Expression Builder

User's Guide and Reference Guide

Autodesk®

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Contents

Creating Expressions For Geospatial Features

Overview of Expressions for Geospatial Features

An expression is the part of a query that specifies its conditions. A query evaluates data and returns only the subset of data that meets the query's conditions.

For example, an expression might specify all parcels on a particular street whose area is larger than 4000 square feet. Only parcels that meet those criteria are displayed or selected by a query containing this expression.

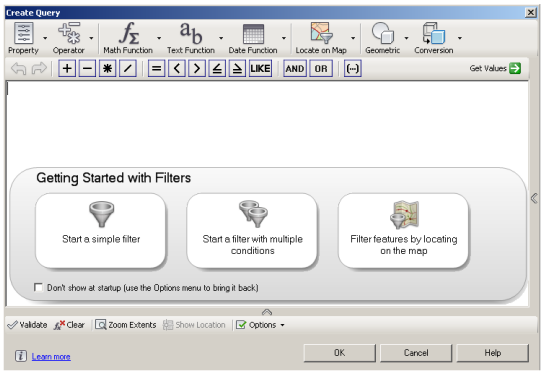
A complete query also specifies the set of data to which the conditions are applied and the action to apply to the data that meets the conditions. For example, you can query a particular feature layer in a map and either display or hide data in that layer, depending on whether it meets the query conditions or not.

In practice, you specify the data set by selecting the feature class or layer to query before you build the expression. You specify the action to apply when you select the command that lets you build the expression. For example, in AutoCAD Map 3D, you might select Query to Add To Map or Search To Select.

The title bar for the dialog box in which you create expressions will be different, depending on the command you choose. The contents of the dialog box are much the same, no matter what it is called.

Use expressions to filter geospatial data, select a subset of data, calculate values, or convert data from one data type to another. Use text expressions to format

text strings for display, for example, as labels. Use numeric expressions to apply math functions to properties with numeric values.



The text in the title bar changes, depending on which command you select.

Basic Steps for Creating Expressions

To create an expression, follow these basic steps:

- Specify the data to which the expression will be applied. For example, select the layer to filter.
- Select a command that can use an expression. For example, right-click a layer and select Filter To Select.
- Use an expression to specify the conditions for the command. For example, create an expression to specify the subset of features on the layer to select.

Ways to Use Expressions	Description
Evaluating Properties (page 10)	You can filter or select data based on the value of one or more properties. A simple expression evaluates a single property, but you can create complex expressions that use multiple properties or multiple values. For example, you could create an expression that shows counties with a population over 50,000 but under 100,000. The result of a filter expression must be a Boolean value.

Ways to Use Expressions	Description
Creating a Calculation (page 15)	You can calculate a new value based on existing values. For example, you can do the following: ■ Calculate the area of a polygon or the length of a linear feature. ■ Convert a text string to a date format and add days or months to the resulting date.
Performing a Conversion (page 18)	Conversions change data values from one data type to another. For example, if a data store keeps date values as text, you can convert these values to date strings so you can use Date Functions (page 61) on them. You can also convert numeric or text strings to a particular numeric format, for example to a single- or double-precision number. You can convert numeric values into text strings, for example, to extract a sub-string or find the number of characters in the string.
Creating Text Expressions (page 19)	With text expressions, you can analyze and manipulate strings. For example, you can do the following: ■ Format multiline labels. ■ Concatenate multiple properties into a single entry. For example, concatenate `First_Name` and `Last_Name` to get `Full_Name`. ■ Find the length of a text string, or the position of one text string within another. ■ Convert a text string to all uppercase or lowercase characters. ■ Trim or add to the beginning or end of a text string.

Ways to Use Expressions	Description
	■ Replace one set of characters with another.
Creating Numeric Expressions (page 20)	Numeric expressions operate only on numeric values. They use math functions, with which you can analyze and manipulate numeric strings. For example, with numeric expressions, you can do the following: ■ Round a value up or down. ■ Find the square root of a value, use trigonometric functions, or determine the remainder of a number after it is divided by another number. ■ Find the average, mean, or median of a set of values.
Using Expressions to Filter Feature Data (page 32)	With filters, you can work with a subset of your data. For example, if your map includes all the counties in California, you can create a filter to show only those with a population over 50,000. Use expressions to do the following: ■ Filter data as you add it to an AutoCAD Map 3D map (page 32). ■ Filter the display of data in a map (page 33). ■ Select only features that meet a set of conditions (page 34).
Using Expressions to Label Features (page 24)	Use a text expression (page 19) or a numeric expression (page 20) to determine the content of labels when you style your map.
Using Expressions In Split/Merge Rules (page 25)	Use expressions in AutoCAD Map 3D to determine how property values are spe-

Ways to Use Expressions	Description
	cified after you merge multiple features into one or split a single feature into multiple features.

Creating Expressions

Overview of Creating Expressions

An expression is the part of a query that specifies the conditions. For example, an expression might specify all parcels on a particular street whose area is larger than 4000 square feet. Only parcels that meet those criteria are displayed or selected by a query containing this expression.

A complete query also specifies the set of data to which the conditions are applied and the action to apply to the data that meets the conditions. For example, you can query a particular feature layer in a map and either display or hide data in that layer, depending on whether it meets the query conditions or not.

In practice, you specify the data set by selecting the feature class or layer to query before you build the expression. You specify the action to apply when you select the command or option for building the expression. For example, in AutoCAD Map 3D, you might select Query to Add To Map or Search To Select.

The title bar for the dialog box in which you create expressions will be different, depending on the command you choose. The contents of the dialog box are much the same, no matter what it is called. In AutoCAD Map 3D, you can create expressions for geospatial features from the following locations:

Command	Title Bar Contents
Edit menu ➤ Search	Search For Features Across Multiple Layers
Right-click a Display Manager layer ➤ Query To Filter Data	Create Query
Data Table ➤ Search To Select	Search To Select

Command	Title Bar Contents
Data Connect ➤ Add To Map With Query	Create Query
Data Table ➤ Create A Calculation	Create A Calculation
Data Table ➤ Set Split And Merge Rules	Split Rule Expression/Merge Rule Expression
Style Editor ➤ Style Label ➤ Property To Display	Create/Modify Expressions

See also:

- Evaluating Properties (page 10)
- Creating a Calculation (page 15)
- Performing a Conversion (page 18)
- Creating Text Expressions (page 19)
- Creating Numeric Expressions (page 20)
- Filtering by Location (page 21)
- Using Dates in Expressions (page 9)

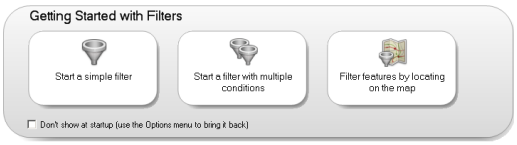
To create an expression

1. Select the feature classes or feature layers to which the expression will apply and the action that will be affected by the query.

   For example, in the AutoCAD Map 3D Display Manager, right-click a layer and click Query to Filter Data. This specifies the layer you right-clicked as the data source for the expression and indicates that only the data in that layer that matches your expression's conditions will be displayed.

2. In the window that displays, insert the elements that comprise the expression.

If the expression startup page is turned on, buttons representing different expression types are displayed. You can click one of these buttons to insert an expression template.



Click one of these buttons to start with a sample expression.

3 In the expression area, do any of the following to build your expression:

- Click an element in the expression to replace it with a property, value, or operator. See Selecting Property Values from a List (page 14) for information on viewing and selecting properties.

Click an element to see a menu of options for replacing or deleting it.

- Use commands and icons to add elements.

Use the menus and buttons at the top of the window to insert elements.

- If you know the names of the properties, values, and operators you want, enter them directly.
  All expressions are text-based.

An expression can combine operations in many ways. For example, you can calculate the area of all parcels and then find features that have the StreetName “Elm” and are larger than 20,000 square feet.

4 In building your expression, you can do any of the following:

- Evaluate the value of a property (page 10). For example, find features on a Parcels layer whose StreetName property is "Elm." That expression would look like this:

  ```
  ST_NAME = 'ELM St'
  ```

- Perform a calculation (page 15), and then evaluate the result of the calculation. For example, first determine the area of parcels, and then find parcels with an area smaller than a value you specify. That expression would look like this:

  ```
  Area2D (Geometry) < 12000
  ```

  NOTE The `Geometry` property may have a different name in your data store. It is always listed under Geometry Properties in the Property list. Insert the property from the list. Do not change it manually or substitute a value for this property.

- Perform a converson (page 18), and then evaluate the result of the conversion. For example, convert a parcel property called `Purchase_Date` from a text string to a date string, and then find parcels purchased before a date you specify. That expression would look like this:

  ```
  ToDate (PURCHASE_DATE, MM/DD/YYYY) AND PURCHASE_DATE <
  01/01/2005
  ```

  NOTE See Using Dates in Expressions (page 9) for information about date formatting.

- Create a text expression (page 19). For example, you can label a layer representing roads with the street name and suffix (for example, "Portobello Road" or "Fifth Avenue"). That expression would look like this:

  ```
  Concat (ST_NAME, SUFFIX)
  ```

- Create a numeric expression (page 20). For example, you can round off repair costs to the next highest dollar. That expression would look like this:

  ```
  Ceil (REPAIR_COST)
  ```

- Filter by location (page 21). For example, you can find all parcels within or touching a circle that you draw on the map.

5 Validate the expression by clicking Validate (at the bottom of the window).

   Validation checks the syntax of the expression only. It does not check whether the values you specified are valid for the data, or whether the results are as expected. If there are validation problems, an error message helps direct you to their solutions (page 28).

