all Portal for ArcGIS and ArcGIS Server machines.

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Configure the portal to support Insights

Before users can access Insights, you must set up a base ArcGIS Enterprise deployment (https://enterprise.arcgis.com/en/get-started/10.5/windows/base-arcgis-enterprise-deployment.htm), which includes Portal for ArcGIS with a federated ArcGIS Server site as your hosting server.

You will also need to install Insights for ArcGIS. For instructions, see Install Insights for ArcGIS.

Setup and configuration roadmap for Insights for ArcGIS

Required base ArcGIS Enterprise deployment

You require all of the components listed below, which together make up a base ArcGIS Enterprise deployment. For a tutorial on how to create this deployment, see Tutorial: Set up a base ArcGIS Enterprise deployment (https://enterprise.arcgis.com/en/get-started/10.5/windows/tutorial-creating-your-first-web-gis-configuration.htm).

- ArcGIS Server (https://enterprise.arcgis.com/en/server/10.5/get-started/linux/steps-to-get-arcgis-for-server-up-and-running.htm)
- Portal for ArcGIS (https://enterprise.arcgis.com/en/portal/10.5/install/linux/steps-to-get-portal-for-arcgis-up-and-running.htm)
- ArcGIS Web Adaptor (one for portal, and one for server) (https://enterprise.arcgis.com/en/web-adaptor/10.5/install/iis/getting-started-with-the-arcgis-web-adaptor.htm)
- ArcGIS Data Store, configured as a relational data store (https://enterprise.arcgis.com/en/portal/10.5/administer/windows/what-is-arcgis-data-store.htm)

Note: ArcGIS Server must be licensed as ArcGIS GIS Server. For more information about ArcGIS Server licensing roles, see ArcGIS Enterprise licensing (https://enterprise.arcgis.com/en/get-started/10.5/windows/what-is-arcgis-enterprise-.htm).

After you build your deployment, you will also need to configure required portal settings (see below).

Required portal configuration settings

After you have set up the base ArcGIS Enterprise deployment, do the following:

1. Configure Insights for ArcGIS licenses (https://enterprise.arcgis.com/en/portal/10.5/administer/windows/configure-insights-licensing.htm).
2. Ensure that users in your organization have the appropriate role, privileges, and membership level to access and use Insights.
   A user requires:
   - The Publisher role to add data, create visualizations, and use spatial analytics
   - The Level 2 membership level

For more information, see Organization roles and membership levels (https://enterprise.arcgis.com/en/portal/10.5/use/roles.htm).

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Next, configure other settings to enable important services and features such as geocoding and routing (see below).

Important portal settings for Insights for ArcGIS features

These configuration settings are not required, but they allow portal members to connect to data warehouses, geocode data, use maps (and extents) suitable for their region, and more.

1. To support database connections that allow users to add datasets from a business database, your portal's hosting server site (https://enterprise.arcgis.com/en/server/10.5/administer/windows/configure-hosting-server-for-portal.htm) must have one or more relational data store types registered for use. See Register Relational Data Store Type in the ArcGIS REST API help (https://developers.arcgis.com/rest/enterprise-administration/server/register-relational-data-store-type.htm). For more information about using database data, see Understanding data in relational databases.

   Tip: Insights displays spatial data in the spatial reference system of your portal organization's default basemap. This is for display and query purposes only, the underlying data is not altered. If the two spatial reference system's underlying geographic coordinate systems are incompatible, alignment and accuracy problems may be observed. To ensure fast performance and accurate display of spatial data, it is recommended that organizations use the same spatial reference system for their default basemap and their spatial data. You can change the default basemap (https://enterprise.arcgis.com/en/portal/10.5/administer/windows/customize-basemaps.htm) of the portal or re-project your spatial data to match your organization's basemap.

2. Configure utility services (https://enterprise.arcgis.com/en/portal/10.5/administer/windows/configure-services.htm) and travel modes (https://enterprise.arcgis.com/en/portal/10.5/administer/windows/travel-modes.htm) required to power specific functionality in your portal, such as performing analysis with tools that depend on utility services. The table below lists each utility service, and the Insights feature it supports:

Geocoding	Allows users to add location to their datasets by specifying an address. For user instructions, see Enable location for your data.
Geometry	Enables the use of dissolved boundaries for the Create Buffer/Drive Times tool. For user instructions, see Create a buffer or drive time area.
Routing	Enables the Find Nearest spatial analysis tool. For user instructions, see Find nearest locations in the Insights Help.

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GeoEnrichment	Allows users to add demographic information to a location or area using the Enrich data tool. For user instructions, see Enrich your data.
Configure travel modes	Allows users to specify a means of transportation, such as walking time or trucking distance, for spatial tools, such as Create Buffer/Drive Times.

Note:
- You can configure your portal to use utility services from ArcGIS Online. See Configure ArcGIS Online utility services for details (https://enterprise.arcgis.com/en/portal/10.5/administer/windows/configure-arcgis-online-utility-services.htm).
- If you are running Insights in a disconnected environment, you must configure the service from a federated or hosting server

3. Configure boundary layers (https://enterprise.arcgis.com/en/portal/10.5/administer/windows/configure-boundary-layers.htm) to allow users to use feature layers containing boundary information for supported countries in their maps and analysis. When you configure boundary layers, users can enable these layers in the **Geographies** section of the data pane in Insights. Boundary layers are another way for users to add location to their data. For user instructions, see:
   - Add geographies to your workbook
   - Enable location for your data
4. Specify a default region (https://enterprise.arcgis.com/en/portal/10.5/administer/windows/configuring-units-and-region.htm) to control both the default map extent, and to make boundary layers for the default region available to users in the **Geographies** section of the data pane.
5. Configure subscriber and premium Living Atlas content (https://enterprise.arcgis.com/en/portal/10.5/administer/windows/configure-living-atlas-content.htm) to make this ArcGIS Online collection available in your portal. Living Atlas content that does not require you to sign in to an ArcGIS Online account is available by default.

Once the portal has been configured to support Insights, users can access it through a URL in the format `http://webadaptorhost.domain.com/<webadaptorname>/apps/insights`. Help documentation can be accessed from the **Help** menu in Insights.

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Reference

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Visualization catalog

Data visualization refers to the graphical representation of your data. In Insights for ArcGIS, each visualization appears as a card on your page. You can visualize your data in a variety of interactive formats that allow you to quickly modify the data you see and the way it's presented.

Field roles determine the default map, chart, or table that's created on your page. Drop zones (or the buttons at the top of the data pane) give you more control over whether you create a map, chart, or table.

Statistics and editable properties allow you to instantly change what data is shown and how it's presented. This flexibility allows you refine your questions and get better, and sometimes surprising answers.

Supported visualizations

The table below indicates required and optional field inputs for each visualization, related visualizations you can switch to using the **Visualization type** button, and questions the visualization can help you answer.

Click a link in the table to get a full explanation of the visualization and see examples, statistics, and editable properties for each visualization.

Visualization	Data types	Related visualization types	Questions it can help you answer
Bar chart	One string field (Required) Optional: • One numeric or rate/ratio field • Additional string field to **Group By**	• Map (Category) • Summary table • Column chart • Donut chart • Treemap • Bubble chart • Line graph	How is it distributed (by category)? How is it ranked?
Bubble chart	Supported visualization type for a card that shows: • One string (Required) • One numeric or rate/ratio field (Optional)	• Map (Category) • Summary table • Column chart • Donut chart • Treemap • Bubble chart • Line graph	How is it distributed (by category)? How is it ranked?
	Supported visualization type for a card that shows three numeric or rate/ratio) fields Drag a third numeric or rate/ratio onto a scatter plot to create a bubble chart	None	How is it ranked?

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Category map	Map styled by one string field	• Bubble chart • Donut chart • Summary table • Bar chart • Column chart • Treemap • Line graph	Where is it located? How is it distributed (by category)?
Choropleth map	Map styled by one rate/ratio	• Summary table • Histogram	How is it distributed?
Column chart	Change from a related visualization type to a column chart.	• Map (Category) • Bubble chart • Donut chart • Summary table • Bar chart • Treemap • Line graph	See bar chart above
Combo chart	Combines the features of a line graph and a bar chart to show two numeric fields by the same categories.	None	How are two numeric series distributed by category?
Donut chart	Change from a related visualization type to a donut chart.	• Map (Category) • Bubble chart • Summary table • Bar chart • Column chart • Treemap • Line graph	What are the proportions of categories to the total?
Heat map	From a map layer showing point data, choose the **Heat map** symbol type from Layer Style properties	None	How is it distributed?
Histogram	One numeric Σ, or rate/ratio field (Required)	Map (Proportional symbol)	How is it distributed? Where are the most common data values? Are there any global or local outliers?

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Line graph	Change from a related visualization type to a line graph.	• Map (Category) • Bubble chart • Donut chart • Summary table • Bar chart • Column chart • Treemap	See bar chart above
Location map	One location field (Required)	None	Where is it located? How is it distributed?
Proportional symbol map	Map styled by one numeric field.	Histogram	Where is it located? How is it distributed? Where are high values? Where are low values?
Scatter plot	Two numeric, or rate/ratio field (Required) One string to **Color by** (Optional)	None	How is it related? How is it distributed? Where are the outliers?
Summary table	Any of the following: • One or more numeric or rate/ratio fields • Maximum of one string or one location field to use as a category column	None	How are numeric values summarized by category? What is the aggregated total of this data?
Time-series graph	• One date/time field (Required) Optional: • One numeric or rate/ratio field • Additional string field to **Group By**	None	How has it changed?

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Treemap	Change from a related visualization type to a treemap	• Map (Category) • Bubble chart • Summary table • Bar chart • Column chart • Line graph	What are the proportions of categories to the total?

Bar and column charts

How are numeric values distributed or summarized by category? How is it ranked?

Create a bar chart to summarize and compare categorical information. A bar chart is composed of a category (y) axis and a statistic (x) axis. The length of each horizontal bar represents the aggregated value for each unique category.

Bar charts use string fields to group data along the category axis by default.

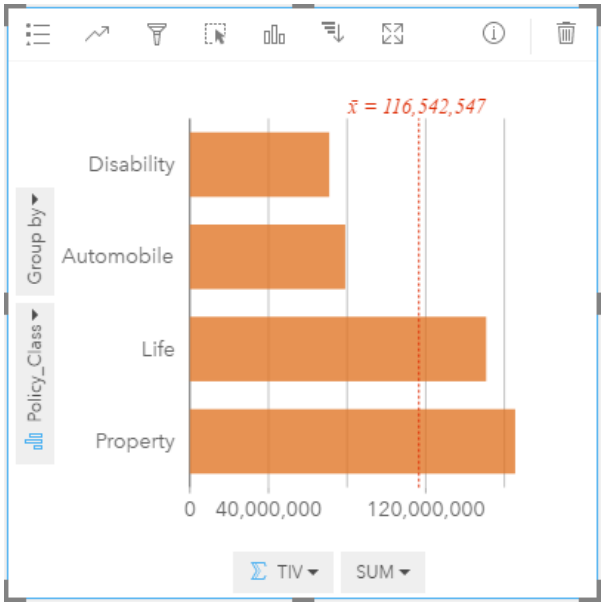
Column charts display the same information as bar charts but with a vertical orientation. Column charts are a better option when your data contains negative values because the negative values will display in a downward direction.

If you create a bar chart using only a string field, Insights for ArcGIS will display unique category values along the y-axis, and provide a count of the number of times that each category value occurs in the dataset.

By default, the chart indicates the mean (average), and displays the mean statistic as a dashed line in red, so that you can quickly see which values fall above or below the mean.

Bar chart examples

An insurance company is reviewing the types of policies it offers to compare their current offerings to the findings from a recently completed market research project. The first step in the review is to determine the total value of policies in each policy class. A bar chart can be used to visualize the sum of total insured values (TIV) for each policy class.



