Editing the AutoCAD entities: constructing a summer theater and circus plan

Guidance for laboratory works for "Informatics and computer modeling basics" course /for foreign students of 2nd year studying by orientation 6.060102 «Architecture»/

Редагування примітивів AutoCAD: побудова плану літнього театру і цирку: Методичні вказівки до виконання лабораторних робіт з курсу "Інформатика і основи комп'ютерного моделювання" (англ.) /для студентів 2 курсу напряму підготовки 6.060102 «Архітектура»/ Укл.: Бочаров Б.П., Яковицький І. Л., Воєводіна М.Ю., Левіков Ю.В.– Х.: ХНАМГ, 2008. – 23с.

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<u>Theme</u>: **Editing the AutoCAD entities: constructing a summer theater and circus plan**

<u>Purpose of work</u>: **entities creation skills developing, working with layers, learning how to copy and remove objects, create objects arrays**

Work order:

1. Start AutoCAD and open the drawing *tsk1.dwg*.
2. Draw a summer theater plan.
   2.1. Create a new layer.
   2.2. Using the PLINE command (width 0), draw seats in form of a square with a side of 1 m.
   2.3. Using the ARRAY command (rectangular array), create a hall for an audience: 15 rows of seats with 10 ones in each row. The distance between the rows is 1 m, the distance between the seats is 0.1 m.
   2.4. Create a new layer.
   2.5. Using the PLINE command (width 0), draw a stage in a rectangular form.
3. Draw a summer circus plan.
   3.1. Create a new layer for the seats of the circus.
   3.2. Copy one of the seats into a free place.
   3.3. Using the CHANGE command, carry a chair into the created layer.
   3.4. Using the ARRAY (polar array) command, create a hall for an audience of four identical sectors. In every sector there are 5 circular rows of seats. Passage-ways are placed between the sectors. Pick the distance between the seats in a row and between the rows yourself.
   3.5. Create a new layer.
   3.6. In the center of the circus draw an arena in a form of a circle.

4. Save the drawing in the personal folder and compress it (Zip).

5. Save this archive in the Academy distance learning system.

Modify Objects

You can easily modify the size, shape, and location of objects. You can

- Enter a command first, and then select the objects to modify.

- Select the objects first, and then enter a command to modify them.

- Select and right-click an object to display a shortcut menu with relevant options.

- Double-click an object to display the Properties palette or, in some cases, a dialog box or editor that is specific to that type of object. (You can specify the double click action for each object type by customizing a CUI file and loading it into the program.)

Select Objects

You have a wide range of options when you need to select objects for editing operations.

Select Objects Individually

At the Select Objects prompt, you can select one or more objects individually.

Use the Pickbox Cursor

When the square pickbox cursor is in position to select an object, the object is highlighted. Click to select the object.

You can control the size of the pickbox in the Options dialog box, Selection tab.

Select Objects Close Together

It is difficult to select objects that are close together or lie directly on top of one another. The example shows two lines and a circle that lie within the pickbox.

first selected object   second selected object   third selected object
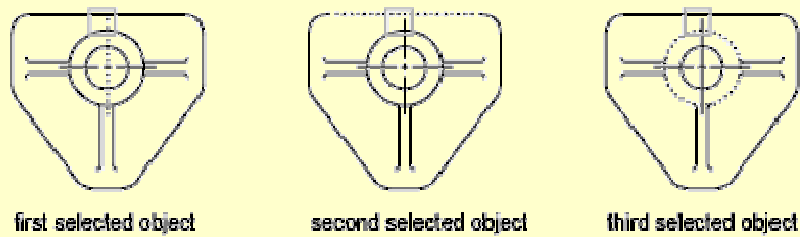
If selection preview is turned on, you can cycle through the objects by rolling over the object on top to highlight it, and pressing and holding SHIFT and then pressing SPACEBAR continuously. When the required object is highlighted, left-click to select it.

If selection preview is turned off, hold down SHIFT + SPACEBAR and click to cycle through these objects, one after the other, until the one you want is selected. Press ESC to turn off cycling.

Remove Selection from Objects

Remove objects from the current selection set by holding down SHIFT and selecting them again.

Select Multiple Objects

At the Select Objects prompt, you can select many objects at the same time.

Specify a Rectangular Selection Area

Specify opposite corners to define a rectangular area. The background inside the area changes color and becomes transparent. The direction that you drag your cursor from the first point to the opposite corner determines which objects are selected.

- **Window selection**. Drag your cursor from left to right to select only objects that are entirely enclosed by the rectangular area.

- **Crossing selection.** Drag your cursor from right to left to select objects that the rectangular window encloses or crosses.