6 To reuse your expression later, save it (page 29) using the Options menu (at the bottom of the window).

7 To apply your expression, click OK.

8 To set expression options (page 30), use the Options menu.

Using Dates in Expressions

You can use the following date options in your expressions:

- To convert a text property that contains date or time information into a date value, use the ToDate or ToString conversion options. See Conversion Options (page 67). These options support a variety of formats (page 69) for the resulting date strings.
- To use standard date and time formats, use the Date-Time Operators (page 46).
  When you insert a date-time property from the Get Values panel into your expression, that value will use a Date-Time operator. If you are an advanced user, you can also add one of these operators to an expression if you know its FDO syntax.

  The Date-Time operators are parsed using the standard SQL literal strings:

  - DATE 'YYYY-MM-DD'
  - TIME 'HH:MM:SS[.sss]'
  - TIMESTAMP 'YYYY-MM-DD HH:MM:SS[.sss]'

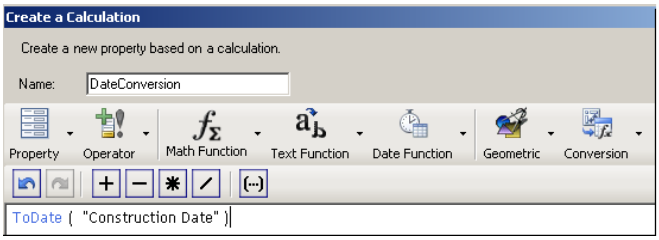
To convert a text string to a date string and change its format

1 Select the command for which you want to create an expression. (page 6)

2 Select ToDate from Conversion.

3 In the ToDate function, do one of the following:

- Within the parentheses, type a property name.
- Click Property. In the Property list, select the property to convert. Select a text property that represents a date value.



Convert a text string to a date string.

4 Optionally, specify the date format (page 69).

5 Specify any further conditions for the expression.

For information about formulating an expression, see Overview of Creating Expressions (page 5).

6 Click OK to apply the expression.

Evaluating Properties

You can use expressions to evaluate properties. Here are some examples:

- Find all features on a layer that have a property equal to, greater than, or less than a particular value. For example, find all parcels with an assessed value greater than $250,000.
- Display all the features on a layer with a property that matches a pattern you specify. For example, display all roads whose names begin with "Mt."
- Label features with the value of a particular property, rounded in a particular way. For example, label roads with their length, rounded up to the nearest whole number.

You can enter property names directly into an expression, or you can select them from the Property list. If you selected multiple feature layers, the properties for all those layers are available.

If you enter a property name that is not in the Property list, the Validate operation may issue a warning. However, the expression may still be valid when it is run if that property exists in your data store.

You can also view and insert the valid values (page 14) for any listed property.

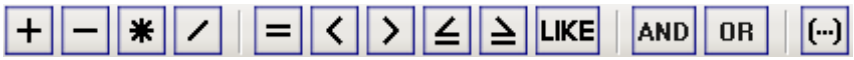
The syntax for an expression that evaluates a property is slightly different, depending on whether you use an operator, a function, or an option. For an operator, the basic syntax is `Property OPERATOR Value`. For functions and options, the basic syntax is `Function (PROPERTY)`.

See also:

- Using Expressions to Filter Feature Data (page 32)
- Overview of Creating Expressions (page 5)

To evaluate properties in an expression using an operator

1. Select the command for which you want to create an expression. (page 6)
2. In the expression area, do one of the following:
   - Enter a property name manually.
   - Click Property. In the Property list, select a property.
3. Enter an operator using one of these methods:
   - Enter an operator manually.
   - Click an operator button.

     Use the Operator buttons.

   - Select an operator from a menu.
4. You can use the following types of operators:
   - Math Operators (page 42)
     For example, this expression could be used to label repair locations with the total amount spent on parts and labor for a pipe repair project:

     ```
     PIPE_PARTS_COST + PIPE_LABOR_COST
     ```

- Comparison Operators (page 43)
  For example, to find parcels whose assessed value is $100,000 or more, use this expression:

  ```
  PARCEL_VALUE >= 100000
  ```

- Logical Operators (page 44)
  For example, to find only parcels that have a value for the `PARCEL_OWNER` property, use this expression:

  ```
  NOT PARCEL_OWNER NULL
  ```

5 Select or type the value to evaluate (page 14).

6 To create a complex property evaluation, insert an AND or OR operator, and then insert another property, operator, and value combination.

  Every operator must be preceded by a property. For example, to find parcels whose last purchase date is after 1990 and before 2005, the expression must look like this:

  ```
  PURCHASE_DATE > 1990 AND PURCHASE_DATE < 2005
  ```

7 Click OK to apply the expression.

To evaluate properties in an expression using a function or option

1 Select the command for which you want to create an expression. (page 6)

2 In the expression area, do one of the following:

- Type a function or option for this property.
- Select a function or option from a menu.
  You can use the following types of functions:
  - Math Functions (page 47)
    For example, to find the square root of the value representing parcel area, use this expression:

    ```
    Sqrt(PARCEL_AREA)
    ```

  - Numeric Functions (page 54)
    Numeric functions are available from the Math Functions menu. For example, to round the assessed value of parcels down to the nearest lower whole dollar, use this expression:

    ```
    Floor(PARCEL_VALUE)
    ```

  - Text Functions (page 56)

For example, to convert pipe names to all uppercase letters, use this expression:

```
Upper(PIPE_NAME)
```

- Date Functions (page 61)
  For example, to add one month to the start date for a project, use this expression:

  ```
  AddMonths(START_DATE, 1)
  ```

You can use the following types of options:

- Geometric Options (page 66)
  For example, to find the perimeter value for parcels, use this expression (when Parcels is the current feature or layer):

  ```
  Length2D(Geometry)
  ```

  NOTE The `Geometry` property may have a different name in your data store. It is always listed under Geometry Properties in the Property list. Insert the property from the list. Do not change it manually or substitute a value for this property.

- Conversion Options (page 67)
  For example, to create label text that displays "Unoccupied" if the property `Occupied` is null, use this expression:

  ```
  NullValue(OCCUPIED, 'Unoccupied')
  ```

- Aggregate Options (page 72)
  Aggregate functions are not available from a menu, but you can type them in. For example, to find the median value of all parcels, use this expression:

  ```
  Median(PARCEL_VALUE)
  ```

3 In your expression, do one of the following:
   - Enter a property name manually.
   - Click Property. In the Property list, select a property.

4 Select or type the value to evaluate (page 14).

5 To create a complex property evaluation, insert an AND or OR operator, and then insert another operator, property, and value combination.

6 Click OK to apply the expression.

Selecting Property Values from a List

You can see the valid values for any property in the current data set. For example, a parcel might have the property `IS_OWNER_OCCUPIED`. Unless you are familiar with the data, you would not know if the valid values for this property are Yes and No, True and False, Y and N, or T and F. You can view and insert the possible values for this property from the Properties pane.

Some properties have many values, which can take a long time to retrieve. In some cases, a warning is displayed. You can retrieve the values anyway, or cancel the retrieval.

NOTE You cannot view or insert values when you are creating a calculation or an expression for a label.

See also:

- Evaluating Properties (page 10)

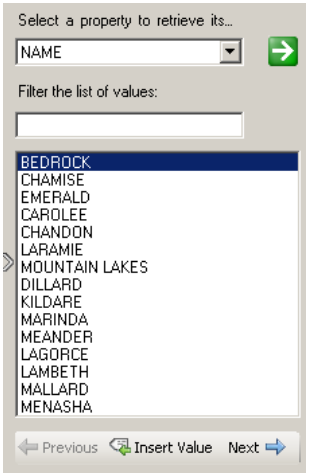
To select property values from a list

NOTE You cannot view or insert values when you are creating a calculation or an expression for a label.

1. Select the command for which you want to create an expression. (page 6)
2. To see the possible values for a property, do one of the following:
   - Click the green arrow next to Get Values and select the property whose values you want to see.
   - Click a property in your expression. In the list that displays, click Get Values From A List.

   The Properties panel is displayed on the right side of the window.
3. In the Properties panel, click the green arrow next to the property name to see the values for this property.

   The list of values is sorted in ascending order or in the order used in the data source.



Use the Properties panel to insert values from a list.

4 To filter the list, under Filter The List Of Values, enter the characters to filter by. For example, enter ill to find Dillard and Fillmore. Click the green arrow. The list shows all values that contain those characters.

NOTE Wildcards are not supported.

5 Double-click a value to insert it in your expression, or select the value and click Insert Value.

Creating a Calculation

You can use operators and functions to calculate a new value based on existing property values. You can use the resulting value to filter or select data. For example, you can calculate the area of parcels and then select parcels whose areas are above a certain area value.

NOTE In AutoCAD Map 3D, you can store the resulting calculation as a new property in the Data Table. The calculated property is stored with the map, but is not written back to the original data store. To save the property to a data store, export the layer to an SDF file.

The syntax for calculations varies, depending on whether you use operators or functions.

There are two special calculations you can perform: finding the area of a polygon and finding the length of a linear feature.

NOTE You must be online and connected to the data store that contains the data for the calculation in order to create or manage calculations.

NOTE For some calculations, values do not update automatically because their underlying functions are not supported by their data providers. Instead, the values display as read-only properties. If you do not see a new calculated value immediately, refresh the layer manually. Right-click the layer in Display Manager and click Refresh Layer.

See also:

- Geometric Options (page 66)
- Using Expressions to Filter Feature Data (page 32)
- Overview of Creating Expressions (page 5)

To perform a calculation using an operator

1. Select the command for which you want to create an expression. (page 6)
2. In the expression area, do one of the following:
   - Enter a property name manually.
   - Click Property. Select the property you want.
3. To insert an operator, do one of the following:
   - Enter an operator for this property manually.
   - Click an operator button.
   - Click Operators (page 42). Select the operator you want.
4. Select or enter the value to evaluate (page 14).
   For example, if you are multiplying the value of the property, enter the number or insert a property to multiply by.
5. Specify any further conditions for the expression.