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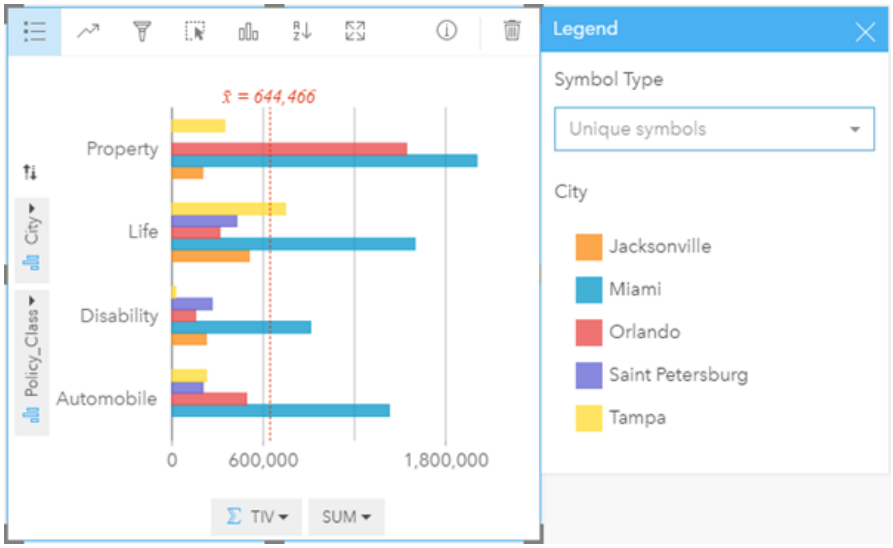
The bar chart above provides a sum of the `TIV` for each category of insurance policy: `Disability`, `Life`, `Automobile`, and `Property`. When the chart is sorted in ascending order, it's easy to see the highest and lowest values.



The insurance company is especially interested in expanding their business in five cities of interest, The **Group by** option can be used to compare the total insured value for each policy class across cities.

The grouped bar chart above shows the distribution of subgroups for each category. The `Policy_Class` values (`Property`, `Life`, `Disability`, and `Automobile`) have subgroups that show a different colored bar for each city that has been included in the card filter.

Tip:

- Have you changed your mind about how you want to group and subgroup the categories? Click the **Flip fields** button to switch the placement of the fields.
- Style related maps with the same field you used to group your bar chart. When you interact with the chart or the map, you'll be able to see simultaneous categorical and spatial patterns.

Bar and column chart statistics

Click the **Chart Statistics** button to see available statistics.

While the mean is displayed by default, you can choose a different statistic to show on your chart.

Tip: If you choose more than one statistic to show on your chart, the statistics may overlap and be difficult to read. At most, you might want to select one or two statistics.

The table below provides more information about each statistic:

Statistic	Description
Mean	Average
Median	The middle number in a sorted list of numbers
Upper quartile	The median of the upper half of a dataset

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Lower quartile	The median of the lower half of a dataset
Custom	Specify a numerical value to show on the chart

Bar and column chart properties

The following options are available when creating a bar or column chart:

- Change the **Visualization type** to a supported visualization for your chosen data (see Supported visualizations).
- Choose a different field to display along the category or statistic axes.
- Choose a field in the **Group by** list to create a grouped bar chart.
- Choose a different supported statistic type for your chosen field on the statistic axis.
- Show the **Legend** to view or select categories, or to change the chart styling. You can specify **Unique Symbols** for ungrouped bar charts to show each bar in a different color. **Single Symbol** is only available for ungrouped bar charts, and allows you to choose a different color for all of the bars.
- Sort your chart in ascending or descending order.

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Bubble charts

How is it related, and how many? How is it distributed?

Create a bubble chart to see how things are related. Bubble charts represent numeric values of variables by area in circles. Insights supports the following types of bubble charts:

- Bubble charts that represent a category and a statistic with circles that are packed together
- Bubble charts that show three numeric (or rate/ratio) variables and use Cartesian coordinates to place the circles

The first type of bubble chart is a supported visualization type for a card that shows categories (such as a bar chart or category map).

The second type is a variation of scatter plots. Instead of points, proportional symbol charts use circles of graduated sizes to indicate numeric values. The bigger the circle, the higher the value. You convert a scatter plot to a bubble chart by dragging and dropping a third numeric field onto a scatter plot. The third numeric field is used to indicate the size of the symbols (z-value). Adding a fourth field to the **Color by** list takes your comparative analysis a step further by coloring the symbols by categories.

Bubble chart examples

An insurance company is reviewing the types of policies it offers to compare their current offerings to the findings from a recently completed market research project. They want to know how policies they have sold in each class relative to the other classes. A bubble chart using categories can be used to visually compare the count of each policy class to the other policy classes.

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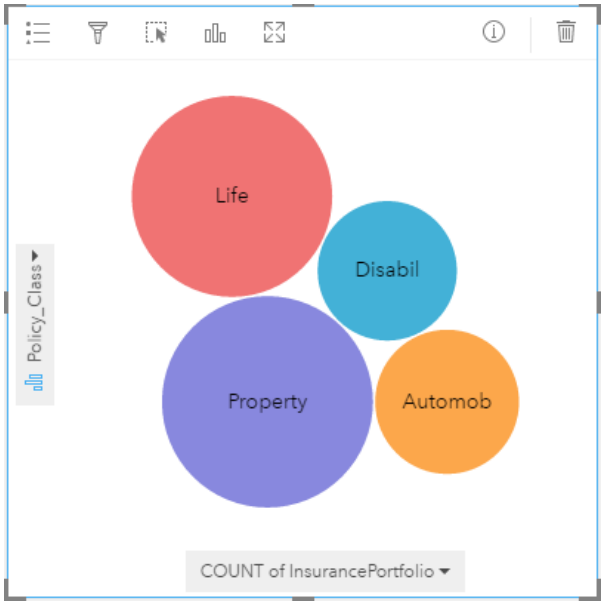
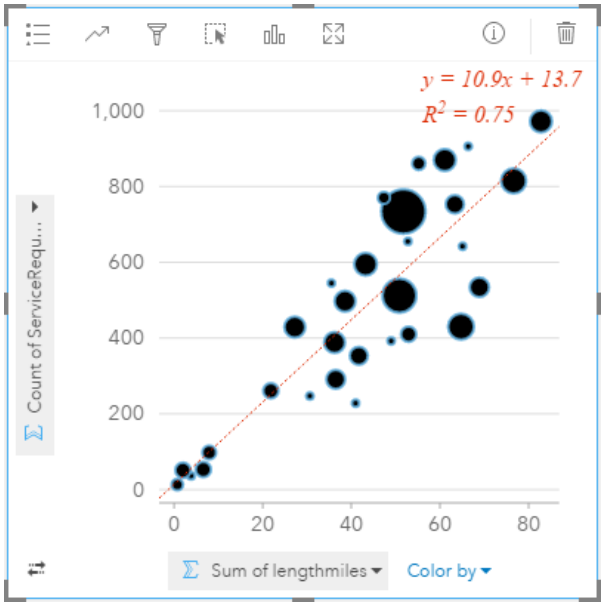


A public works department has been noticing an increase in leaks on water mains. The department wants to know how much of an effect the total length of pipes has on the number of leaks, versus the impact of properties of the pipes, such as age or circumference. They also want to know if there is a relationship between the number of leaks or length of pipes and the cost per day (including construction, maintenance and repairs, and lost resources through leaks). A bubble chart using Cartesian coordinates can be used to plot the total number of leaks versus the total length of pipes in each zone, with the size of the points representing the cost per day.



Similar to the scatter plot example, there's a positive relationship between the length of pipes and number of leaks. Unlike the scatter plot, the proportional symbols in the chart give us information about a third variable and that's the cost per day.

The public works department also wants to know if there is any difference between pipes surveyed at different times of the year. Using the **Color by** option will style the points using unique colors for every unique value (`month`) in the specified field.

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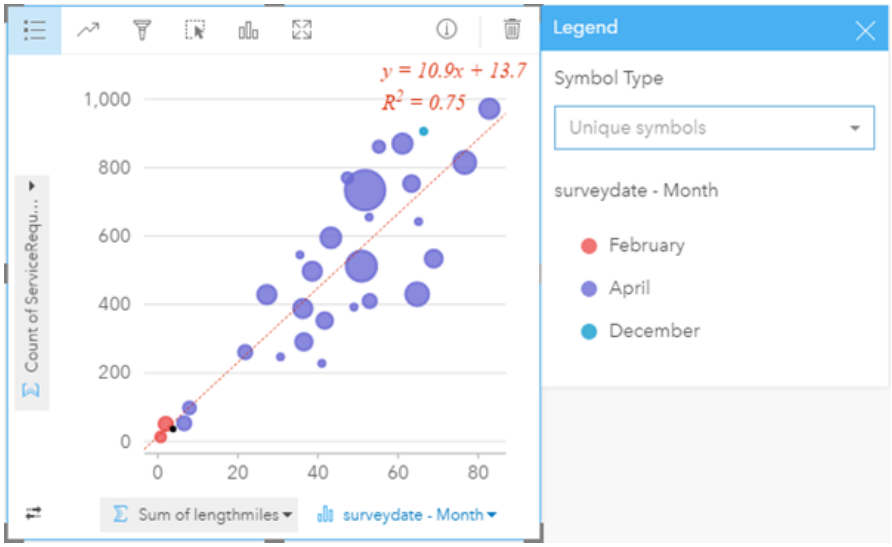

The above bubble chart indicates that most of the pipe surveys occurred in the month of April.

Bubble chart statistics

Bubble charts that use Cartesian coordinates provide the same chart statistics as scatter plots. For more information, see Scatter plot statistics. Statistics are not available for bubble charts that have a category axis.

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Bubble chart properties

The following options are available for bubble charts that show categories:

- Choose different fields for the category or statistic axis.
- Choose a different supported statistic type for your chosen field on the statistic axis.
- Change the **Visualization type** to a supported visualization for your chosen data (see Supported visualizations).

The following options are available for bubble charts that use Cartesian coordinates:

- Choose a different field to display along the x and y axes
- Categorize the symbols by color by choosing a field in **Color by**
- Show the **Legend** to view or select categories (if you have selected a field to **Color by**), or to change the chart color for uncategorized scatter plots
- Drag a different number onto the chart to use that number to size the circles on the chart
- Show the **Legend** to view or select categories
- Change your chart color

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Category maps (Types - Unique Symbols)

Where is it located? How is it distributed?

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Category maps use unique symbols to style distinct categories in your map, so you can see where point, line, or area features are located and what type they are, such as tree species or restaurant types.

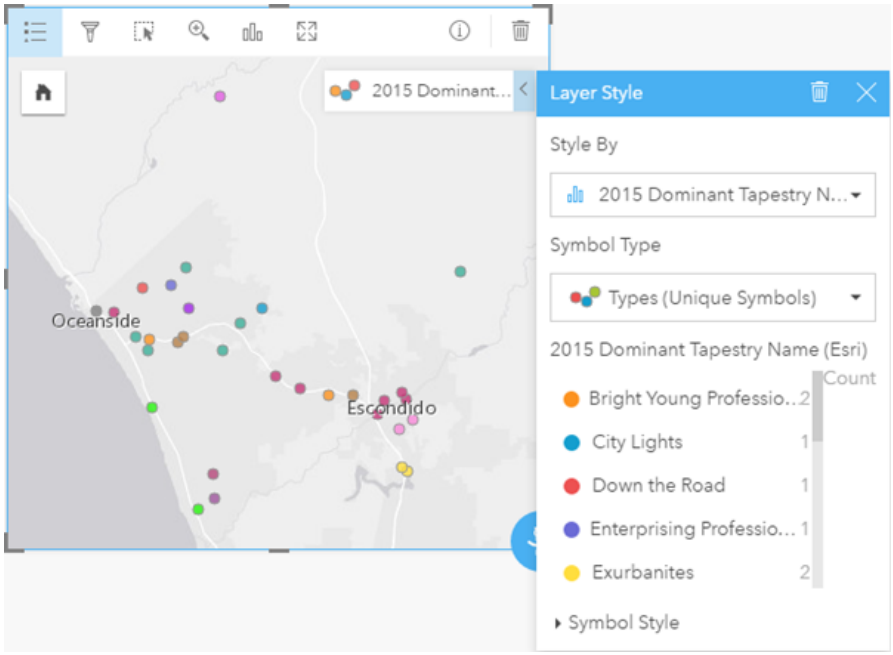
When you create a map using a string field (or drag a string field onto an existing map), the **Types (Unique Symbols)** smart mapping symbol type is applied to the map by default. You can also create a category map from an existing chart, such as a bar chart, donut chart, or bubble chart.

Category maps can handle up to 100 unique categories, applying a unique color to each of the 100 categories. Categories over and above 100 are put into an **Others** category.

Tip: Group related bar or time-series charts with the same field you used to style your category map. That way, your interactions among the category map, bar charts, and line chart will show you simultaneous categorical, temporal, and spatial patterns.

Category map example

A small retail chain wants to expand its business throughout the region and is looking at prospective sites for new stores. The marketers know that the dominant demographic group that shops at the store is young people under 30 years of age, especially students and recent graduates. A category map can be used to symbolize each prospect by the dominant tapestry segment in the area where the potential new store site is located.



The above map shows where each prospect is located and uses a unique color to indicate the Tapestry Segment (https://doc.arcgis.com/en/esri-demographics/data/tapestry-segmentation.htm) that categorizes each prospect.

Category map statistics

Click the **Info** button to turn the map card over and see summary statistics.

A category map provides a count of features (either point, line, or area features) for each map layer.