With a window selection, usually the entire object must be contained in the rectangular selection area. However, if an object with a noncontinuous (dashed) linetype is only partially visible in the viewport and all the visible vectors of the linetype can be enclosed within the selection window, the entire object is selected.
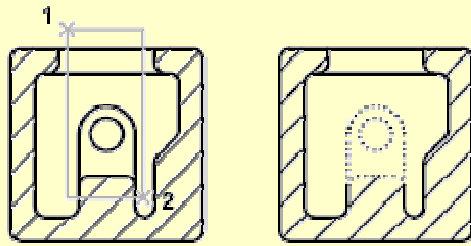
objects selected using window selection box
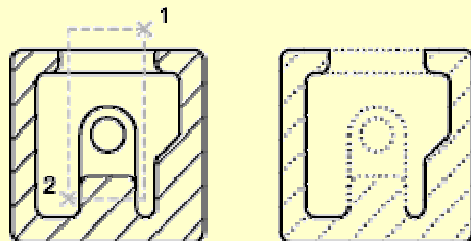
objects selected using crossing selection box

Specify an Irregularly Shaped Selection Area

Specify points to define an irregularly shaped area. Use window polygon selection to select objects entirely enclosed by the selection area. Use crossing polygon selection to select objects enclosed or crossed by the selection area.
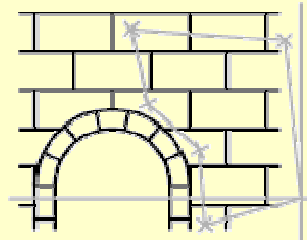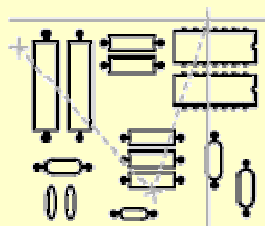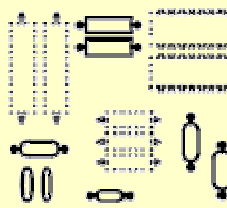
window polygon
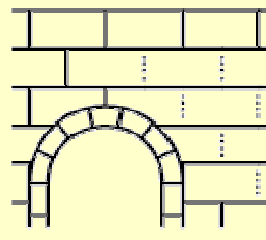
result

Specify a Selection Fence

In a complex drawing, use a selection fence. A selection fence looks like a polyline and selects only the objects it passes through. The circuit board illustration shows a fence selecting several components.

fence selection

selected objects highlighted

Use Other Selection Options

You can see all selection options by **entering ?** at the Select Objects prompt. For a description of each of the selection options, see SELECT.

Remove Selection from Multiple Objects

You can enter r (Remove) at the Select Objects prompt and use any selection option to remove objects from the selection set. If you are using the Remove option and want to return to adding objects to the selection set, enter a (Add).

You can also remove objects from the current selection set by holding down SHIFT and selecting them again, or by holding down SHIFT and then clicking and dragging window or crossing selections. You can add and remove objects repeatedly from the selection set.

Correct Mistakes

You can backtrack your recent actions using one of several methods.

Undo a Single Action

The simplest method of backtracking is to use Undo on the Standard toolbar or the U command to undo a single action. Many commands include their own U (undo) option so that you can correct mistakes without leaving the command. When you are creating lines and polylines, for example, enter u to undo the last segment.

Note. By default, the UNDO command is set to combine consecutive pan and zoom commands into a single operation when you undo or redo. However, pan and zoom commands that are started from the menu are not combined, and always remain separate actions.

Undo Several Actions at Once

Use the Mark option of UNDO to mark an action as you work. You can then use the Back option of UNDO to undo all actions that occurred after the marked action. Use the Begin and End options of UNDO to define a set of actions to be treated as a group.

You can also undo several actions at once with the Undo list on the Standard toolbar.

Reverse the Effect of Undo

You can reverse the effect of a single U or UNDO command by using REDO immediately after using U or UNDO.

You can also redo several actions at once with the Redo list on the Standard toolbar.

Erase Objects

You can erase any object that you draw. If you accidentally erase the wrong object, you can use the UNDO command or the OOPS command to restore it.

Cancel a Command

You can cancel a command without completing it by pressing ESC.

Erase Objects

You can erase objects from your drawing using several methods.

- Erase them with ERASE.

- Select them and then cut them to the Clipboard with CTRL+X.

- Select them and press DELETE.

You can restore accidentally erased objects using UNDO. The OOPS command restores all objects deleted by the most recent use of ERASE.

Toolbar: Modify

Menu: Modify➤Erase

Shortcut menu: Select the objects to erase, right-click in the drawing area, and click Erase.

Command entry: erase

Clean Up the Display

You can remove the plus-shaped markers called blips and stray pixels that may be left over from some editing operations from the display area.

- To remove blips, use REDRAW.

- To remove stray pixels, use REGEN.

Move Objects

You can move objects at a specified distance and direction from the originals.