To create a complex property evaluation, insert an AND or OR operator, and then insert another operator/property combination.

6 Click OK to apply the expression.

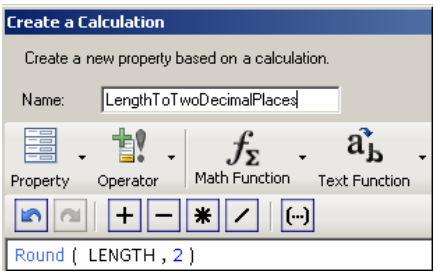
To perform a calculation using a function

1 Select the command for which you want to create an expression. (page 6)

2 In the expression area, click one of the following and select a function:

- Math Function (page 47)
- Text Functions (page 56)
- Date Functions (page 61)

3 Click Property and select the property to apply the function to.



This calculation is the definition of a calculated property.

4 Click OK to apply the expression.

To find area or length

1 Select the command for which you want to create an expression. (page 6)

2 In the expression area, enter or insert the geometric function (`Area2D` or `Length2D`).

3 Insert the property `Geometry` in parentheses after the function.

NOTE The `Geometry` property may have a different name in your data store. It is always listed under Geometry Properties in the Property list. Insert the property from the list. Do not change it manually or substitute a value for this property.

4 Click OK to apply the expression.

Performing a Conversion

Conversions change data values from one data type to another. For example, an assessor database might store the last date that a parcel was sold as a simple text string. You can convert these text strings to date strings so you can use Date Functions (page 61) on them.

You can also convert numeric or text strings to a particular numeric format. For example, if your data source stores a numeric value as a single-precision floating-point value, you can convert it to double-precision.

You can convert numeric values into text strings, for example, to extract a sub-string or find the number of characters in the string.

See also:

- Conversion Options (page 67)
- Creating Expressions (page 5)

To convert a data value to a different format

1 Select the command for which you want to create an expression. (page 6)

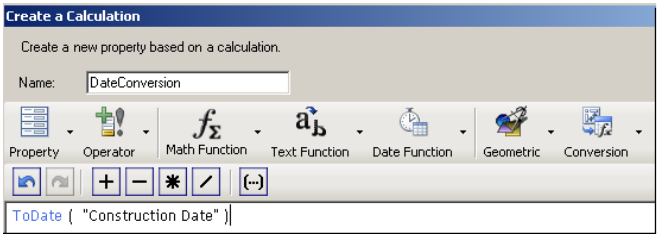
2 In the expression area, select the conversion type you want from Conversion.

For a complete list, see Conversion Options (page 67)

3 Click Property and select the property to convert.

4 Specify any further arguments or values required by the conversion.

Some conversions let you specify the format of the converted string. For example, if you convert a text string to a date format, you can specify how the date value will appear. For more information, see Date Formatting Options (page 69).



Use conversions to change the format or type of a string property.

5 Click OK to apply the expression.

Creating Text Expressions

Text expressions are useful for formatting the results of text-related queries. You can use text epxressions when you create labels for features.

See also:

- Text Functions (page 56)
- Creating Expressions (page 5)
- Using Expressions to Label Features (page 24)
- Adding Labels to Features

To create a text expression

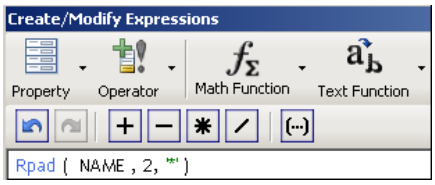
1 Select the command for which you want to create an expression. (page 6)

2 In the expression area, do one of the following:
   - Enter a text function (page 56) manually.
   - Click Text Function and select the function you want.

3 Click Property. In the Property list, select the property for the function.

4 Specify any arguments required by the function, enclosed in single quotation marks.

   For example, if you are padding the right side of a text string with three asterisks, the expression might look like this:



For text expressions, the property is within parentheses, followed by any arguments within single quotation marks.

If you are translating a text string from mixed case to lowercase, the expression might look like this:

```
Lower (PRODUCT_NAME)
```

5 Specify any further conditions for the expression.

To create a complex property evaluation, insert an AND or OR operator, and then insert another operator, property, and value combination.

6 Click OK to apply the expression.

Creating Numeric Expressions

Numeric expressions operate on numeric properties and are useful for performing calculations within expressions.

See also:

- Numeric Functions (page 54)
- Creating Expressions (page 5)

To create a numeric expression

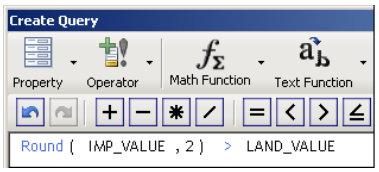
1 Select the command for which you want to create an expression. (page 6)

2 In the expression area, do one of the following:
   - Enter a numeric function (page 54) manually.
   - Click Math Function and select the function you want.

3 Click Property. In the Property list, select the property for the function.

4 Specify any arguments required by the function.

For example, if you are rounding off the length of an item to two decimal places,the expression might look like this:



Numeric expressions operate on numeric properties or values.

If you are truncating the value for population estimates to a specified number of digits, the expression might look like this:

```
Trunc(POPULATION, 5)
```

If you are checking the sign of a profit/loss value, the expression might look like this:

```
Sign(PROFIT_LOSS)
```

5 Click OK to apply the expression.

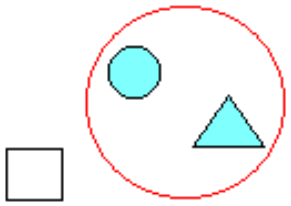
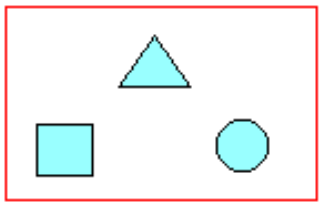
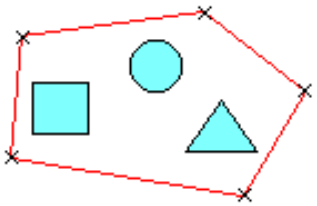
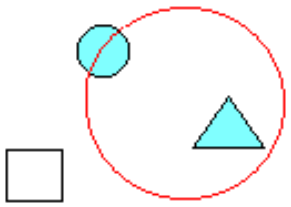
Filtering by Location

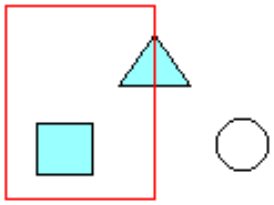
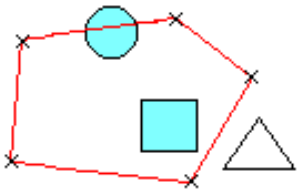
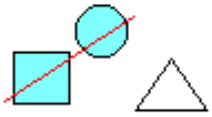
You can filter or select data by specifying a location in your map. For example, you can find all roads within 100 meters of a power line, or all parcels within a specific section of the drawing.

When you specify a location condition in an expression, you switch to your map and draw the location manually. For example, if you want to find all parcels within a circular area, you draw the circle on your map. As soon as your designation is complete, you return to the expression.

You cannot use location filters for labels or calculations.

In the following illustrations, the objects that are retrieved are highlighted.

Location Type	Items retrieved
Inside Circle	
Inside Rectangle	
Inside Polygon	
Touching any part of a circle	

Location Type	Items retrieved
Touching any part of a rectangle	
Touching any part of a polygon	
Touching any part of a fence (line)	
Touching a point	

To specify a location condition

1 Select the command for which you want to create an expression. (page 6)

2 Click Location and select a location condition.

   The dialog box is hidden while you specify the area for the condition.

3 In the map, indicate whether to create a boundary or use an existing feature as the boundary.

4 Do one of the following:

   - If you chose Create, draw the area to include.
   - If you chose Select, click the feature to use as a boundary.

   Once you specify the area, the dialog box appears again.

5 Click OK to apply the expression.

Using Expressions to Label Features

You can create text or numeric expressions that determine the content of labels when you style features.

To use expressions in labels

1 Display the Style Editor for the feature or layer you are labeling.

2 Under Feature Label, click  for the appropriate entry.

   If you are theming this feature, there is one entry for each theme rule. Click the entry for the rule that will display labels.

3 In the Style Label dialog box, do one of the following:

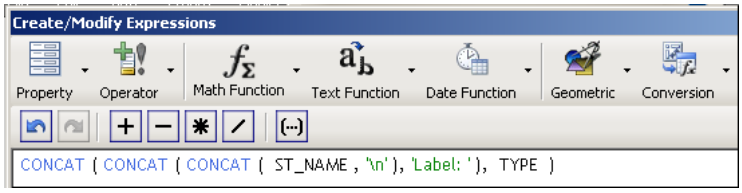
   - To create a label with multiple lines, select Multiline.
   - To create single-line labels in which text follows the outline of a linear feature, displays a single label even if there are multiple line segments, and the text shrinks to fit the length of the line, select Advanced Placement.

   In either case, you can specify an expression for the content of the label.

4 To create an expression for the label content, click Property To Display and scroll to the bottom of the list. Click Expression.

5 In the Create/Modify Expressions dialog box, enter the expression (page 19).

If you selected Multiline, use `'\n'` to insert a line break. For example, you could place the street name on one line and the street type on another:



To create multiline labels, use `'\n'` to insert a line break.

NOTE The syntax for the `CONCAT` operator is somewhat complex. It takes only two parameters, and you must nest the functions you use with it when there are multiple parameters. For more information, see Text Functions (page 56).

6 Click OK to apply the expression to the labels.

Using Expressions In Split/Merge Rules

In AutoCAD Map 3D, you can set rules for the assignment of properties when you split and merge geospatial features. You can use expressions to define these rules.

For example, if you are splitting a parcel, you can specify that the land value of the resulting parcels be based on a calculation that you define. There are also choices for automatic calculations, such as assigning the average value of all merged features to the resulting feature, or dividing the value of a feature evenly among all its split features.