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Category map properties

From Layer Style properties, you can:

- Add or remove a layer
- Choose different data to style your map

  Tip: You can also drag and drop a field onto an existing map to show and style your map using a different field.

- Choose a different smart mapping symbol type
- Change other symbol style properties, such as size and transparency

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Choropleth maps (Counts and Amounts - Color)

How do rates or percentages compare by geographic feature?

Choropleth maps use the **Counts and Amounts (Color)** smart mapping symbol type to show normalized data as shaded points, lines, or areas.

A choropleth map is automatically created when a `Rate/Ratio` field is used to create a map. A `Numeric` field can also be used to create a choropleth map by switching the **Symbol Type** from `Counts and Amounts (Size)` to `Counts and Amounts (Color)`. Numeric data should then be normalized using the **Divide By** parameter when used to create a choropleth map.

In a process referred to as data classification, proportional numeric values are grouped into ranges. For example, the population of youth between the ages of 12 and 17 can be normalized by total population to give the proportion of the population within that age group. The proportions are then classified and each classification range is represented by a shade or color on the color ramp.

By default, Insights for ArcGIS groups numeric data using a data classification method called **Natural Breaks** (also called Jenks Optimal). You can change the classification method in Layer Style properties.

Choropleth map example

A crime analyst is researching crime frequencies across the city and the correlation between crime and other social issues, such as high unemployment rate. The city will use the results to implement new social programming across the city in an effort to reduce the crime rates. A choropleth map can be used to visualize the unemployment rates in police districts across the city and compare unemployment to crime rates.

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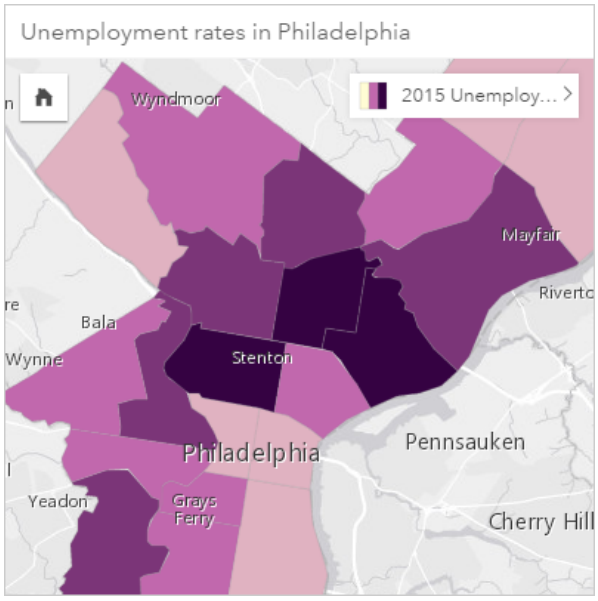

Darker areas in the above map indicate high levels of unemployment, while lighter areas indicate low levels of unemployment.

Choropleth map statistics

Click the **Info** button ⓘ to turn the map card over and see summary statistics.

A choropleth map provides a list of all the statistic types supported for the numeric field you used to style your map layer.

Choropleth map properties

From Layer Style properties, you can:

- Add or remove a layer
- Choose different data to style your map

  Note: You can also drag and drop a field onto an existing map to show and style your map using a different field.

- Choose a different smart mapping symbol type
- View or change the classification method
- Change other symbol style properties, such as the color ramp, and transparency
- Calculate a rate/ratio for your layer using the **Divide by** field in **Symbol Style** to normalize your data

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Combo charts

What are the trends for the same categories?

Create a combo chart to visualize two numbers, or rate/ratios for the same categories. Numeric values by category are shown as columns and a line chart on the same card.

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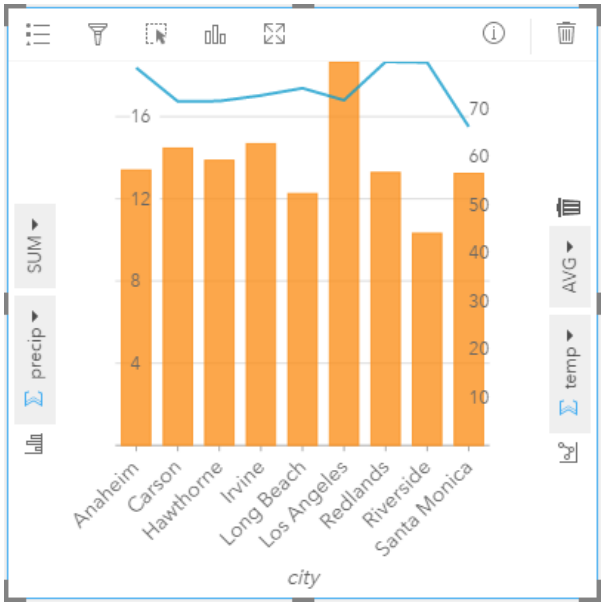
Combo chart example

An environmental organization is keeping track of the drought conditions across southern California and wants to compare temperatures and precipitation to determine which cities are most vulnerable. The organization uses a combo chart to show both the total precipitation and average temperature for each city in one chart.



Combo chart statistics

Statistics are not available for combo charts.

Combo chart properties

The following options are available for combo charts:

- Choose a different numeric or rate/ratio field to display the statistic axes
- Choose a different supported statistic type for your chosen field on each statistic axis
- Change your chart color

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Donut chart

What are the proportions of categories to the total?

Create a donut chart to show the percentage of qualitative data to the total. Each slice represents the percentage of each category, with a numerical total in the center of the ring. As a general rule, donut charts should have fewer than 10 (and preferably six or fewer) categories. Donut charts showing 10 or more categories can be hard for you audience to interpret.

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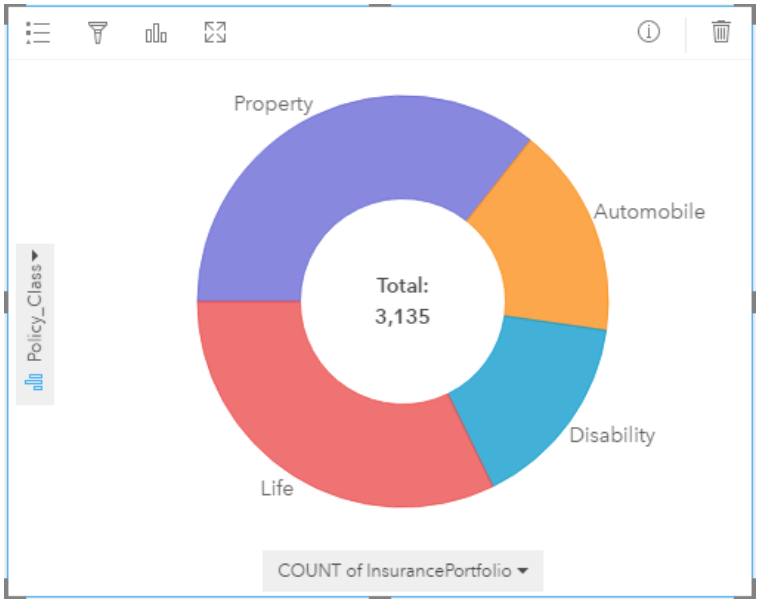
Donut chart example

An insurance company is reviewing the types of policies it offers to compare their current offerings to the findings from a recently completed market research project. One step in the review is to compare the total value of policies in each policy class. A donut chart can be used to visualize the proportion of total insured value (TIV) in each policy class.



The donut chart above gives a visual representation of each policy class, with the total insured value in the center. You can also see this data in the treemap example.

Donut chart statistics

Statistics for donut charts are not available.

Donut chart properties

- Click the **Visualization type** button to change to a related visualization type
- Show the **Legend**
- Choose a different field to show in the category axis (y-axis)
- Choose a different field and/or statistic type to show on the statistic axis (x-axis)

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Heat map

How is it distributed?

Create a heat map to visualize areas with the most point features as the hottest. A heat map is created using a map of point features and changing the **Symbol Type** in **Layer Style** properties

Heat maps are more of a visual aid than an accurate way to show point density, and are best used in conjunction with another visualization type, such as a time-series chart. As a general rule, if your map has more than 2,000 points apply a density calculation and map the calculated result instead of creating a heat map.

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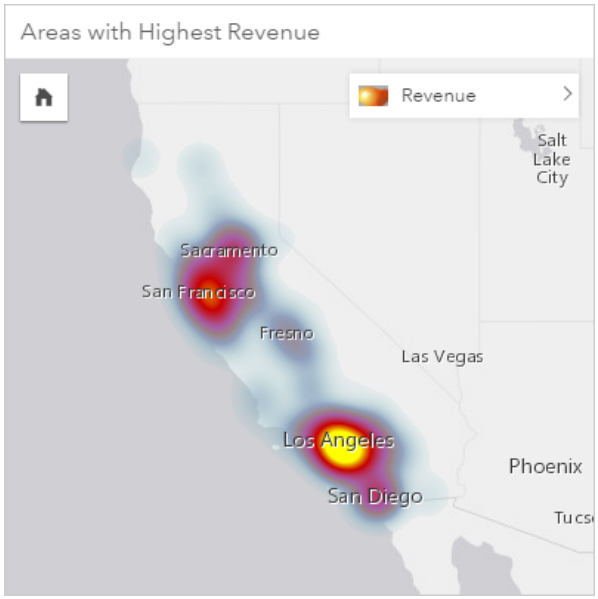
Heat map example

A retail chain is trying to decide which region of California has the most potential for high sales volume and should have new store branches added. The market researcher uses a heat map to quickly determine the areas where the revenue is highest.



Heat map statistics

Click the **Info** button ⓘ to turn the map card over and see summary statistics.

A heat map provides a count of point features for each map layer.

Heat map properties

From Layer Style properties, you can:

- Add or remove a layer
- Choose different data to style your map

  Tip: You can also drag and drop a field onto an existing map to show and style your map using a different field.

- Choose a different smart mapping symbol type
- Change other symbol style properties, such as: color, size, shape, and transparency

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Histograms

What is the distribution of numeric values and their frequency of occurrence in a data set? Are there outliers?

Create a histogram to group continuous numeric data into ranges, called bins, along the x-axis. A count of the number of times each range occurs in the dataset determines the height of the bins.

A histogram is a critical tool for classifying numeric data to show on a choropleth map or a proportional symbol map.

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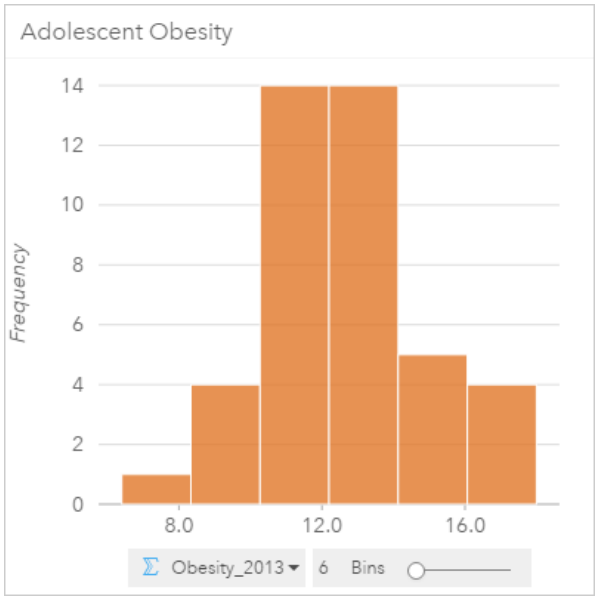
Do you know where else you'll see histograms in Insights for ArcGIS? In filters for numbers or rate/ratios in your data. A histogram filter lets you see how much data you're including or excluding from your visualization when filtering.

The following assessments can be made by viewing and adjusting the number of bins in your histogram:

- See gaps in your data
- Identify numeric ranges that are the most or least concentrated
- Assess probability distribution:
  - Does the data show a normal bell-curve distribution?
  - Is the data skewed (spread more to the left or the right)?

Histogram examples

A non-governmental health organization is studying obesity rates among adolescents in the United States. A histogram of the frequency of obesity rates in youth across each states can be used to determine the distribution of obesity rates, including the most and least common frequencies and overall range.



This histogram above shows a normal distribution and indicates that the most frequently occurring rates are between the 10 and 14 percent range.

Increasing or decreasing the number of bins can have an effect on how you analyze your data. While the data itself does not change, its appearance can. It is important to choose an appropriate number of bins for your data so that patterns in the data are not misinterpreted. Too few bins can hide important patterns and too many bins can make small but expected fluctuations in data appear important. The following figure is an example of an appropriate number of bins for the data. Each bin contains a range of approximately one percent and the data can be examined at a finer scale to see patterns that are not visible when using six bins. In this case, the pattern that emerges is a normal distribution around the mean with a slight, but likely not significant, skew toward the left.