Use coordinates, grid snap, object snaps, and other tools to move objects with precision.

Toolbar: Modify

Menu: Modify ➤ Move

Shortcut menu: Select the objects to move, and right-click in the drawing area. Click Move.

Command entry: move

Specify Distance with Two Points

Move an object using the distance and direction specified by a base point followed by a second point. In this example, you move the block representing a window. Click Edit menu ➤ Move. Then select the object to be moved (1). Specify the base point for the move (2) followed by a second point (3). The object is moved the distance and direction of point 2 to point 3.
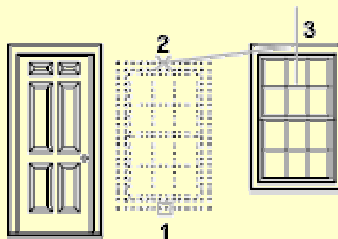
Specify Distance with Relative Coordinates

You can move an object using a relative distance by entering coordinate values for the first point and pressing ENTER for the second point. The coordinate values are used as a relative displacement rather than the location of a base point.

Note. Do not include an @ sign as you normally would for relative coordinates, because relative coordinates are expected.

To copy objects a specified distance, you can also use direct distance entry with Ortho mode and polar tracking. For more information, see Enter Direct Distances

Use a Stretch-Move

You can also use STRETCH to move objects if all their endpoints lie entirely within the selection window. Turn on Ortho mode or polar tracking to move the objects at a specific angle.

A practical example is moving a door in a wall. The door in the illustration is entirely within a crossing selection, while the wall lines are only partly within the crossing selection area.

objects selected with crossing selection

door moved with Ortho mode on and direct distance entry
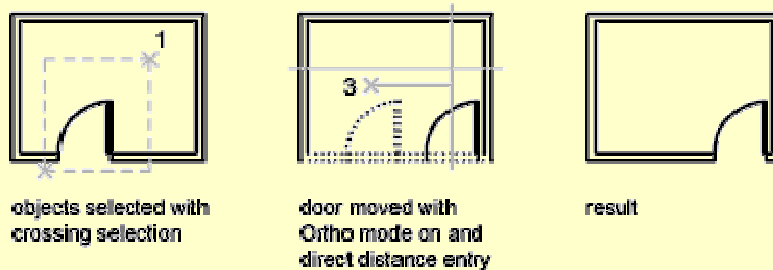
result

The result is that only the endpoints that lie within the crossing selection move.

Rotate Objects

You can rotate objects in your drawing around a specified base point.

To determine the angle of rotation, you can enter an angle value, drag using the cursor, or specify a reference angle to align to an absolute angle.

Toolbar: Modify

Menu: Modify➤ Rotate

Shortcut menu:Select the objects to rotate, and right-click in the drawing area. Click Rotate.

Command entry: rotate

Rotate an Object by a Specified Angle

Enter a rotation angle value from 0 to 360 degrees. You can also enter values in radians, grads, or surveyor bearings. Entering a positive angle value rotates the objects counterclockwise or clockwise, depending on the Direction Control setting in the Drawing Units dialog box.

Rotate an Object by Dragging

Drag the object around the base point and specify a second point. Use Ortho mode, polar tracking, or object snaps for greater precision.

For example, you can rotate the plan view of a house by selecting the objects (1), specifying a base point (2), and specifying an angle of rotation by dragging to another point (3).

object selected

base point and angle of rotation

result
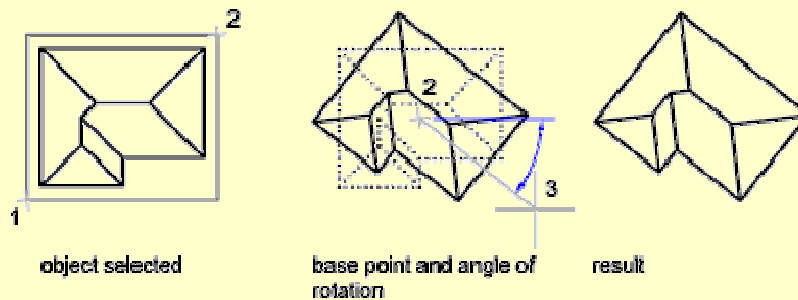
Rotate an Object to an Absolute Angle

With the Reference option, you can rotate an object to align it to an absolute angle.