This table lists all the split and merge rule options and describes how to use them.

Split Rules	Merge Rules
Copy gives each new feature an exact copy of the original property value. The original is unchanged.	Average gives the new feature a value that is an average of the original features. This option is for numeric values only.

Split Rules	Merge Rules
Divide gives each resulting feature an equal fraction of the original value. This option is for numeric values only.	Count gives the new feature the value of the total number of features merged to produce it. This option is for numeric values only.
Empty leaves the new property value empty for each new feature. The original is unchanged.	First gives the new feature the value of the first feature you select for the merge. This option is meaningful only if you select the objects for the merge sequentially. (First is the default for all properties except numeric ones.)
Proportional divides the value of the property for each resulting feature proportionally, based on a value you specify. For example, you can assign a proportional value for Parcel_Acres based on the value of the area of the resulting parcels. This option is for numeric values only.	Last gives the new feature the value of the last feature you select for the merge. This option is meaningful only if you select the objects for the merge sequentially.
Calculation divides the value of the property for each resulting feature based on an expression you specify. For example, you can specify that Land_Value for each resulting parcel be equal to 2000 times the value of the property Parcel_Acres, if that's the average property value for that neighborhood. This option is for numeric values only.	Maximum gives the new feature the maximum value available in all features in the merge. (This option is available for numeric properties only.)
	Median gives the new feature the median value calculated from all features in the merge. (This option is available for numeric properties only.)
	Minimum gives the new feature the minimum value available in all features in the merge. (This option is available for numeric properties only.)

Split Rules	Merge Rules
	Standard Deviation gives the new feature the standard deviation value calculated from all features in the merge. (This option is available for numeric properties only.)
	Sum gives the new feature the total value of all features in the merge. (This option is available for numeric properties only.)
	Calculation determines the value of the property for the resulting feature based on an expression you specify. For example, you can specify that Net_Value for each resulting parcel be equal to Land_Value minus Imp_Value. (This option is available for numeric properties only.)
	Concatenation appends the values for each merged feature to create the value for the new feature.

See also:

- Splitting Features
- Merging Features
- Tutorial 5: Styling, Splitting, and Editing Polygon Features

To create split/merge rules using expressions

1. In Display Manager, select the layer containing the feature to split or merge.
2. In the Task Pane, click Table.
3. In the Data Table, click Options (at the bottom of the window) and select Set Split And Merge Rules.
4. Under Feature Properties, select a property whose rules you want to set.

For example, if you are splitting or merging parcels, select LAND_VALUE to specify how the land value of the resulting parcels will be determined.

5 Click Split Rule and select a value.

6 Click Merge Rule and select a value.

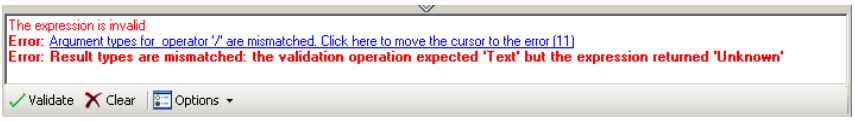
For a description of the possible values, see the Concept tab of this topic.

7 Click OK.

Troubleshooting Validation Errors

When you save an expression, it is always checked to be sure it is valid. You can also check whether your expression is valid before you save it.

The validation checks the syntax of the expression, whether the properties you specified are present in the current data store, and whether the values for those properties are valid.



When possible, the validation operation displays a message describing the errors it finds. Often, you can click this error message to place the cursor at the problem spot so you can correct it.

Validation might fail for one of the following reasons:

- A separator character is missing or invalid. For example, you may use a function with arguments that need to be separated by commas. Perhaps one of the commas is missing, or you entered a semicolon instead of a comma.
- An operator or property is missing. This is common in expressions with multiple conditions. For example, the expression `PARCEL_VALUE > 100000 AND <200000` is invalid. It should be `PARCEL_VALUE > 100000 AND PARCEL_VALUE < 200000`. Notice that in the second example, `PARCEL_VALUE` appears twice, while in the first example it appears only once.
- A character or property is the wrong type. You may have used an operator that requires a numeric value and inserted a text character instead. You may have used a function that requires a hexadecimal value and supplied

a numeral instead. You may have used a text property when a numeric one was required.

- A required value is missing or "empty." Perhaps you failed to insert a property value or a value for an argument.
- The expression is missing a bracket, quotation mark, or parenthesis character. For example, there is an opening bracket that has no related closing bracket. This is common in complex expressions.

The validation process can help you avoid many errors, but it cannot guarantee that your expression will work the way you intend when it is applied. Validation does not execute the query against actual data, it only checks that the expression syntax is correct and that the properties and values are valid for the current data store.

See also:

- Creating Expressions (page 5)

To validate an expression

1. Select the command for which you want to create an expression. (page 6).
2. Create the expression.
3. Save the expression or click Validate.
4. If the validation panel displays errors, click the error message to move the cursor to the problem area.
5. Resolve the problems and run the validation check again, until the validation panel indicates that the expression is valid.

Saving and Reusing Expressions

You can save any expression for reuse. You can share expressions you've saved with other users.

You cannot save a calculation (page 15). The calculation becomes a property for the current feature class in the current map, but is not saved back to the original data store. You can export the feature class layer from the Display Manager to create a feature that permanently includes the calculated property.

See also:

- Creating Expressions (page 5)
- Saving or Exporting a Display Manager Layer

To save an expression

1. Select the command for which you want to create an expression. (page 6).
2. Create the expression.
3. When your expression is complete, click Options and select Save Expression.
4. In the dialog box that displays, specify a location and name for the saved expression file.

   The next time you save or load an expression, this location will be displayed by default. To share this saved expression with another user, send that user the file from this location.

   By default, the expression's file name is the first element in the expression. All expressions use the file extension *.fdq*.
5. Click Save.

To reuse a saved expression

1. In your map, select the command for which the expression will be used.
2. Click Options and select Load Expression.
3. Select the saved expression file to open and click Load.

   The last location you used to save or load an expression will be displayed by default. You can navigate to a different location.

   The saved expression replaces whatever you may have entered in the expression area. Click OK to apply it.

Customizing Expression Options

You can set display options and use navigation options while you are creating expressions.

Setting Expression Display Options

You can set the following display options for expressions:

- Display the buttons that show expression templates every time you start creating an expression.
- Show or hide tooltips.

To display the buttons that show expression templates

1. Select the command for which you want to create an expression. (page 6)
2. Click Options (at the bottom of the window).
3. Click Show Startup Page so it is checked.
4. Click OK.

To show or hide tooltips

1. Select the command for which you want to create an expression. (page 6)
2. Click Options (at the bottom of the window).
3. Click Show Tool Tips.
4. Click OK.

Navigating While Creating Expressions

While creating an expression, use the following to navigate:

- **Zoom Extents.** You can zoom to the extents of the selected feature layers.

  NOTE Zoom Extents is not available when you create a calculation or when you are using expressions for labeling.

- **Show Location.** If you applied a location filter (page 21), you can view the area on the map defined by that filter.

NOTE Show Location is not available in MapGuide Studio. In AutoCAD Map 3D, it is not available when you create a calculation or when you are using expressions for labeling.

To navigate while creating expressions

1. To zoom the map to the extents of the current feature layer, click Zoom Extents (at the bottom of the window).
2. To see the dotted line representing the location filter currently applied to the map, click the location component of the expression and then click Show Location.

Using Expressions to Filter Feature Data

You can filter layers based on a single property, multiple properties, a location in the map that you specify, or a set of conditions.

Before you create an expression for the filter, you select the feature layers to filter. Methods for doing this vary, depending on whether you are using AutoCAD Map 3D or MapGuide Studio. For example, in AutoCAD Map 3D, you can filter feature layers as you add them to the map, so that only a subset of data is added. You can also select layers in Display Manager and filter the data after it is added to the map. You can filter a single layer or multiple layers at one time.

The result of a filter expression must be a Boolean value.

Filtering the Layers You Add to a Map

When you connect to a geospatial data store in AutoCAD Map 3D, you can use Add To Map With Query to filter the data you bring into your map.

You can filter a single layer or multiple layers. You can filter the data by location, by data properties, and by conditions that you define.

The result of a filter expression must be a Boolean value.

See also:

- Creating Expressions (page 5)

- Evaluating Properties (page 10)
- Filtering Features When You Add Them to a Map

To filter feature data when you add it to a map

1. In AutoCAD Map 3D, connect to the data source in the Data Connect window.

   For detailed information, see Overview of Bringing In GIS Features.
2. In the Data Connect window, under Add Data To Map, select the layers to add.
3. Click the Add To Map down arrow and select Add To Map With Query.
4. In the Create Query dialog box, create the expression for your query (page 5).
5. Click OK.

Filtering a Feature Layer

Filter a feature source layer so that only some of the features appear in your map. Using a filter can help you improve performance when working with large sets of feature data.

To filter the layer, define a query condition or a set of conditions that specify which features you want. The procedure is similar to performing a search.

The result of a filter expression must be a Boolean value.

TIP In AutoCAD Map 3D, you can filter data after you bring it into your map, or you can use the Add To Map With Query option *while* bringing it in and then use Edit Query to apply a filter.

See also:

- Filtering the Layers You Add to a Map (page 32)
- Finding and Selecting Features
- Overview of Creating Expressions (page 5)
- Evaluating Properties (page 10)
- Filtering by Location (page 21)

To filter a feature layer

1. If you are filtering by location, zoom the window to the extents of the selected feature class.
2. In Display Manager, select the feature layer and select the filter command.