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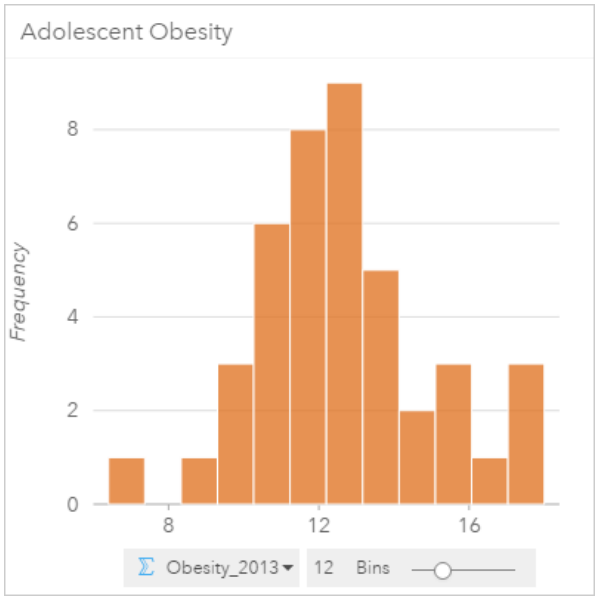

Histogram statistics

Statistics for histograms are not available.

Histogram properties

The following options are available when making a histogram:

- Adjust the number of bins, using the slider.
- Choose a different number or rate/ratio to show on the x-axis.
- Click the **Visualization Type** button to change the histogram to a proportional symbol map or a summary table.
- Show the **Legend** to change the chart color.

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Line graphs

How are numeric values distributed or summarized by category?

Create a line graph to show information as a series of data points that are connected by straight line segments. Categories are shown along the x-axis, and statistics are provided along the y-axis. Unlike time-series graphs which only use date/time along the category axis, line graphs allow you to use string fields along the category axis.

By default, the chart indicates the mean (average), and displays the mean statistic as a dashed line in red, so that you can quickly see which values fall above or below the mean.

Line graph example

An environmental organization is keeping track of the drought conditions across southern California and wants to compare precipitation levels across the region to determine which cities are most vulnerable. The organization uses a line graph to show the total precipitation for each city.

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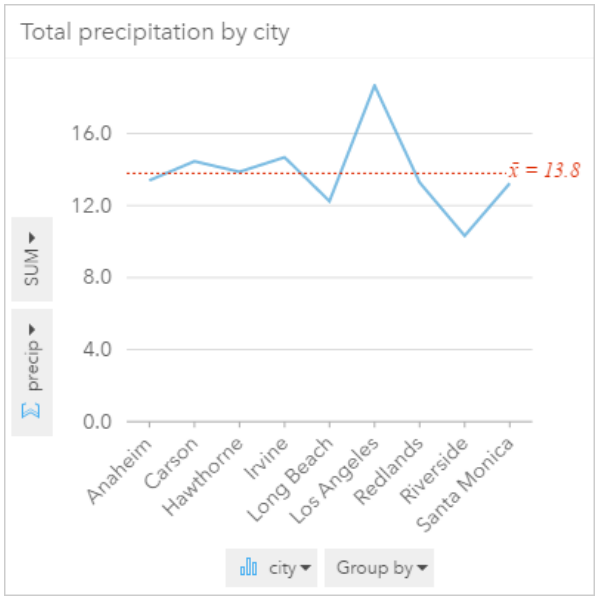

The line graph above shows how precipitation values fluctuate by city.

Line graph statistics

Chart statistics are the same statistics provided by a bar and column chart.

Line graph properties

The following options are available when creating a line graph:

- Choose a different field for the statistic axis
- Choose a different supported statistic type for your selected field on the statistic axis, for example `AVG`
- Change the **Visualization type** to a supported visualization for your chosen data (see Supported visualizations).
- Change your chart color

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Location maps (Single symbol)

Where is it located? How is it distributed?

Create a location map to see how features are distributed—whether they're clustered or dispersed. For example, a map of restaurant locations would likely show that the restaurants are clustered together in a business district. A location map renders points, lines or areas using a single, uniform symbol. When you create a map using a location field, the **Location (Single Symbol)** smart mapping symbol type is applied.

Note: An error will occur when you try to map a location field from a joined dataset from a database connection for an SAP HANA 1.0 SPS database if the join keys include a field that participates in a promary key or a unique index. This issue does not occur for datasets from SAP HANA 1.0 SPS 12 databases.

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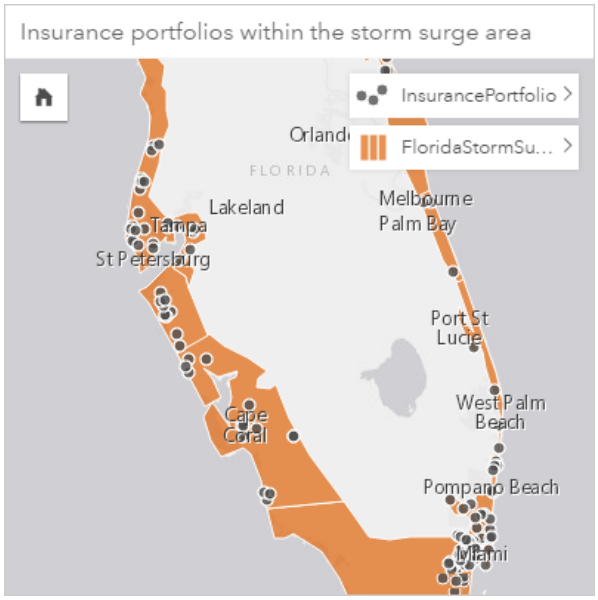
While it is important to see where your data are, it can also be important to see where they are not. For example, if you expected to see trees on a city lot and your tree inventory location map isn't showing any, then the absence of trees would raise some questions.

Location map example

An insurance company is conducting an assessment to determine how many of its current policies are within a storm surge area and the associated risk. A location map can be used to give the analyst an idea of the number of the policies that are in the high risk area.



The above location map shows customer locations on the topmost layer as point features, and the storm surge area as area features in the bottom layer. Spatial filtering was used to filter the point data layer (`InsurancePortfolio`) using the area layer (`FloridaStormSurge`) to include only those customers who live within the anticipated storm surge area.

Location map summary statistics

Click the **Info** button ⓘ to turn the map card over and see summary statistics.

A location map provides a count of features (either point, line, or area features) for each map layer.

Location map properties

From Layer Style properties, you can:

- Add or remove a layer
- Choose different data to style your map

  Note: You can also drag and drop a field onto an existing map to show and style your map using a different field.

- Choose a different smart mapping symbol type
- Change other symbol style properties, such as: color, size, shape, and transparency

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Proportional symbol maps

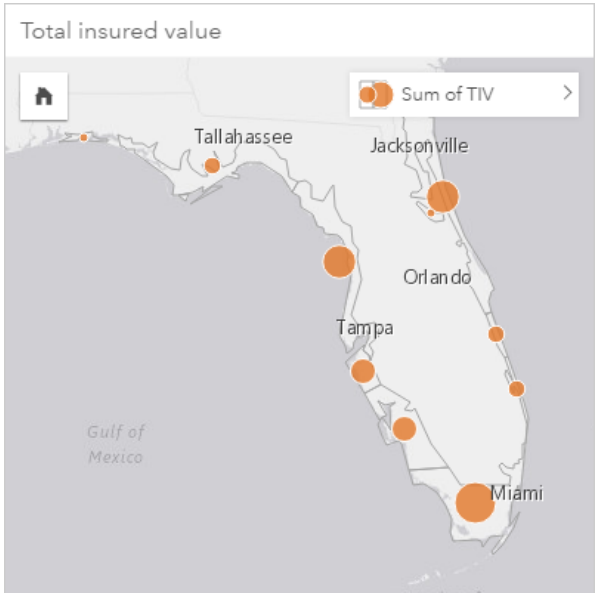
Where is it located? Where is it biggest? Where is it smallest?

Create a proportional symbol map to show symbols of graduated sizes to indicate numeric values, where larger symbols represent larger values. Proportional symbol maps use the `Counts and Amounts (Size)` smart mapping symbol type. A proportional symbol map will be created by default when a numeric field is used to create a map.

Proportional symbols make it easy to distinguish between low and high values, allowing you to show differences and make comparisons on a map. Adjust the size of the symbols to clarify the story you're telling. You create a proportional symbol map when you style your layer using a numeric field Σ, or when you perform a spatial aggregation between two datasets.

Proportional symbol map example (Counts and Amounts - Size)

An insurance company is conducting an assessment to determine how many of its current policies are within a storm surge area and the associated risk. A proportional symbol map using the sum of total insured values (TIV) can be used to determine which storm surge areas have the highest value of policies.



The above proportional symbol map is the result of a spatial aggregation between the `InsurancePortfolio` and the `FloridaStormSurge` layers (shown in the location map example above). The map indicates the highest `TIV` on the southern tip with the largest symbol.

Proportional symbol map statistics

Click the **Info** button ⓘ to turn the map card over and see summary statistics.

A proportional symbol map provides a list of all the statistic types supported by the numeric field you used to style your map layer.

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Proportional symbol map properties

From Layer Style properties, you can:

- Add or remove a layer
- Choose different data to style your map

  Note: You can also drag and drop a field onto an existing map to show and style your map using a different field.

- Choose a different smart mapping symbol type
- View or change the classification method
- Change other symbol style properties, such as the color ramp, and transparency
- Calculate a rate/ratio for your layer using the **Divide by** field in Symbol Style to normalize your data

Scatter plots

What is the relationship between two variables?

Create a scatter plot to show the possible correlation between two numbers or rate/ratios. This allows you to see if changes in one variable affect changes in the other variable, either positively or negatively.

When you select two numeric fields, Insights for ArcGIS plots the first field it encounters in your dataset on the x-axis. The independent variable should be on the x-axis, and the dependent variable should be on the y-axis.

Tip:

- Don't know which variable to put where? Here's a little trick. Rephrase the question like this: What is the effect of the length of pipes on the number of leaks? The first variable mentioned after "effect of" is the independent variable (length of pipes) and goes on the x-axis. The variable that is being affected "on" is the dependent variable (number of leaks), which goes on the y-axis. For example, what is the effect of altitude on air temperature? In this question, altitude is the independent variable and is plotted along the x-axis, while air temperature is the dependent variable and is plotted along the y-axis of the scatter plot.
- Don't worry if you guessed wrong about which variable goes where. Just click the **Flip fields** button to reverse field placements on the chart.

Scatter plots can also answer other questions such as:

- **How is it distributed?**
  Diffuse dots across the chart indicates the data are widespread. Points that are clustered together in a small area indicate concentrated data.
- **Where are the outliers?**
  Points that fall far outside a predominant pattern are considered outliers.

Adding a third value to the **Color by** list takes your comparative analysis a step further by sorting the symbols into categories using color. This allows you to see distribution by categories.

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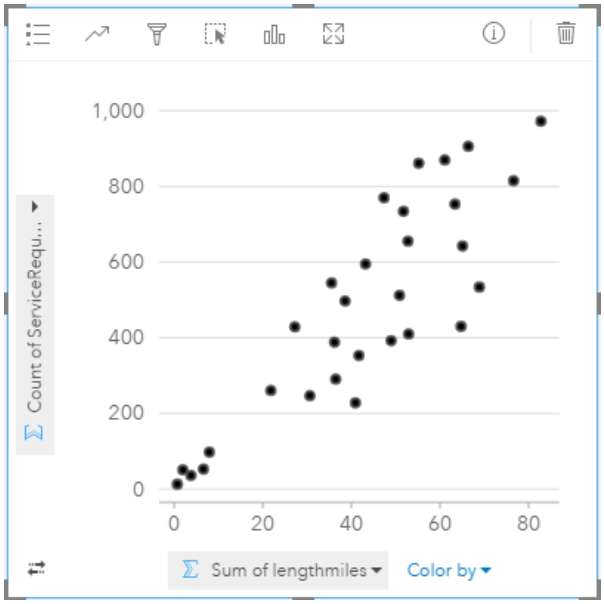
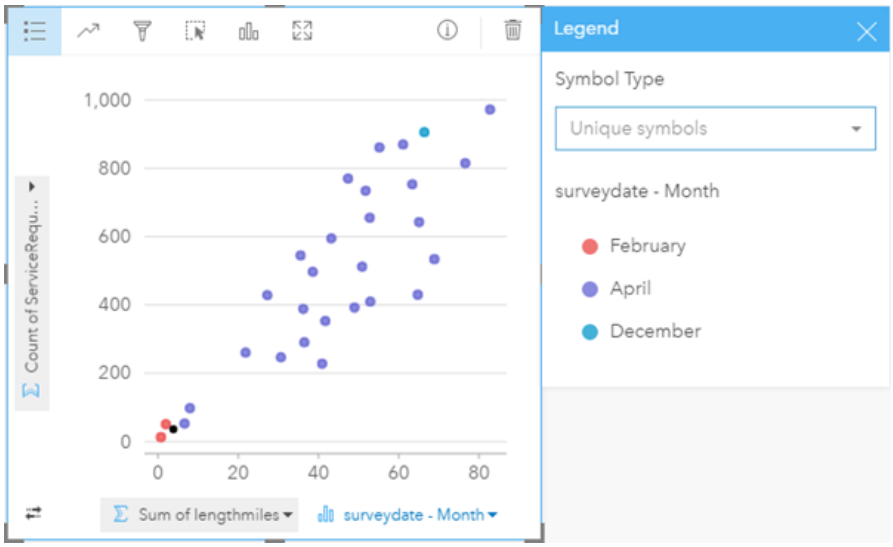
You can go deeper into your analysis by modeling a formal relationship between a dependent and independent variable using a regression equation. The modeling can be linear, exponential, or polynomial.