   For example, in AutoCAD Map 3D, right-click the layer in the Display Manager and click Query To Filter Data.
3. Create an expression, using any of the following expression types:
   - Filtering by Location (page 21) — Selects all features in a location you specify. Select one of the Locate On Map options and define a location in your drawing.
     For example, use a location expression to find all manholes in one section of town, or all parcels that touch a road, or all water pipes within 100 meters of a road.
   - Evaluating Properties (page 10)— Selects all features that have the property value you specify. Insert a property, an operator, and a value. For example, to select all pipes with a diameter greater than 10, specify `Diameter > 10`.

     The Property list displays the properties available for this feature class. You can view and insert available values for a property from a list (page 14).
4. Optionally, add conditions to the expression.
5. Validate your expression (page 28).
6. Click OK to apply the filter.

Searching to Select Feature Layers

You can find and select features in your map based on their location or properties. You create an expression that specifies a set of conditions to use for finding and selecting the features.

For example, you can find just the roads in Shanghai within a circular area you specify. To do this, you specify criteria that limits the results to road features whose City field is "Shanghai" and within the a circle you define.

See also:

- Finding and Selecting Features

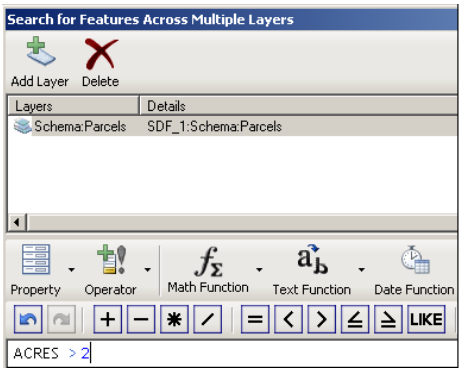
- Overview of Creating Expressions (page 5)
- Evaluating Properties (page 10)
- Filtering by Location (page 21)

To search for and select part of a feature layer

1. If you are filtering by location, zoom the drawing window to the extents of the selected feature class.
2. In your map, select the feature layer and select the search command.

   For example, in AutoCAD Map 3D, click Edit menu ➤ Search.
3. To add more feature layers to the data being searched by the expression, click Add Layer and select the layer to add. To delete a layer, select it in the list and click Delete.
4. In the expression area, use any of the following expression types:
   - Location Condition (page 21) — Select one of the Locate On Map options and define a location in your drawing.
     For example, use a location condition to find all manholes in one section of town, all parcels that touch a road, or all water pipes within 100 meters of a road.
   - Property Condition (page 10)— Selects all features that have the property value you specify. Insert a property, an operator, and a value. For example, to select all pipes with a diameter greater than 10, specify `Diameter > 10`.

     The Property list displays the properties available for this feature class. You can view and insert available values for a property from a list (page 14).



Add layers and specify the expression for the search.

5 Optionally, add conditions to the expression.

6 Validate your expression (page 28).

7 Click OK to apply the filter.

About Expressions and Data Providers

Most expression functions behave the same way across all data providers, but there are a few exceptions.

Unsupported Functions

You can use any function when creating a filter or a calculated property. These results are not saved back to the data store. However, if you use a function that returns an unsupported data type to insert a value into the Data Table, you will get an exception because that operation is not valid for the data provider. For example, SHP files do not support the `FdoInt16` or `FdoDouble` data types. If you try to save a value of that data type back to a SHP data store, you will get an error.

ODBC Providers

You can apply an expression before you actually connect to the data store, for example, when you query to add features to a map. This can be an issue for ODBC providers, which can connect to multiple data sources. Support of expression functions may not be supported by the ODBC source. For this

reason, the functions are evaluated as part of the expression-building process in all cases, even if the connected data source can do so.

Soundex

The Soundex function (page 56) is natively supported by all relational database management systems (RDBMS). Any expression including this function is evaluated by the underlying RDBMS. However, the result returned by a MySQL provider may differ from the result you receive from other providers.

Boolean Value Representation

SDF and SHP providers represent a Boolean value with the terms TRUE and FALSE. RDBMS providers represent a Boolean value with 0 and 1. This can affect the display of labels. For example, a label that indicates whether or not a valve is open might be defined by the expression:

```
Concat('Valve is open: ', <valve_status_property>)
```

For SDF and SHP data, the label will say "Valve is open: True." For RDBMS data, the label will say, "Valve is open: 1."

AddMonths and MonthsBetween

The AddMonths and MonthsBetween functions (page 61) do not take day information into account, but RDBMS systems do.

For example, for the expression `AddMonths(<date_property>, 88.7)`, an RDBMS provider might add 88.7 months to the provided date. The function in expressions you create in the product adds 88 months only.

Similarly, for the expression `MonthsBetween(<date_1>, <date_2>)`, an RDBMS provider might return a value of 77.4. The function in expressions you create in the product returns 77.

Cache-based Operation Versus RDBMS-based Operation

Some operations (for example, the creation of a calculated property) are cache-based operations and use the expression-building process for evaluation. Other operations (for example, a filter on a RDBMS data store) use the underlying RDBMS system.

Due to differences between providers, the results may be different. For example, if you connect to a MySQL data store you can create two calculated properties CP1 and CP2, where CP1 is defined by the expression `Soundex(<property>)` and CP2 is defined by the expression `Soundex(<literal>)`. In the Data Table,

the value for CP1 and CP2 may be identical. However, if you use a filter containing the expression `Soundex(<property>) = Soundex(<literal>)`, the resulting values may be different. In the Data Table, the expressions are evaluated by the expression-building process, but the filter is evaluated by the MySQL data store, which uses a different function definition.

Creating Expressions - Reference

2

Creating Expressions - Dialog Box

Use expressions to define conditions that retrieve the features you want from the feature source, select features for an operation, specify criteria for styling or labeling, or define split/merge rules.

Layers

This area is displayed only when you click Edit menu ➤ Search.

Add Layer
: Adds another feature layer to the search operation.

Delete
: Deletes the selected layer from the search operation.

Layers list
: Lists the layers that will be searched.

Menus and Toolbar

Inserts elements into your expression.

Property
: Displays a list of properties. Select a property to display its values. For example, for a Parcel feature with a Street_Address property, you can examine the Street_Address values and choose only parcels on a particular street.

Properties are sometimes called **attributes** in other GIS systems. Properties can provide demographic, physical, historical, and other data about a geometric feature.

Operator

Displays a list of math (page 42), comparison (page 43), and logical (page 44) operators.

Math Function

Displays a list of math and numeric functions, including standard trigonometric operations, as well as functions for absolute value, exponents, and others.

Text Function

Displays a list of functions that operate on text properties and are useful for formatting the results of text-related queries.

Date Function

Displays a list of functions that return the current date or operate on a date string.

Locate on Map

Specifies a location as a filter when you draw it on your map. For example, select all items within or touching a specified circle, rectangle, or polygon that you draw.

Geometric

Displays the geometric elements Area2D and Length2D. Each of these takes only the argument `Geometry`. Using that argument, the expression determines the area or length of the data on the layer, which allows you to create an expression that filters data by its size. For example, you can select only pipes longer than 50 feet.

Conversion

Displays a list of options for converting strings from one format to another. For example, you can convert text strings to dates, and then select only items before or after a particular date.

Undo/Redo

Reverses or reinstates your most recent edit.

Math operators

Inserts +, -, *, or / into your expression.

Comparison operators

Inserts Boolean comparison operators (equal to, less than, greater than, etc.) into your expression.

Logical operators

Inserts AND, OR, or grouping parentheses into your expression.

Get values

Displays a pane that lists property values. Select a property from the list and click the green arrow to see the values for that property. You can filter the list. If the list is long, use Previous and Next to page through it. Select a value and click Insert Value to add that value to your expression at the insertion point.

Expression area

Displays the current expression.

Lower command area

Validate

Checks whether the current expression is valid. If it is not, a message helps you determine where the problems are.

Clear

Deletes the current expression.

Zoom Extents

Zooms to the extents of the selected feature source.

Show Location

If you have defined a location condition, click that part of your expression and then click this button to display the location extents in the drawing window.

Options

Displays options for saving or reusing expressions and hiding or showing startup tips and tooltips.

Overview of Expression Elements

When you create an expression to filter, search, or style geospatial features, you can use a set of operators, functions, conditions, and options across all

supported FDO providers. To check the syntax for a particular element, or to see examples of use, see the following topics:

- Operators (page 42)
- Functions (page 47)
- Location Conditions (page 63)
- Options (page 66)

Operators

When you create an expression for geospatial features, you can use the following types of operators:

Type of Operator	Definition	Example
Math Operators (page 42)	Simple arithmetic operators	Plus, minus, multiply, divide
Comparison Operators (page 43)	Simple comparative operators	Greater than, less than, not equal to
Logical Operators (page 44)	Operators that match or group values	Like, Not Like, Boolean operators (And, Or, Not)
Date-Time Operators (page 46)	Operators that convert a string to a date or time value.	Date, Time, Timestamp

Math Operators

Math operators are available from the Operator menu. They perform simple arithmetic operations. (Do not confuse the Math + operator with the Boolean AND operator. They are not interchangeable.)

When you create an expression for geospatial features, you can use the following math operators:

Operator	Definition	Syntax

+	Add	`Property + Value`
		`Value + Property`
		`Property + Property`

-	Subtract	`Property - Value`
		`Value - Property`
		`Property - Property`

*	Multiply by	`Property * Value`
		`Value * Property`
		`Property * Property`

/	Divide by	`Property / Value`
		`Value / Property`
		`Property / Property`

Comparison Operators

Comparison operators are available from the Operator menu. They modify a property value. Make sure every instance of a comparison operator is preceded by a property and followed by a value. For example, if you create an expression to find every parcel whose street number is greater than 100 but less than 200, your expression would be:

```
Parcel_Street_Address > 100 AND Parcel_Street_Address < 200
```

In the example above, notice that the property Parcel_Street_Address is inserted twice. A single instance of Parcel_Street_Address will not work.