Scatter plot examples

A public works department has been noticing an increase in leaks on water mains. The department wants to know how much of an effect the total length of pipes has on the number of leaks, versus the impact of properties of the pipes, such as age or circumference. A scatter plot can be used to plot the total number of leaks versus the total length of pipes in each zone.



The public works department also wants to know if there is any difference between pipes surveyed at different times of the year. Using the **Color by** option will style the points using unique colors for every unique value (`month`) in the specified field.



The above scatter plot indicates that most of the pipe surveys occurred in the month of April.

A scatter plot can use regression analysis to estimate the strength and direction of the relationship between dependent and independent variables. Statistical models are illustrated with a straight or curved line, depending on your selected chart statistic. The R^2 value can be added to give a measure of the impact of the length of pipes on the number of leaks.

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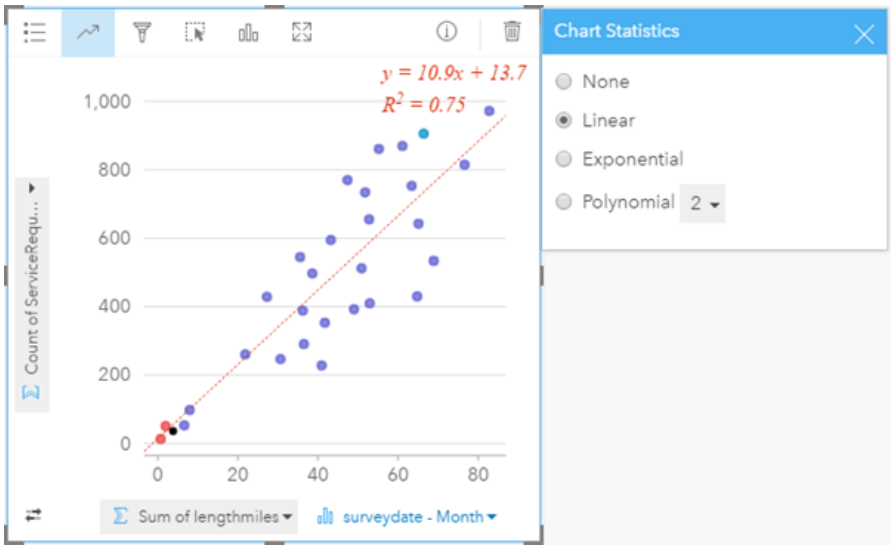

Scatter plot (and bubble chart) statistics

Click the **Chart Statistics** button to see available statistics.

Statistical models are illustrated with a straight or curved best-fit line (depending on your selection). In the upper right, the equation for your selected regression model is displayed, along with the R^2 values that indicate the strength of the relationship between the independent (x) and dependent (y) variables. The table below provides more information about the available statistical models:

Statistic	Description
Linear	Linear regression attempts to fit a straight line through a set of values so that the distance between the values and the fitted line are as small as possible. A positively sloped line (from lower left to upper right of the chart) indicates a positive linear relationship. Positive relationships mean that values increase together. A negatively sloped line indicates a negative linear relationship. A negative relationship means that as one value decreases as another increases. Goodness of fit measures, such as R^2 can be used to quantify the relationship. The closer to 1, the stronger the relationship.

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Exponential	Calculates an exponential (upward) curve of best fit to model a non-linear relationship in your data (R^2 at 0 or close to 0).
Polynomial	Calculates a curve of best fit for a non-linear relationship in your data (R^2 at 0 or close to 0). A second-degree polynomial equation is used for the calculation by default. You can change the equation to a third or fourth-degree polynomial equation.

For more information about regression analysis, see Regression analysis basics in ArcGIS Desktop help (https://desktop.arcgis.com/en/arcmap/10.5/tools/spatial-statistics-toolbox/regression-analysis-basics.htm).

Scatter plot (and proportional symbol chart) properties

You can:

- Show the **Legend** to view or select categories (if you have selected a field to **Color by**), or to change the chart color for uncategorized scatter plots
- Change your scatter plot to a proportional symbol chart by dragging a third number onto the chart
- Show different data along the x- and y-axes
- Categorize the symbols by color by choosing a field in **Color by**
- Change your chart color

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Summary tables

How are numeric values summarized by category?

Create a summary table to show statistics for unique categorical groups, or numeric totals if you choose only numbers or rate/ratios to create the table. A summary table can provide multiple statistics—one for each numeric column.

Note: A summary table can only have one category column. You can choose either a string or location field to provide unique categorical values for the column.

Summary table example

A health analyst wants to evaluate readmission totals for hospitals by ownership. This table lists distinct category values, and calculates a statistical summary for each category value.

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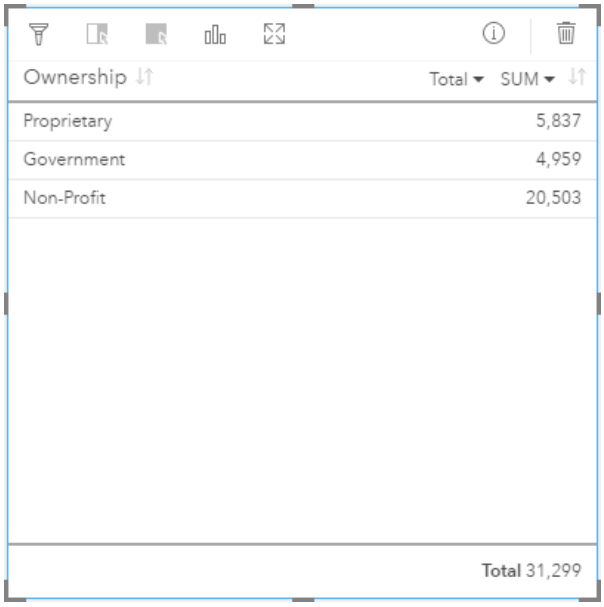

That analyst can add more numeric or rate/ratio fields to the table, such as average rate to see other statistics by ownership type, but only one category column is supported for a summary table. By contrast, when you view your data as a data table, you would see every occurrence of ownership type, so you'd see multiple rows for each ownership category (and no statistics, just raw numbers).

Summary table statistics

The default statistic for numeric data is `Sum`. One statistic is available per statistic column.

Click the down arrow in the statistic column to apply a different statistic type. Available statistic types are: `Sum`, `Min`, `Max`, or `Avg`.

Summary table properties

The following options are available when creating summary tables:

- Drag additional fields onto the table card to add more columns.
- Drag a different field onto an existing column to replace the field being summarized.
- Change the statistic type for one or more statistic columns.
- Reorder a column by dragging the field name (column header).
- Sort columns in ascending or descending order.
- Resize columns.

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Time-series graphs

How does the trend change over time?

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Create a time-series graph to visualize trends over time. Because date or time information is continuous categorical data (expressed as a range of values), points are plotted along the x-axis and connected by a continuous line. Missing data is indicated with a dashed line. The category (x) axis in a time-series graph always represents a date/time field, while the statistic (y) axis provides an aggregated value for each point in the line.

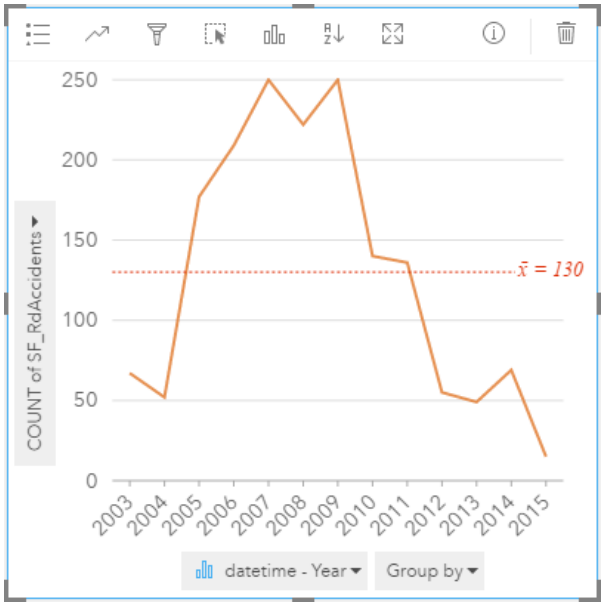
By default, the chart indicates the mean (average), and displays the mean statistic as a dashed line in red, so that you can quickly see which values fall above or below the mean.

If you selected only a date/time field, Insights for ArcGIS provides a count of one of the following for the y-axis:

- The number of features in your dataset if your dataset contains geography
- The number of times that each value occurs in the date/time field if your dataset does not contain geography

Time-series graph examples

A traffic analyst is researching the effect of redesigning streets on the number of traffic accidents, including adding or removing traffic lights and one-way streets. The analyst uses a time-series graph and compares the number of traffic accidents in each year to the number or type of alterations made each year to determine the effect of alterations on driving safety.



The above chart shows a peak of accidents in 2007 to 2009, followed by a significant decrease in the following years. If the alterations took place between 2007 and 2009, then that would imply that the changes caused a temporary increase in traffic accidents, after which the drivers adjusted to the changes and the number of accidents decreased back to normal.

The traffic analyst realizes that looking at a total number of accidents over an entire year only tells part of the story. Grouping the time-series map by another field, such as `DayOfWeek`, can give more insight into what causes traffic accidents.

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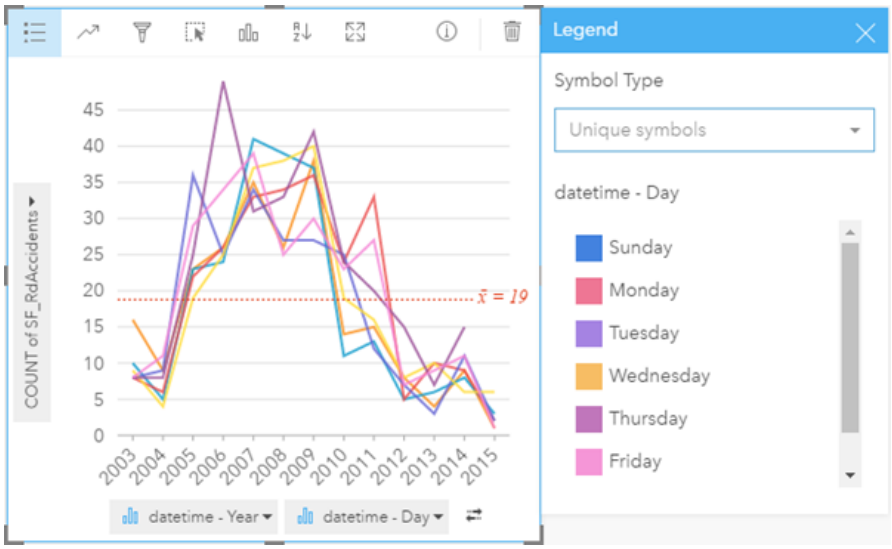

The grouped time-series graph above indicates that the number of occurrences vary considerably by day of the week. Friday has the most accidents in 2006 and 2010, but Tuesday has the tallest peak in 2012. There's also an interesting trend where Monday is at the top around 2008, but at the bottom in 2010. The traffic analyst will want to incorporate these trends into the study.

Tip: The following cards may be helpful to pair with your grouped time-series graph:

- A related map styled with the same field you used to group your time-series graph, for example `DayOfWeek`. When you interact with the time-series graph or the map, you'll be able to see simultaneous temporal, categorical, and spatial patterns.
- A related bar chart using the field you used to group your time-series graph to see highest and lowest values by your chart subgroup.

Time-series chart statistics

Chart statistics are the same statistics provided by a bar and column chart.