Numeric properties are evaluated arithmetically. Date properties are evaluated chronologically. Text properties are evaluated alphabetically. For example, Parcel_Area < 20000 will find parcels whose area is less than 20000 square feet; Purchase_Date > 01/01/2001 will find parcels purchased after the beginning of 2001; Street_Address < “Mt. Whitney” will find parcels whose street address comes before Mt. Whitney alphabetically.

When you create an expression for geospatial features, you can use the following comparison operators:

Operator	Definition	Syntax
=	Equals	`Property = Value` `Value = Property`
>	Is greater than	`Property > Value` `Value > Property`
<	Is less than	`Property < Value` `Value < Property`
< =	Is less than or equal to	`Property <= Value` `Value <= Property`
> =	Is greater than or equal to	`Property >= Value` `Value >= Property`
< >	Is not equal to	`Property <> Value` `Value <> Property`

Logical Operators

Logical operators are available from the Operator menu. They create conditions that return a value for a text property if it matches a particular pattern, or appears within a particular list.

When you create an expression for geospatial features, you can use the following logical operators:

Operator	Definition	Syntax
LIKE	Finds text that matches a pattern. The pattern you specify (within single quotation marks) can include regular characters and the percent (%) wildcard character. In order to match, regular	`Property LIKE 'text%'`

Operator	Definition	Syntax
	characters must exactly match the characters specified in the pattern; the percent character can match an arbitrary fragment of the pattern.	
NOT LIKE	Finds text that does not match a pattern. You can use the percent wildcard as you do with LIKE.	`NOT Property LIKE 'text%'`
IN	Determines whether a specified value matches any value in a list.	`Property IN (Value,Value)`
NOT IN	Determines whether a specified value does not match any value in a list.	`NOT Property IN (Value,Value)`
IS NULL	Returns the specified property if it is null. An expression with a bitwise or arithmetic operator evaluates to NULL if any one of the operands is NULL.	`Property IS NULL`
IS NOT NULL	Returns the specified property if it is not null. An expression with a bitwise or arithmetic operator evaluates to NULL if any one of the operands is NULL.	`NOT Property IS NULL`
AND	Combines conditions and matches a value if it meets all conditions.	`Expression AND Expression`
OR	Combines conditions and matches a value if it meets any one of the conditions.	`Expression OR Expression`
NOT	Negates a Boolean expression.	`NOT Value`
( )	Groups the selection in parentheses.	`(Value, Value)`

Date-Time Operators

When you insert a date-time property from the Get Values panel into your expression, that value uses one of the following operators, depending on the field type. If you are an advanced user, you can also add one of these operators to an expression if you know its FDO syntax. These operators are not available from a list.

The Date-Time operators are parsed using the standard SQL literal strings:

- DATE 'YYYY-MM-DD'
- TIME 'HH:MM:SS[.sss]'
- TIMESTAMP 'YYYY-MM-DD HH:MM:SS[.sss]'

To use other formats, use TODATE or TOSTRING instead. See Conversion Options (page 67).

Function	Definition	Syntax	Example
DATE	Converts the string you specify into a date value using the format you choose from a list.	`DATE 'string'`	`DATE '1971-12-24'`
TIME	Converts the string you specify into a time value using the format you choose from a list.	`TIME 'string'`	`TIME'11:00:02'`
TIMESTAMP	Converts the string you specify into a date and time value using the format you choose from a list.	`TIMESTAMP 'string'`	`TIMESTAMP '2003-10-23 11:00:02'`

Functions

When you create an expression for geospatial features, you can use the following types of functions:

Type of function	Definition	Example
Math Functions (page 47)	Trigonometric, exponential, log, and other functions	Absolute value, modulus, remainder, square root, logarithmic operators, exponent
Numeric Functions (page 54)	Functions that round off, truncate, or find the sign of a numeric value	Ceiling, Floor, Round, Truncate
Text Functions (page 56)	Functions that operate on text strings	Concatenate, pad or trim the left or right side of a string, specify the length or position of a string
Date Functions (page 61)	Functions that operate on date values	Specify the current date, find the result of adding months to a date

Math Functions

Math functions are available from the Math Function menu. They include standard trigonometric operations, as well as functions for absolute value, exponents, and others. These functions are available for every data provider except for raster, WFS, and WMS providers.

The functions that return angles (for example, ARCCOS) are helpful in formulating expressions that define rotation.

When you create an expression for geospatial features, you can use the following math functions.

Function	Definition	Syntax	Example
ABS	Returns the absolute value of a number (without its sign) using the input data type. For example, `ABS(-2)=2`	`ABS(Numeric_Property)`	`ABS(Pipe_Angle)`
ACOS	Returns the arccosine, or inverse cosine, of a number between or equal to -1 and 1. (This is the angle that has a cosine equal to a given number.) The returned value is in radians with a Double data type. For example, `ACOS(.5)=pi/3`	`ACOS(Numeric_Property)`	`ACOS(Pipe_Property)`
ASIN	Returns the arcsine, or inverse sine, of a number between or equal to -1 and 1. (This is the angle that has a sine equal to a given number.) The returned value is in radians with a Double data type.	`ASIN(Numeric_Property)`	`ASIN(Pipe_Property)`

Function	Definition	Syntax	Example
	For example, `ASIN(.5)=pi/6`		
ATAN	Returns the arctangent, or inverse tangent, of any number. (This is the angle that has a tangent equal to a given number.) The returned value is in radians with a Double data type. For example, `ATAN(1)=pi/4`	`ATAN(Numeric Property)`	`ATAN(Pipe_Property)`
ATAN2	Returns the arctangent, or inverse tangent, of X and Y coordinates of a point. Each coordinate can be any real number. The returned value is in radians with a Double data type. For example, `ATAN2(-.7071,.7071)=3pi/4`	`ATAN2(x_Numeric_Property, y_Numeric_Property)`	`ATAN2(NS_Street_Property, EW_Street_Property)`
COS	Returns the cosine of an angle. The returned value has a Double data type. (In a right triangle, the cosine	`COS(Angle_Property)`	`COS(Pipe_Angle)`

Function	Definition	Syntax	Example
	of an angle is the ratio of the adjacent side to the hypotenuse.) For example, `COS(pi/3)=.5`		
EXP	EXP returns e raised to the specified power, where e = 2.71828183 ... EXP returns a value with a Double data type. For example, `EXP(2)=7.389056099...`	`EXP(Numeric_Property)`	`EXP(Street_Length_Property)`
LN	Returns the natural logarithm of a positive number. The returned value has a Double data type. The natural log is often used to determine how long it will take to achieve a stated level. For example, `LN(2.71828183)=1`	`LN(Numeric Property)`	`LN(Desired_Level_Property)`
LOG	Returns the logarithm, to the base specified, of a number. The returned value has a Double data type. The base	`LOG(Base, Numeric_Property)`	`LOG(10,Cost_Property)`

Function	Definition	Syntax	Example
	can be any positive value other than 1 and the number can be any positive value. For example, `LOG(10,100)=2`		
MOD	Returns the remainder of a number (the dividend) after being divided by a another number (the divisor). For example, `MOD(11,4)=3` Uses the FLOOR (page 54) function to round. For more information, see Using Mod and Remainder (page 53).	`MOD(Dividend, Divisor)`	`MOD(Parcel_Value, Parcel_Area)`
POWER	Returns the result of one number raised to the power of a second number. The returned value has a Double data type. The base and the exponent can be any numbers, but if the base is negative, then the	`POWER(Base_number,Power_number)`	`POWER(Parcel_Cost,2)`

Function	Definition	Syntax	Example
	power must be an integer. For example, `POWER(5,2)=25`		
REMAINDER	Returns the remainder of a number after being divided by a another number. For example, `REMAINDER(11,4)=-1` Uses the ROUND (page 54) function to round. For more information, see Using Mod and Remainder (page 53)	`REMAINDER(Dividend, Divisor)`	`REMAINDER(Parcel_Cost,4)`
SIN	Returns the sine of an angle. The returned value has a Double data type. In a right triangle, the sine of an angle is the ratio of the opposite side to the hypotenuse. For example, `SIN(pi/6)=.5`	`SIN(Angle_Property)`	`SIN(Pipe_Angle)`
SQRT	Returns the square root of a positive number. The returned	`SQRT(Numeric_Property)`	`SQRT(Parcel_Area)`

Function	Definition	Syntax	Example
	value has a Double data type. For example, `SQRT(25)=5`		
TAN	Returns the tangent of an angle. The returned value has a Double data type. In a right triangle, TAN is the ratio of the opposite side to the adjacent side. For example, `TAN(pi/4)=1`	`TAN(Angle_Property)`	`TAN(Pipe_Angle)`

Using Mod and Remainder

The functions `MOD` and `REMAINDER` both return the remainder of a division of two numbers. The difference is that `MOD` uses the function `FLOOR` in its algorithm, and `REMAINDER` uses the function `ROUND` instead. This can affect the result. For example, the call to `MOD (34.5, 3)` returns `1.5`. The call `REMAINDER (34.5, 3)` returns `-1.5`. For `REMAINDER`, `n` cannot equal zero.

The formulas for the two functions are:

```
MOD (m, n) = SIGN (m) * (ABS(m) - (ABS (n) * FLOOR(ABS (m) / ABS (n))))
```

```
REMAINDER (m,n) = m - (n*ROUND (m/n)
```

You can see the differences that can result by examining the following table:

If m=	And n=	MOD (m,n) returns	REMAINDER (m,n) returns
11	4	3	-1

If m=	And n=	MOD (m,n) returns	REMAINDER (m,n) returns
11	-4	3	-1
-11	4	-3	1
-11	-4	-3	1

Numeric Functions

Numeric functions are available from the Math Function menu. They operate on numeric values to round numbers up or down, truncate them, or determine whether the number is negative or positive. These functions are available for every data provider except for raster, WFS, and WMS providers.

When you create an expression for geospatial features, you can use the following numeric functions:

Function	Definition	Syntax	Example

CEIL	Rounds a number up to the next highest integer. The return value uses the input data type.
	For example,
	`CEIL(2.6)=3`
	`CEIL(-2.6)=-2`
		`CEIL(Numeric_Property)`	`CEIL(Part_Cost)`

FLOOR	Rounds a number down to the next lowest integer. The return value uses the input data type.	`FLOOR(Numeric_Property)`	`FLOOR(Part_Cost)`

Function	Definition	Syntax	Example
	For example, `FLOOR(2.6)=2` `FLOOR(-2.6)=-3`		
ROUND	Rounds a number to the specified decimal places. The return value uses the input data type. For example, `ROUND(1.476,2)=1.48`	`ROUND(Numeric_Property], Number of decimal places)`	`ROUND(Part_Cost,2)`
SIGN	Finds the sign of a number. Returns 1 if the number is positive; 0 if the number is 0; -1 if the number is negative. The return value uses an Int16 data type. For example, `SIGN(-3.76)=-1`	`SIGN(Numeric_Property)`	`SIGN(Parcel_Sale_Profit)`
TRUNC	Truncates a date property to the specified format ('YEAR', 'MONTH', 'DAY', 'HOUR' or 'MINUTE') or Truncates a numeric property	`TRUNC(Date_Property, 'Format')` `TRUNC(Numeric_Property, Number of decimal places)`	`TRUNC(Repair_Date, 'DAY')` or `TRUNC(Repair_Cost, 2)`

Function	Definition	Syntax	Example
	to the specified number of decimal places. The return value uses the input data type. For example, `TRUNC(1.476, 2)=1.47` This function returns a DOUBLE.		

Text Functions

Text functions are available from the Text Function menu. They operate on text properties and are useful for formatting the results of text-related queries. These functions are available for every data provider except for raster, WFS, and WMS providers.

When you create an expression for geospatial features, you can use the following text functions:

Function	Definition	Syntax	Example
CONCAT	Joins two strings into one. CONCAT takes two arguments, which can be any property type except Geometry or Raster properties. The return value uses the String data type.	`CONCAT(Property, Property)`	`CONCAT(First_Name, Last_Name)`

Function	Definition	Syntax	Example
	You must nest any functions you use with this function, because it takes only two parameters.		
INSTR	Finds the position of the first occurrence of a substring in another string. Specify the source string as the first argument and the string you are searching for as the second argument. Returns an integer with the data type Int64.	`INSTR(Text property or value, Text value or property)`	`INSTR(Parcel_Owner,'field)` This example looks for the substring "field" within the parcel owner string. If the parcel owner's name is Smithfield, the value returned would be 6.
LENGTH	Returns the number of characters of the specified string as an integer with the data type Int64. Does not include trailing blank characters.	`LENGTH(Text_property)`	`LENGTH(First_Name)` This example finds the number of characters in the First_Name property.
LOWER	Converts text to lowercase. The return value uses the String data type.	`LOWER(Text_property)`	`LOWER(Product_Name)` This example changes a product name entry to lowercase (for example, PIPE COMPOUND to pipe compound).

Function	Definition	Syntax	Example
LPAD	Pads the left side of a string with the characters specified. The return value uses the String data type. LPAD can take two to three parameters. If you don't specify the text character argument, a space character is used.	`LPAD(Text_property, Number of characters,'text character')`	`LPAD(High_Priority,3,'*')` This example would show a value for the property High_Priority (for example, "Emergency Repair") preceded by ***.
LTRIM	Trims characters from the left side of a text string. The return value uses the String data type.	`LTRIM(Text_property)`	`LTRIM(Parcel_ID)` This example removes leading characters from parcel identifiers.
RPAD	Pads the right side of a string with the characters specified. The return value uses the String data type. RPAD can take two to three parameters. If you don't specify the text character argument, a space character is used.	`RPAD(Text_property, Number of characters,'text character')`	`RPAD(Costly_Repair,3,$)` This example would show a value for the property Costly_Repair (for example, "Complete Redesign") followed by $$$.

Function	Definition	Syntax	Example
RTRIM	Trims characters from the right side of a text string (trailing characters). The return value uses the String data type. To remove leading characters, use TRIM. See TRIM (page ?).	`RTRIM(Text_property)`	`RTRIM(Parcel_ID)` This example removes characters that follow parcel identifiers.
SOUNDEX	Returns names that, in English, sound like the specified text string. The return value uses the String data type. Any expression including the SOUNDEX function is evaluated by the underlying RDBMS. However, the result returned by a MySQL provider may differ from the result you receive from other providers.	`SOUNDEX(Text_property) = SOUNDEX('text string')`	`SOUNDEX(Last_Name) = SOUNDEX('Smith')` This example finds last names that sound like Smith (for example, "Smythe").
SUBSTR	Extracts a substring from a string. If the start position is 0, it is treated as 1. If	`SUBSTR(Text_property, Starting position, Length`	`SUBSTR(Last_Name,0,4)`

Function	Definition	Syntax	Example
	you specify a negative value for this position, the expression counts backwards from the end of the string. The return value uses the String data type. For example, `SUBSTR('ABCDEFG',-6,4)` finds BCDE.	`of substring)`	
TRANSLATE	Replaces a sequence of characters with another set of characters. The return value uses the String data type. For example, `TRANSLATE('AGIS Specialist''s Guide to C#' ''#', '___')` transforms the book title shown to "A_GIS_Specialist_s_Guide_to_C_)." Note that the original title required an additional single quote as an escape character.	`TRANSLATE(Text_property,'fromtext','totext')`	`TRANSLATE(Comment_Property ' ''#', '___')` This example changes spaces, quotation marks, and # characters to underscore characters.

Function	Definition	Syntax	Example
TRIM	Trims leading characters from a text string. To remove trailing characters, use RTRIM. The return value uses the String data type. You can specify an optional argument: be BOTH, LEADING or TRAILING. If you do not specify the trim character, a blank space is assumed. See RTRIM (page ?).	`TRIM('optional_argument', Text_property)`	`TRIM('trailing', Parcel_ID]` This example trims trailing characters from the parcel ID.
UPPER	Converts text to uppercase. The return value uses the String data type.	`UPPER(Text property)`	`UPPER(Parcel_Owner)` This example would display the value "John McMansion" as "JOHN MCMANSION."

Date Functions

Date functions are available from the Date Function menu. They return the current date or operate on a date string. These functions are available every data provider except for raster, WFS, and WMS providers.

When you create an expression for geospatial features, you can use the following date functions.

Function	Definition	Syntax	Example
ADDMONTHS	Finds the result of adding months to a date. The property value provided must have an integer value. Returns a string with a DateTime data type in the format of the original date value.	`ADDMONTHS(Date_property, Number)`	`ADD_MONTHS(Start_Date,1)` This example adds one month to the value of `Start_Date`. If `Start_Date` is June 1, 2008, `ADDMONTHS` would return July 1, 2008.
CURRENTDATE	Returns the current date as a string with a DateTime data type.	`CURRENTDATE( )`	`CURRENTDATE ( )`
EXTRACT	Extracts a date/time field from a date/time value. Returns a value in the Gregorian calendar with a DateTime data type. The date/time field can be 'YEAR', 'MONTH', 'DAY', 'HOUR', 'MINUTE', or 'SECOND'.	`EXTRACT(field, Date_property)`	`EXTRACT(YEAR,Start_Date)` This example extracts the year from the value of `Start_Date`. If `Start_Date` is June 1, 2008, `EXTRACT` would return 2008.

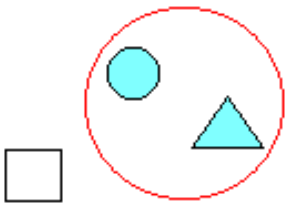
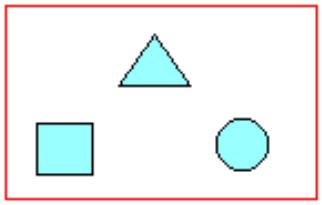
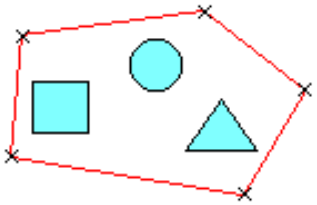
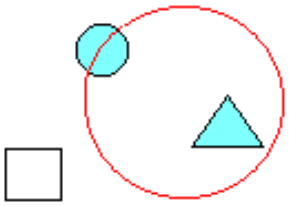
Function	Definition	Syntax	Example
MONTHSBETWEEN	Returns the number of months between two dates as a Double data type. If the first date is later than the second one, the result is positive. If the first date is earlier than the second one, the result is negative. If both dates are the same day of a month or are both the last day of a month, the result is an integer. Otherwise, it is the fractional portion of the result based on a 31-day month.	`MONTHSBETWEEN(Date_property,Date_property)`	`MONTHSBETWEEN(Start_Date, End_Date)` In this example, if Start_Date is March 1, 2007 and End_Date is April 1, 2007, MONTHSBETWEEN would return 1.

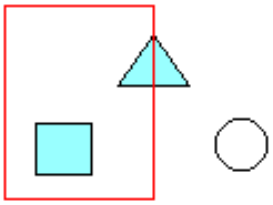
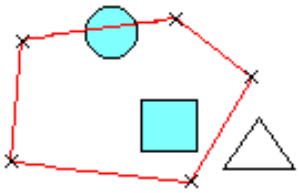
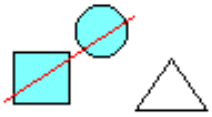
Location Conditions

Location conditions are available from the Locate On Map menu. They filter or select data based on a location you specify in your map.

For example, you can find all roads within 100 meters of a power line, or all parcels within a specific section of the drawing.