Time-series properties and tools

The following options are available when creating a time-series map:

- Choose a different field for the statistic axis.
- Choose a different supported statistic type for your selected field on the statistic axis, for example `AVG`.
- Choose a field in the **Group by** list to display a line for each subgroup in the selected field.
- Show the **Legend** to view or select categories, or to change the chart styling. You can specify a different line color for an ungrouped time-series graph. A grouped time-series graph shows **Unique Symbols** with each line in a different color.
- Change the **Visualization type** to a supported visualization for your chosen data (see Supported visualizations).

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Treemaps

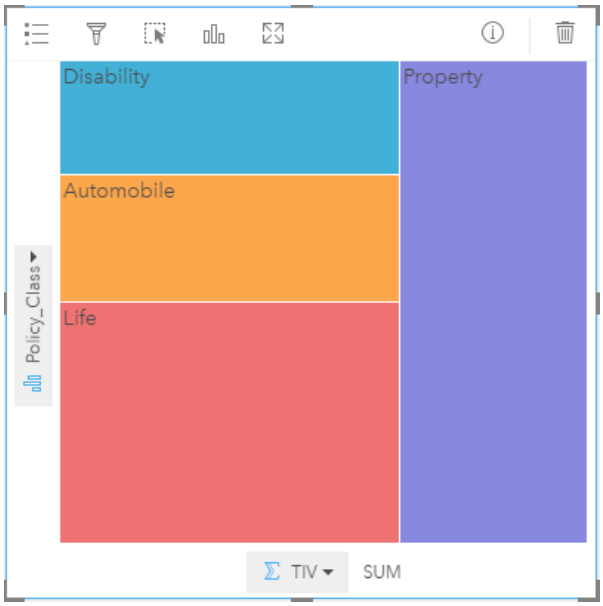
What are the proportions of categories to the total?

Create a treemap to see your data in a hierarchical format using nested rectangles. A treemap is like a tree diagram that uses differently-sized rectangles to convey numeric values for each branch. The bigger the rectangle, the higher the numeric value.

The field selected on the category (y) axis groups the data by unique categories that are displayed as proportional rectangles in different colors. Hovering over each rectangle provides a sum or count for each category.

Treemap example

An insurance company is reviewing the types of policies it offers to compare their current offerings to the findings from a recently completed market research project. One step in the review is to compare the total value of policies in each policy class. A treemap can be used to visualize the proportion of total insured value (TIV) in each policy class.



The treemap above gives a visual representation of each policy class, with each rectangle representing a portion of the total insured value.

Treemap chart statistics

Statistics are not available for treemap charts.

Treemap properties

With a treemap you can:

- Change the **Visualization type** to a supported visualization for your chosen data (see Supported visualizations).
- Show the **Legend**
- Choose a different field to show in the category axis (y-axis)
- Choose a different field to show on the statistic axis (x-axis)

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Essential vocabulary

Aggregation

Aggregation allows you to step back from your data to see a larger picture. Datasets may have detailed information about specific locations, products, and revenue, but aggregation helps you understand general patterns by allowing you to slice data along any specified context and see a statistical summary. Aggregation automatically applies a statistic type that can be shown on a map or a chart. For example, annual revenue is useful information, but more meaningful answers can be provided for questions such as the following:

- What is my `SalesAmount` by `SalesRegion`?
- What is my `SalesAmount` by `SalesRep`?

To answer the first question, visualize the `SalesAmount` and `SalesRegion` fields as a map to perform a spatial aggregation that sums subtotals by geographic areas (`SalesRegion`).

To answer the second question, visualize `SalesAmount` and `SalesRep` as a bar chart to perform an attribute aggregation that automatically sums sales subtotals for each name in the `SalesRep` field:

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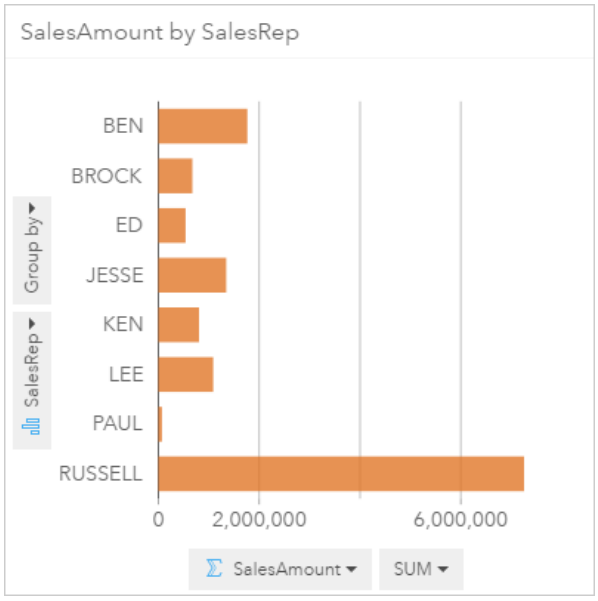

ArcGIS

ArcGIS is a comprehensive system for collecting, editing, mapping, storing, and sharing many kinds of geographic information. It has many components that allow users to work in desktop, web, and mobile environments. Insights for ArcGIS is an app that easily connects to data from many sources; brings multidimensional data to life as interactive maps, charts, and tables; and allows you to achieve spatial insights from your data effortlessly.

Basemap

A basemap provides a geographical context, or background, for the content you want to display on a map. With Insights for ArcGIS, you can choose from several Esri basemaps hosted on ArcGIS. These basemaps include many options that combine road, aerial, and topographic data with a variety of symbology.

Buffer

A buffer is a zone around a map feature measured in units of distance or time. Buffers help you answer questions about what's nearby, such as How many crimes occurred within one kilometer of a police station? Buffers can be applied to points, lines, or areas. Once calculated, a buffer layer is stored as a results set, allowing you to reuse the results on other cards and other pages. Buffers appear as a new layer on your map. Buffers can be used as part of a model to aggregate your data. To answer the question above, specify a one-kilometer buffer around each police station on your map, and then either drag a numeric field (`CrimeIncidents`) or a point layer (`CrimeLocations`) onto the **Spatial aggregation** drop zone that appears on your buffer layer.

Card

Cards are the primary focus of your work in Insights for ArcGIS. You can add as many cards as you want to a page. A card is a container for a visualization, which can be a map, chart, or table. Cards generated from the same dataset are automatically linked, allowing you to make selections on a card and have related cards update automatically to reflect your selections. From a card, you can apply spatial analysis tools, switch to different visualization types, change styling, or select different data to view.

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Coordinates

A set of values represented by the letters x and y that define a position within a spatial reference. Coordinates are used to represent locations in space relative to other locations. Coordinates are often shown in latitude-longitude pairs, where x coordinates range from -180 to 180 and y coordinates range from -90 to 90, or as values with 6, 7, or 8 digits to the left of the decimal point. When using Insights for ArcGIS, these value pairs are often composed of the values from two columns in your data.

Dataset

When you add data to your page, you are associating tables of data to your workbook page. Data you add appears as one or more datasets in the data pane. A single dataset can be one of the following:

- Feature layer
- Excel table from a single spreadsheet

  Note: One Excel spreadsheet can contain more than one Excel table.

- Table from a database connection

Each column in a table is listed as a single field in the dataset. Insights for ArcGIS assigns a role to each field based on the type of data it contains.

Data source

A data source is exactly what it sounds like: the source of the data. Insights for ArcGIS allows you to use a variety of data sources to find answers to your questions. Each of the following is a data source: Portal for ArcGIS (feature layers you own or that have been shared with you), Excel workbooks, and a database connection.

Drop zone

A drop zone is a floating user interface (UI) element that appears when you drag selected fields onto your page. Drop zones give you control over whether you create a map, chart, or table. If your dataset has location enabled, three drop zones appear when you drag one or two fields onto the page—**Create Map**, **Create Chart**, and **Show Table**. If you haven't yet enabled location, only the **Create Chart**, and **Show Table** drop zones appear. If you prefer not to use drop zones, you can use the **Map**, **Chart**, and **Table** buttons above **My Data** in the data pane.

Equal interval classification method

Equal interval classification divides the range of attribute values into subranges of equal size. With this classification method, you specify the number of intervals (or subranges), and the map viewer automatically determines how to divide the data. For example, if you specify three classes for an attribute field whose values range from 0 to 300, the map viewer creates three classes with ranges of 0–100, 101–200, and 201–300.

Equal interval is best applied to familiar data ranges, such as percentages and temperature. This method emphasizes the amount of an attribute value relative to other values. For example, it could show that a store is part of the group of stores that make up the top one-third of all sales.

Feature

Geographic features are representations of things located on or near the surface of the earth. Geographic features can occur naturally (such as rivers and vegetation), can be constructions (such as roads, pipelines, wells, and buildings), and can be

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subdivisions of land (such as counties, political divisions, and land parcels). Geographic features are most commonly represented as points, lines, or polygons. In Insights for ArcGIS, data you have added is often referred to as features on the map.

Feature service

A feature service is a collection of geographic features. Each feature in the collection has a location, set of properties, map symbology, and pop-up. In Insights for ArcGIS, you can search for feature services in ArcGIS and add them to your map. When you add a feature service to your map, it becomes one or more layers in the map.

Field roles

Insights for ArcGIS identifies field roles using icons that indicate the default behavior of each field from your dataset in visualizations. The field role also determines the default statistic type applied to each field in a visualization.

While the table below lists the default visualization for each field role, you can change to a different visualization type depending on the data selected in the card. See the Visualization catalog for more information about supported visualizations.

Tip: There are times when you may want to specify a different role for a field. You can change a field role in the data pane.

Icon	Role	Behavior	Default visualization	Default statistic type (for aggregations)
	Location Example: Coordinates	Allows you to plot data on a map as points, lines, and areas, and perform spatial analysis. Can be used as unique categories in charts and tables.	Location map	Count
	String Example: StoreName	Groups data as bars, slices, or lines in charts. Groups data as a category column in summary tables. Appears as unique symbols in maps. Can be calculated as a count along the statistics axis of charts, or statistics columns in summary tables.	Default chart: Bar chart *Default map: Category map	Count

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Σ	Number Example: Σ SalesRevenue	Determines the height, length, or size of bars, columns, slices, and bubbles in charts. Determines the size of the graduated circles in proportional symbol maps.	Default chart: • 1 number: Histogram • 2 numbers: Scatter plot *Default map: Proportional symbol map	Sum
R/B	Rate/Ratio Example: R/B ObesityRate	Determines the height, length, or size of bars, columns, slices, and bubbles in charts. Grouped ranges of rate/ratios determine the level of shading for features shown in maps.	Default chart: • 1 rate/ratio: Histogram • 2 rate/ratios: Scatter plot *Default map: Choropleth map	Sum in charts None in choropleth maps
	Date/Time Example: AdmissionDate Year Quarter Month Day of week	Displays a series of data points graphed in time order. Insights automatically divides date/time fields into parts that can be used as string fields in other visualizations. Date parts are the following: • year_<fieldname> • Quarter • Month • Day of week	Default chart: time-series graph Default map: not applicable	Count

*To create a map using a string, number, or rate/ratio, your dataset must contain one location field. See Enable location for your dataset.

Geocode

Geocoding is the process of transforming a description of a location—such as a pair of coordinates, an address, or a name of a place—to a location on the earth's surface. You can geocode by entering one location description at a time or by providing many of them at once in a table. The resulting locations are output as geographic features with attributes, which can be used for mapping or spatial analysis.

Heat map

When you have too many points on your map to interpret patterns or make sense of the information, consider using a heat map. A heat map represents point features as density using colors. Areas that look the hottest, where colors are the most intense, indicate the highest point density.

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Layer

A layer is the way in which Insights for ArcGIS visually represents geographic datasets. A layer is rendered as a map, and each layer has a legend. A map can contain multiple layers. On a road map, for example, roads, national parks, political boundaries, and rivers might be considered different layers. When you add business data to a map, Insights for ArcGIS creates a layer and displays it on a card.

Lines

Lines represent the linear nature of a feature. For example, the length of a road is the primary interest while the width of the road might be of secondary interest, so the map displays the road as linear, but the width can be added as an attribute.

Map

A map displays geographic data and allows you to explore and interact with that data. In Insights for ArcGIS, you can add data directly to the map and combine it with additional content from Portal for ArcGIS.

Model

A model records your analysis steps on your workbook page, including adding and joining datasets, spatial analysis (such as spatial filtering), data analysis (such as attribute aggregation), and styling. You can edit, use, and share the model to automate common analytical tasks.

Natural breaks classification method

Natural breaks (also known as Jenks Optimal) classes are based on natural groupings inherent in the data. Class breaks that best group similar values and that maximize the differences between classes—for example, tree height in a national forest—are identified. The features are divided into classes whose boundaries are set where there are relatively big differences in the data values.