In the following illustrations, the objects that are retrieved are highlighted:

Condition	Definition	Illustration
Inside Circle	Selects features entirely inside a circle drawn on the map.	
Inside Rectangle	Selects features entirely inside a rectangle drawn on the map.	
Inside Polygon	Selects features entirely inside a polygon drawn on the map.	
Touching Any Part Of Circle	Selects features touching a circle drawn on the map.	

Condition	Definition	Illustration
Touching Any Part Of Rectangle	Selects features touching a rectangle drawn on the map.	
Touching Any Part Of Polygon	Selects features touching a polygon drawn on the map.	
Touching Any Part Of Fence	Selects features touching a line drawn on the map.	
Touching Any Part Of Point	Selects features touching a point drawn on the map.	

Options

When you create an expression for geospatial features, you can use the following types of options:

Type of Option	Definition	Example
Geometric Options (page 66)	Ways to calculate length and area	Length, area
Conversion Options (page 67)	Ways to convert values from one format to another	ToDate, ToDouble, ToFloat
Aggregate Options (page 72)	Operate on a set of values	Average, Count, Standard Deviation

Geometric Options

Geometric options are available from the Geometric menu. They calculate the length of lines and the perimeters or areas of polygons in a particular feature layer. These options perform calculations on fields in the data store, but the results of these calculations are not saved back to the data store. In AutoCAD Map, you can create a calculated field to store this information. These functions are available for every data provider except for raster, WFS, and WMS providers.

To use these options, select the object whose length or area you want, and then create the exact expression shown in the example below. Do not replace the argument `Geometry` with an actual vaue.

Option	Definition	Syntax	Example
LENGTH2D	Calculates the length of lines and perimeters of polygons	`LENGTH2D(Geometry)`	`LENGTH2D(Geometry)`

Option	Definition	Syntax	Example
AREA2D	Calculates the area of a polygon	`AREA2D(Geometry)`	`AREA2D(Geometry)`

Conversion Options

Conversion options are available from the Conversion menu. They convert strings from one format to another. These functions are available for every data provider except for raster, WFS, and WMS providers.

The functions TODATE and TOSTRING support date formatting options (page 69).

Option	Definition	Syntax	Example
NULVALUE	Evaluates two properties. If the first one is not null, NULLVALUE returns the value for that property. Otherwise, NULLVALUE returns the second property value.	`NULLVALUE(Text_Property, Value)`	`NullValue(Parcel_Owner,'No Owner Listed')` In this example, NULLVALUE evaluates the value of Parcel_Owner. If it is null, it converts that null value to the string "no owner listed." If there is a value for Parcel_Owner, it returns the owner value.
TODATE	Converts a text string representing date/time information to a date object. The returned value has a	`TODATE(Text_property,format)`	`TODATE(Purchase_Date,MM/DD/YYYY)` In this example, the value for purchase date is converted to a date value with the format MM/DD/YYYY. If the purchase date value is November 2, 2002, it would convert to 11/02/2002.

Option	Definition	Syntax	Example
	DateTime data type. The text property provided must match the format provided. If it does not match, the conversion does not take place. See Date Formatting Options (page 69).		
TODOUBLE	Converts a numeric or text string to a double-precision, floating-point number.	`TODOUBLE(Text_property)`	`TODOUBLE(Parcel_Value)` In this example, the Parcel_Value value is converted to a text string.
TOFLOAT	Converts a numeric or text string to a single-precision floating-point number.	`TOFLOAT(Text_property)`	`TOFLOAT(Parcel_Value)` In this example, the Parcel_Value value is converted to a string.
TOINT32	Converts a numeric or string expression to an int32.	`TOINT32(Text_property)`	

Option	Definition	Syntax	Example
TOINT64	Converts a numeric or string expression to an int64.	`TOINT64(Text_property)`	

TOSTRING	Converts a numeric or date expression to a string using an optional format you specify
	or
	Converts a numeric property to a text string (no format can be assigned).
	See Date Formatting Options (page 69) for format options.
		`TOSTRING(Date_property, format)`
		or
		`TOSTRING(Numeric_property)`
			`TOSTRING(Parcel_Sale_Date,MM/DD/YYYY)`
			In this example, if the value for Parcel_Sale_Date is January 12, 2007, it is converted to the text string 01/12/2007.

Date Formatting Options

The TOSTRING and TODATE Conversion Options (page 67) provide different formatting options.

TOSTRING Formatting

TOSTRING takes a date value and creates a representation of it as a string. The optional format specification parameter defines the structure of the string to create. For example, if the date information is 1998-APR-02, you can format the resulting string as April 2, 1998.

You can use any combination in your format except those that return the number of a day or week within a year for a given date. For example, TOSTRING (1998-APR-02, 'MONTH DD, YY') returns the value APRIL 02, 98.

If you use a relational database management system, your data store may not be able to use its native (built-in) functions to execute the request. If this is the case, the conversion is handled by the program, which might take more time than if the data store did the conversion.

TODATE Formatting Options

TODATE takes a string value representing a date or time and converts it to a date object. The optional format specification parameter defines the format used to represent the date in the string. For example, for a string containing the date April 2, 1998 ,the format specification should contain Month DD, YYYY. The following table outlines the formatting options available:

Abbreviation	Description
YY	Defines the year as a two-digit number, for example, 07.
YYYY	Defines the year as a four-digit number, for example, 2007.
MONTH	Defines the month using its name in upper-case letters, for example, APRIL.
month	Defines the month using its name in lowercase letters, for example, april.
Month	Defines the month using its name with an initial capital letter, for example, April.
MON	Defines the month using its three-letter abbreviation in uppercase, for example, APR.
mon	Defines the month using its three-letter abbreviation in lowercase, for example, apr.

Abbreviation	Description
MM	Defines the month using its two-number abbreviation, for example, 04.
DAY	Defines the day using its name in upper-case letters, for example, FRIDAY.
day	Defines the day using its name in lowercase letters, for example, friday.
Day	Defines the day using its name with an initial capital letter, for example, Friday.
DY	Defines the day using its abbreviation in uppercase, for example, FRI.
dy	Defines the day using its abbreviation in lowercase, for example, fri.
DD	Defines the day using its two-number abbreviation, for example, 06.
hh24	Defines an hour using its number in the range [0-24].
hh12	Defines an hour using its number in the range [0-12].
hh	Defines an hour using its number in the default representation (by default, hh24).
mm	Defines minutes.
ss	Defines seconds.
ms	Defines milliseconds.

Abbreviation	Description
am|pm	Uses the ante-meridiem (morning) and post-meridiem (after noon) specification. Noon is often called 12:00 p.m. and midnight 12:00 a.m., as at the beginning of a day. This format is considered only when used with the time range [1-12] (format hh12).

Aggregate Options

Aggregate functions are not available from a menu. They operate on a set of values. These functions are available for every data provider except for raster, WFS, and WMS providers (which can use only the SpatialExtent function.

Option	Definition	Syntax	Example
AVG	Returns the average of the values as a Double data type. You can specify an optional argument: ALL or DISTINCT. For example: `AVG(Id)`, `AVG('all', Id)`, `AVG('distinct', Id)`	`AVG('all', Numeric_property)`	`AVG('all', Parcel_Value)` This example finds the average of all parcels that have a Parcel_Value property, including those that are null or empty.
COUNT	Returns the number of rows as an	`COUNT('optional_argument', Numeric_property)`	`COUNT('all', Parcel_ID)` This example counts all the rows containing a Parcel_ID

Option	Definition	Syntax	Example
	Int64 data type. You can specify an optional argument: ALL or DISTINCT. For example: `COUNT(Id)`, `COUNT('all', Id)`, `COUNT('distinct', Id)`		property, including those that are null or empty.
MAX	Returns the maximum value with the same data type as the input parameter. You can specify an optional argument: ALL or DISTINCT. For example: `MAX(Id)`, `MAX('all', Id)`, `MAX('distinct', Id)`	`MAX('optional_argument', Numeric_property)`	`MAX('all', Parcel_Area)` This example finds the largest parcel area value for all parcels containing a Parcel_Area property, including those that are null or empty.
MEDIAN	Takes a numeric value and returns the middle value or an	`MEDIAN(Numeric_property)`	`MEDIAN(Parcel_Value)` This example finds the median parcel value for all parcels that have a Parcel_Value property, including those

Option	Definition	Syntax	Example
	interpolated value that would be the middle value once the values are sorted. The returned value has the same data type as the input parameter. Represents an inverse distribution function that assumes a continuous distribution model.		that are null or empty, assuming that Parcel_Value is a numeric property.
MIN	Returns the minimum value with the same data type as the input parameter. The returned value has the same data type as the input parameter. You can specify an optional argument: ALL or DISTINCT.	`MIN('optional_argument', Numeric_property)`	`MIN('all', Parcel_Area)` This example finds the area of the smallest parcel that has a Parcel_Area property, including those that are null or empty.

Option	Definition	Syntax	Example
	For example: `Min(Id)`, `Min('all', Id)`, `Min('distinct', Id)`		
SPATIALEXTENT	Returns the smallest possible bounding rectangle of all geometries in a layer.	`SPATIALEXTENT(geometry)`	`SPATIALEXTENT(geometry)`
STDDEV	Returns the sample standard deviation as a Double data type.	`STDDEV(Numeric_property)`	`STDDEV(Parcel_Value)` This example finds the standard deviation among parcel values for all parcels with a Parcel_Value property, including those that are null or empty.
SUM	Returns the sum of the values as a Double data type. You can specify an optional argument: ALL or DISTINCT. For example: `Sum(Id)`, `Sum('all', Id)`, `Sum('dis-`	`SUM('all', Numeric_property)`	`SUM('all', Parcel_Value)` This example finds the total of parcel values for all parcels with a Parcel_Value property, including those that are null or empty.

Option	Definition	Syntax	Example
	`tinct', Id)`		

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