Because natural breaks classification places clustered values in the same class, this method is good for mapping data values that are not evenly distributed.

Normalization

In GIS terms, normalizing data means converting your data from totals (or counts) to a rate, ratio, or other proportion related to a common denominator such as area or population. Normalization allows you to directly compare places that might have very large differences in size or population. For example, comparing the number of births in 2011 in China (more than 16 million) to the number of births in the United States (almost 4 million) is misleading. Over 12 million more babies were born in a year in China than in the United States, but China's overall population is much larger. A more accurate approach is to compare the birth rate from each country. The per capita birth rate is calculated by dividing the total number of births by the population. At 1.66 births per capita, China's birth rate is lower than the US rate of 1.90.

If your dataset already contains a field that has been normalized, but Insights for ArcGIS mistakenly identifies it as a number, you can change the field role to a rate or ratio directly in **My Data**. If your dataset does not contain normalized data, you can do one of the following:

- Go to **View Data Table** in **Dataset options** ⋮ to calculate the field.
- Access the **Divide By** field in Layer Style properties for your choropleth or proportional symbol map.
- Use the Calculate Ratio tool in **Find Answers**.

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In database management terms, normalization is the process of organizing, analyzing, and cleaning data to increase efficiency for data use and sharing. Normalization usually includes data structuring and refinement, and redundancy and error elimination.

Page

A page in a workbook contains related content. You add data to a page, and ask questions by visualizing data fields. Visualizations appear as linked cards on a page. A workbook can contain many pages. A page can contain many cards. When you share your results as a page item in portal, users with the Viewer role (https://enterprise.arcgis.com/en/portal/10.5/use/roles.htm) can interact with cards on the page in a separate, read-only Insights viewer.

Pan (the map display)

Shift a map image relative to the display window without changing the viewing scale. Panning a map can also be thought of as moving the map image in the display window so you can see different parts of the map.

Points

Points represent discrete locations of geographic features too small to be depicted as lines or areas, such as well locations, telephone poles, and stream gauges. Points can also represent address locations, Global Positioning System (GPS) coordinates, or mountain peaks.

Polygons or Areas

Polygons are enclosed areas (many-sided figures) that represent the shape and location of homogeneous features such as states, counties, parcels, and land-use zones. Polygons are often called areas.

Quantile classification method

With quantile classification, each class contains an equal number of features—for example, 10 per class or 20 per class. There are no empty classes or classes with too few or too many values. Quantile classification is well suited to linearly (evenly) distributed data. If you need to have the same number of features or values in each class, use quantile classification.

Because features are grouped in equal numbers in each class, the resulting map can often be misleading. Similar features can be placed in adjacent classes, or features with widely different values can be put in the same class. You can minimize this distortion by increasing the number of classes.

Spatial aggregation

Spatial aggregation is a spatial analysis tool that creates a statistical summary of features or numeric data within the boundaries of areas on a map. Spatial aggregation can provide the same statistic types as attribute aggregation.

Spatial analysis

Spatial analysis is the process of examining the locations, attributes, and relationships of features in data through spatial operators, such as buffer, and analytical techniques, such as hotspot analysis, to answer a question or gain useful knowledge. Spatial analysis creates a reusable dataset of your results. Because it is stored as a feature layer, analytical results can be reused on other cards or pages. For example, create a 10-kilometer buffer around store locations and reuse it with other datasets, or on other cards to make spatial selections or apply spatial filters.

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Standard deviation classification method

Standard deviation classification shows you how much a feature's attribute value varies from the mean. By emphasizing values above the mean and below the mean, standard deviation classification helps show which features are above or below an average value. Use this classification method when it is important to know how values relate to the mean, such as when looking at population density in a given area, or comparing foreclosure rates across the country. For greater detail in your map, you can change the class size from 1 standard deviation to .5 standard deviation.

Statistic types

Statistic types provide a statistical summary (known as an aggregation) for a specified context, such as the following:

- `Revenue` by `ProductType`
- `Income` by `Country`

In these examples, `ProductType` and `Country` provide the grouping role in the aggregation, while `Revenue` and `Income` are the fields that are aggregated to provide a subtotal for each value in the `ProductType` and `Country` fields (`bikes`, `skis`, and `skates`, or `Canada`, `United States`, and `Norway`). Sum applies by default when a numeric field is calculated, but you can apply any statistic type to a numeric field. Nonnumeric fields (strings) can be calculated as well, but only using count.

The table below provides more information about each statistic type:

Statistic type	Description
`AVG`	Also known as the mean. The result of dividing the sum of all the numeric values (records) in a field, and then dividing by how many (the count of) numbers there are. Example: (122 + 333 + 67) / 3 = 70
`COUNT`	The number of values in a field. Example: `TreeSpecies` contains these values: `alder`, `spruce`, `maple`, `spruce`, `red pine`, `white pine`, `alder` `COUNT` = 7
`SUM`	The result of adding two or more numeric values (records) in a field. Example: 122 + 333 + 67 = 522

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`MAX`	The highest numeric value in a set. Example: `StudentAttendance` contains these records: `31`, `27`, `33`, `29`, `22` `MAX` = 33
`MIN`	The lowest value in a field. Using the `StudentAttendance` field above as an example, `MIN` = 22.

For more information about the default statistic types applied to fields in visualizations, see Field roles.

Unclassed maps

Instead of using groups (or classes) of numbers to determine symbol size and color, unclassed maps determine size and color proportional to where each value falls between the upper and lower bounds of your data. Unlike classed maps (natural breaks, equal interval, quantile, and standard deviation) that have a fixed number of colors or sizes (for example, five), unclassed maps smoothly vary the size or colors of the symbols proportionally according to each value at a specific location. This applies less generalization than classed maps, which group observations data into only a few sizes or colors. Smart mapping adjustments called bounded continuous color and bounded continuous size adjust the upper and lower limits (bounds) of your data to one standard variation around the mean. The dark vertical line on the histogram indicates the mean. Bounded unclassed maps show a nice variation across the data, while not being influenced by extreme values (outliers).

Workbook

A workbook is a dynamic collection of data and analysis. A workbook collects or associates all your data and analytical activity for a project in a single place, capturing and maintaining relationships such as data locations, results layers, models, pages, and cards. As an author or coauthor of a workbook, you can see all of these items within the workbook provided that you have access to the items that may reside outside the workbook, such as enterprise databases, or layers in your web GIS. A workbook can have many pages. You add data to each page, and ask questions by selecting data to visualize. If you find your page becoming cluttered, add a new page, or perhaps tackle one question per page. Answers are provided in the form of visualization cards that you can further refine by applying spatial analysis tools, filtering, styling, and switching to other types of visualizations. Cards are the result of analytical activity as well as inputs for other forms of analysis, such as spatial aggregation.

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Compatibility with Portal for ArcGIS

The following table indicates version support between Insights for ArcGIS and Portal for ArcGIS:

Insights version	**Portal for ArcGIS version**
	10.5
1.0	✓
1.1	✓
1.2	✓
1.2.1	✓

Additional resources

- Configure the portal to support Insights
- Supported data
- Supported databases
- Supported browsers

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Localizing Insights for ArcGIS

The Insights for ArcGIS setup installs language-specific resources that allow you to localize the user interface of the Insights website. Localized help documentation is available as a separate installation, which you download from My Esri (https://my.esri.com/).

Localizing the Insights website

Language determines the user interface as well as the way time, date, and numerical values appear. The user interface of the Insights website can be viewed in the following languages:

Arabic	Lithuanian
Croatian	Norwegian
Czech	Polish
Danish	Portuguese (Brazil)
Dutch	Portuguese (Portugal)
English	Romanian
Estonian	Russian
Finnish	Serbian
French	Simplified Chinese
German	Spanish
Greek	Swedish
Hebrew	Thai
Italian	Traditional Chinese (Hong Kong)
Japanese	Traditional Chinese (Taiwan)
Korean	Turkish
Latvian	Vietnamese

The display language of the Insights website is determined by the language of the web browser you are using. Check the Help information for the web browser you are using for information on how to change your browser language.

Localizing the help documentation

The English help documentation is installed as part of the Insights for ArcGIS setup. To view the help in a language other than English, you'll need to download and install the Insights for ArcGIS Help Language Pack from My Esri (https://my.esri.com/). The language pack contains help in the following languages: Arabic, Chinese (Simplified Han), Chinese (Hong Kong), Chinese (Taiwan), Dutch, French, German, Italian, Japanese, Korean, Polish, Portuguese (Brazil), Romanian, Russian, and Spanish.

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Supported browsers

Insights for ArcGIS supports the following browsers:

- Internet Explorer (version 11 or later) — Windows 8.1 and 10 only
- Edge
- Firefox (version 10 or later)
- Chrome (version 10 or later)
- macOS Safari
- iOS Safari (tablets only)

Additional resources

- Supported data
- Access Insights

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Supported databases

The following table lists the supported databases you can connect to when using Insights for ArcGIS. Database connections allow you to add data from these databases to Insights for ArcGIS.

Note: Currently, Insights for ArcGIS does not allow you to create a connection to a relational database that has an enterprise geodatabase defined. Similarly, Insights does not work directly with file and personal geodatabases. For geodatabase tables and feature classes to be used in Insights, they must be made available in your portal organization as either hosted or registered feature layers (https://enterprise.arcgis.com/en/portal/10.5/use/layers.htm), and then added to your workbook page. For more information, see the following resources:

- Use ArcGIS Desktop with your portal (https://enterprise.arcgis.com/en/portal/10.5/use/use-with-desktop.htm)
- Relationships between web services and portal items (https://enterprise.arcgis.com/en/server/10.5/administer/windows/relationships-between-web-services-and-portal-items.htm)
- Types of geodatabases (https://desktop.arcgis.com/en/arcmap/10.5/manage-data/geodatabases/types-of-geodatabases.htm)

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Supported database	Description
Microsoft SQL Server	Standard/Enterprise editions: • Microsoft SQL Server 2016 (64 bit) • Microsoft SQL Server 2014 (64 bit) • Microsoft SQL Server 2012 SP1 (64 bit)
SAP HANA	• SAP HANA 1.0 SPS11* • SAP HANA 1.0 SPS12 • SAP HANA 2.0 SPS00
Teradata	• Teradata 14.10** • Teradata 15.00** • Teradata 15.10

*For spatially-enabled databases, SPS11 Revision 2 (1.00.112) or later is required to avoid 'Unregistered function name: "__cs_field_Geometry__"' errors during certain workflows.

**The date arithmetic operations on Teradata 14.10 and Teradata 15.00 are not fully supported.

For more information about supported data and databases, see the following:

- Configure the portal to support Insights for ArcGIS
- Create a database connection
- Supported data types from database datasets

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Required database privileges

The following tables list the minimum required privileges you need toconnect to and browse the contents of a relational database. The connections are read-only. Insights for ArcGIS does not permit you to create or edit data in the database.

Microsoft SQL Server

Required privileges	Purpose
CONNECT	This privilege allows users to connect to the database. The CONNECT privilege is granted on databases to the public database role by default. If you revoke this privilege from public, you must explicitly grant CONNECT on databases to specific roles and/or logins.
SELECT on other users' tables	Data viewers need select privileges on specific tables you want them to see and query. If allowed to read all tables in the database, you can assign users to the db_datareader database role; otherwise, grant SELECT on specific tables and views.

SAP HANA

Required privileges	Purpose
SELECT ON sys.st_geometry_columns and sys.st_spatial_reference_systems	These privileges are required to read ST_GEOMETRY metadata for spatial operations.
SELECT ON <table1>,<table2>, <tablen>	Data viewers need select privileges on specific tables you want them to see and query.

Teradata

Required privileges	Purpose

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SELECT ON SYSSPATIAL.SPATIAL_REF_SYS SELECT ON SYSSPATIAL.GEOMETRY_COLUMNS	Required to read ST_GEOMETRY metadata for spatial operations.
SELECT ON <table1>,<table2>, <tablen>	Allows data viewers to query data in specific tables.
UDTUSAGE ON SYSUDTLIB	Required to preview features.
SELECT ON DBC.UDTInfo	Required to submit queries.

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Supported data types from databases

The following tables list data types for each supported database, and how each type maps to Esri field types.

Microsoft SQL Server data types

Microsoft SQL Server data type	Esri field type
bigint	esriFieldTypeDouble
binary	esriFieldTypeString
bit	Not supported
char	esriFieldTypeString
date	esriFieldTypeDate
datetime	esriFieldTypeDate
datetime2	esriFieldTypeDate
datetimeoffset	Not supported
decimal	esriFieldTypeDouble
float	esriFieldTypeDouble
geography	esriFieldTypeGeometry
geometry	esriFieldTypeGeometry
image	Not supported
int	esriFieldTypeInteger
money	esriFieldTypeDouble
nchar	esriFieldTypeString
ntext	Not supported
numeric	esriFieldTypeDouble
nvarchar	esriFieldTypeString
real	esriFieldTypeSingle
smalldatetime	esriFieldTypeDate
smallint	esriFieldTypeSmallInteger
smallmoney	esriFieldTypeDouble
text	Not supported
time	Not supported
timestamp	Not supported
tinyint	esriFieldTypeSmallInteger
udt	Not supported
uniqueidentifier	esriFieldTypeString

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varbinary	Not supported
varchar	esriFieldTypeString
xml	Not supported

SAP HANA data types

SAP HANA data type	Esri field type
ALPHANUM	esriFieldTypeString
BIGINT	esriFieldTypeDouble
BINTEXT	Not supported
BLOB	Not supported
BOOLEAN	Not supported
CLOB	Not supported
DATE	esriFieldTypeDate
DECIMAL	esriFieldTypeDouble
DOUBLE	esriFieldTypeDouble
INTEGER	esriFieldTypeInteger
NCLOB	Not supported
NVARCHAR	esriFieldTypeString
REAL	esriFieldTypeSingle
SECONDDATE	esriFieldTypeDate
SHORTTEXT	esriFieldTypeString
SMALLDECIMAL	esriFieldTypeDouble
SMALLINT	esriFieldTypeSmallInteger
ST_GEOMETRY	esriFieldTypeGeometry
ST_POINT	esriFieldTypeGeometry
TEXT	Not supported
TIME	Not supported
TIMESTAMP	esriFieldTypeDate
TINYINT	esriFieldTypeSmallInteger
VARBINARY	Not supported
VARCHAR	esriFieldTypeString

Teradata data types

Teradata data type	Esri field type
BIGINT	esriFieldTypeDouble

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BLOB	Not supported
BYTE	esriFieldTypeString
BYTEINT	esriFieldTypeSmallInteger
CHAR	esriFieldTypeString
CHARVARYING	esriFieldTypeString
CHARACTER	esriFieldTypeString
CHARACTER VARYING	esriFieldTypeString
CLOB	Not supported
DATE	esriFieldTypeDate
DECIMAL	esriFieldTypeDouble
DOUBLE PRECISION	esriFieldTypeDouble
FLOAT	esriFieldTypeDouble
GRAPHIC	Not supported
INT	esriFieldTypeInteger
INTEGER	esriFieldTypeInteger
INTERVAL DAY	Not supported
INTERVAL DAY TO HOUR	Not supported
INTERVAL DAY TO MINUTE	Not supported
INTERVAL DAY TO SECOND	Not supported
INTERVAL HOUR	Not supported
INTERVAL HOUR TO MINUTE	Not supported
INTERVAL HOUR TO SECOND	Not supported
INTERVAL MINUTE	Not supported
INTERVAL MINUTE TO SECOND	Not supported
INTERVAL MONTH	Not supported
INTERVAL YEAR	Not supported
INTERVAL YEAR TO MONTH	Not supported
JSON	Not supported
LONG VARCHAR	esriFieldTypeString
LONG VARGRAPHIC	Not supported

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MBR	Not supported
NUMBER	esriFieldTypeDouble
NUMERIC	esriFieldTypeDouble
PERIOD(DATE)	Not supported
PERIOD(TIME)	Not supported
PERIOD(TIMESTAMP)	Not supported
REAL	esriFieldTypeDouble
SMALLINT	esriFieldTypeSmallInteger
ST_GEOMETRY	esriFieldTypeGeometry
TIME	Not supported
TIME WITH TIMEZONE	Not supported
TIMESTAMP	esriFieldTypeDate
TIMESTAMP WITH TIMEZONE	esriFieldTypeDate
UDT	Not supported
VARBYTE	esriFieldTypeString
VARBYTE(6400)	esriFieldTypeString
VARCHAR	esriFieldTypeString
VARGRAPHIC	Not supported
XML	Not supported

For more information about databases and Insights for ArcGIS, see the following:

- Supported databases
- Create a database connection

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Understanding data in relational databases

Relational databases

Data in relational databases is stored in tables. Each table is a set of rows and columns. Each column has a type, and many databases support one or more native spatial data types.

The data type determines:

- What values can be stored in a column
- What operations can be performed on the data in that column
- How the data is physically stored in the database

Insights for ArcGIS supports direct access to specific data types from a list of supported database management systems. When accessing a database table directly through an add data workflow, Insights filters out any unsupported data types.

Note: Database tables accessed through Insights are read-only. They cannot be edited. This includes the case where a dataset has been shared with others in your organization as a feature layer, and edits are being attempted in a client application other than Insights.

Tip: When using data from a database causes an error, detailed information is added to the ArcGIS Server logs on your portal's hosting server site. Work with your ArcGIS Server administrator to diagnose and resolve any issues.

Connecting to a database

Before you can use data from a database in Insights, you must create a database connection. Before you create a database connection, certain prerequisites must be met.

The process of establishing a database connection creates a Relational Database Connection item in the portal's geoinformation model (https://enterprise.arcgis.com/en/portal/10.5/use/geo-info.htm) as part of My Content (https://enterprise.arcgis.com/en/portal/10.5/use/my-content.htm). This item can subsequently be shared with others. It is important to note that sharing a database connection item is only sharing the ability to browse the contents of the database. The credentials used when establishing the connection are never exposed to those with whom the item has been shared.

When connecting to a database, things can go wrong. For more information, see Troubleshoot a database connection.

Caution: If you are having trouble using a database connection item that previously worked in Insights, you may need to update the connection. Do not delete it from **My Content**. When Insights creates a dataset from a database table (or multiple database tables in the case of a joined dataset), a database connection is required. Deleting the database connection will cause any dependent datasets to be inoperable. This caution is especially important if the database connection has been shared with others. Only when you are sure no datasets are dependent, or you purposefully want to disable upstream datasets, should you delete a relational database connection.

While database connections update to reflect the current state of the database, datasets reflect the schema of the table or view at the time of dataset creation. Note that datasets created from a database connection are dependent upon the schema, naming conventions, and existing spatial data objects (geometry types and spatial reference identifiers) of the database. It is

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imperative that the tables and views referenced by a dataset are not renamed or deleted, as this will break the dataset. Likewise, fields names and data types must remain static for a dataset to be functional.

Geodatabases

Note: Currently, Insights for ArcGIS does not allow you to create a connection to a relational database that has an enterprise geodatabase defined. Similarly, Insights does not work directly with file and personal geodatabases. For geodatabase tables and feature classes to be used in Insights, they must be made available in your portal organization as either hosted or registered feature layers (https://enterprise.arcgis.com/en/portal/10.5/use/layers.htm), and then added to your workbook page. For more information, see the following resources:

- Use ArcGIS Desktop with your portal (https://enterprise.arcgis.com/en/portal/10.5/use/use-with-desktop.htm)
- Relationships between web services and portal items (https://enterprise.arcgis.com/en/server/10.5/administer/windows/relationships-between-web-services-and-portal-items.htm)
- Types of geodatabases (https://desktop.arcgis.com/en/arcmap/10.5/manage-data/geodatabases/types-of-geodatabases.htm)

Additional database platforms

The ArcGIS platform supports many database management systems (https://pro.arcgis.com/en/pro-app/help/data/databases/dbms-support.htm) that Insights does not support direct access to. To use tables from these databases (geodatabase-enabled or not), they must be first made available in your portal as either a hosted or registered feature layer (https://enterprise.arcgis.com/en/portal/10.5/use/layers.htm).

Note: The list of database management systems that Insights will work directly with will grow over time. Contact Esri Technical Support (https://support.esri.com/en/) to provide feedback on your preferred vendor.

Uniqueness of rows

Insights requires the ability to uniquely identify each row in a dataset. To do this, the following logic is used in determining the fields to be used to identify uniqueness:

1. Look for a primary key. If found, use the fields that define the primary key.
2. Look for an index that is flagged as ‘unique’. If found, use the fields that define the index.

If the above criteria are not met, Insights will use all non-spatial fields in the dataset to determine the uniqueness of rows. Spatially-enabled tables will be treated as non-spatial datasets under these conditions.

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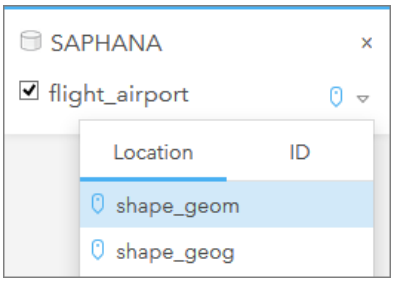
Tip: If Insights could not find a primary key, but could find a unique index, there can be unexpected results if there are any null values in the chosen fields. Therefore, it is considered best practice to have a primary key defined on all tables. If it is not possible to define a primary key, the fields that participate in a unique index should not have null values, and ideally would be flagged in the database as `not null`. Insights will not enforce this for you.

Spatial datasets

There is no requirement in Insights that database tables be spatially enabled. A spatially-enabled table contains a field that Insights interprets as a location field. When a location field is detected in a dataset (table), Insights makes a number of assumptions described in the topics below.

Single spatial column

Insights only supports one spatial column per database table. In Insights 1.1 and later, you can choose which spatial field will be used as the location field by clicking the location field icon next to the table name under **Selected Data** and choosing from the list of spatial fields.



Supported geometry types

The databases Insights supports are compliant with the open Geospatial Consortium (OGC) and International Organization for Standardization (ISO) standard for simple feature access. The following table lists supported OGC/ISO geometry types, along with how they are interpreted in Insights:

OGC/ISO	Geometry Type
`POINT`	Point
`LINESTRING` `MULTILINESTRING`	Polyline
`POLYGON` `MULTIPOLYGON`	Polygon

Insights does not enforce the above. When an unsupported geometry type is encountered, an error will occur.

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Same geometry type

It is expected that all geometries in a spatial column share the same geometry type; For example, all point, all polyline, or all polygon. The geometry type for a dataset is determined by querying the first row in the table where the spatial column is not a null value.

Insights does not check for the same geometry. Unexpected results or errors may occur if rows in the dataset fails to meet this expectation.

Same spatial reference

It is expected that all geometries in a spatial column share a common spatial reference identifier (SRID). The spatial reference of the dataset is determined by querying the first row in the table where the spatial column is not a null value.

Insights does not check for the same spatial reference. Unexpected results or errors may occur if rows in the database fail to meet this expectation.

Project on the fly

Insights displays spatial data in the spatial reference system of your portal organization’s default basemap. This is for display and query purposes only, the underlying data is not altered. If the underlying geographic coordinate systems of the two spatial reference systems are incompatible, alignment and accuracy problems may be observed. To ensure fast performance and accurate display of spatial data, the spatial reference system of your spatial datasets should match the spatial reference system of the default basemap. If this is not possible, it is recommended that unbounded SRIDs be used for your spatial datasets. Unbounded SRIDs will ensure that your spatial data can be displayed even if the extent of your organization's default basemap exceeds the extent of the spatial reference system of your spatial data.

Spatial operations

When performing spatial aggregation or spatial filtering using two datasets from a database connection, the spatial data in both datasets must have the same spatial reference system. For SQL Server database connections, the data must also have the same data type (geography or geometry).

Coordinate dimensionality

Coordinate dimensionality is defined by the x, y, z, and m coordinates for each vertex in a geometry. Insights ignores any z and m coordinates returned from the database.

Optimizing database content for performance

Properly configured and tuned databases always perform best. The following represent some considerations database administrators should make for ensuring an optimal user experience in Insights:

- Up-to-date database statistics
  Database statistics are used by the database management system optimizer to choose the optimal execution plan for the query being executed. Up-to-date statistics will help maintain query performance.
- Primary key constraints

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A primary key constraint uniquely identifies each row in a database table. Although not a requirement, it is recommended that a primary key be defined on database tables. Further, a single integer type field is recommend for a primary key.

- Use both attribute and spatial indexes
  If your database platform supports it, index any fields used for querying or rendering your data.
- Common spatial reference
  If possible, keep all data in a common spatial reference, and ideally, use the same projection as your organization's default basemap. This will avoid on-the-fly projection calculations when drawing data on a map, and will prevent errors during spatial analysis.
- Simplified data
  Use the most simplified or generalized version of spatial data that will satisfy the visualization and analysis requirements of your organization. Because it has fewer vertices and line segments, simplified data will draw much faster and the results analysis will be returned sooner. Getting this right for your needs may take some experimentation.
- Spatial joins at ETL time
  Spatial joins at runtime can be expensive. Because spatial data does not change all that much, it's worth it to pay the price of performing spatial joins on data in the database once, and then at runtime performing attribute joins to achieve the same results.

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