For example, to rotate the part in the illustration so the diagonal edge rotates to 90 degrees, you select the objects to be rotated (1, 2), specify the base point (3), and enter the Reference option. For the reference angle, specify the two endpoints of the diagonal line (4, 5). For the new angle, enter 90.

objects selected
(1, 2)

base point (3),
reference points (4, 5)

result
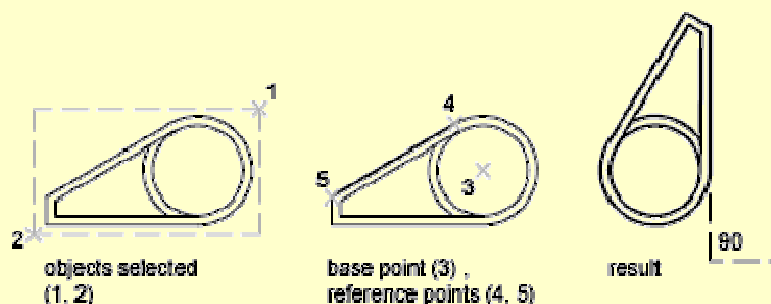
Scale Objects

You can enlarge or reduce selected objects proportionally in the X, Y, and Z directions

Toolbar: Modify

Menu: Modify ► Scale

Shortcut menu: Select the objects to scale, and right-click in the drawing area. Click Scale.

Command entry: scale

Scale Objects Using a Scale Factor

With SCALE, you can make an object uniformly larger or smaller. To scale an object, you specify a base point and a scale factor. Alternatively, you can specify a length to be used as a scale factor based on the current drawing units.

A scale factor greater than 1 enlarges the object. A scale factor between 0 and 1 shrinks the object.

Scaling changes the size of all dimensions of the selected object. A scale factor greater than 1 enlarges the object. A scale factor less than 1 shrinks the object.

object selected   object scaled by factor   result
                         of 0.5
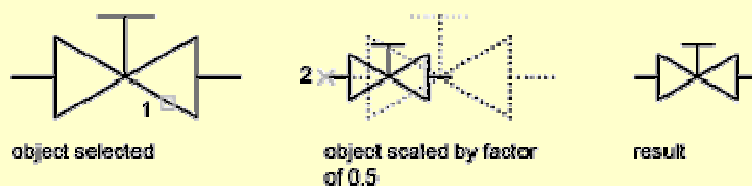
Note. When you use the SCALE command with annotative objects, the position or location of the object is scaled relative to the base point of the scale operation, but the size of the object is not changed.

Scale Objects Using a Reference Distance

You can also scale by reference. Scaling by reference uses an existing distance as a basis for the new size. To scale by reference, specify the current distance and then the new desired size. For example, if one side of an object is 4.8 units long and

you want to expand it to 7.5 units, use 4.8 as the reference length.

You can use the Reference option to scale an entire drawing. For example, use this option when the original drawing units need to be changed. Select all objects in the drawing. Then use Reference to select two points and specify the intended distance. All the objects in the drawing are scaled accordingly.

Copy Objects

You can create duplicates of objects at a specified distance and direction from the originals.

Use coordinates, grid snap, object snaps, and other tools to copy objects with precision.

Toolbar: Modify

Menu: Modify ➤ Copy

Shortcut menu: Select the objects to copy, and right-click in the drawing area. Click Copy Selection.

Command entry: copy

Specify Distance with Two Points

Copy an object using the distance and direction specified by a base point followed by a second point. In this example, you copy the block representing an electronic component.Click Edit menu ➤ Copy.At the Command prompt, enter copyclip. Then select the original object to be copied. Specify the base point for the move (1) followed by a second point (2). The object is copied the distance and direction of point 1 to point 2.
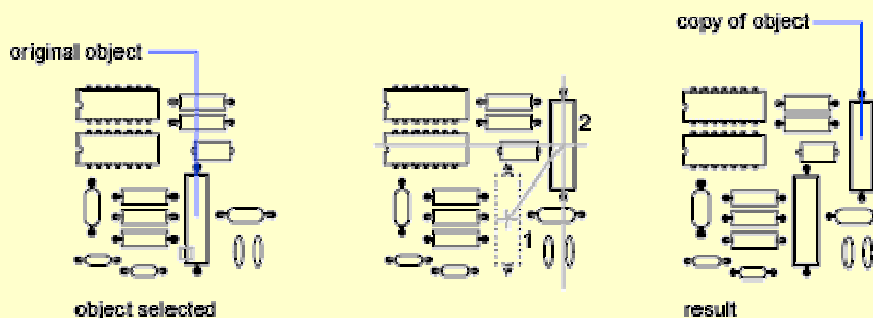
Specify Distance with Relative Coordinates

Copy an object using a relative distance by entering coordinate values for the first point and pressing ENTER for the second point. The coordinate values are used as a relative displacement rather than the location of a base point.

Note. Do not include an @ sign as you normally would for relative coordinates, because relative coordinates are expected.

To copy objects a specified distance, you can also use direct distance entry with Ortho mode and polar tracking. For more information, see Enter Direct Distances.

Create Multiple Copies

The COPY command repeats automatically by default. To exit the command, press ENTER. To change the default, use the COPYMODE system variable.

object selected   result
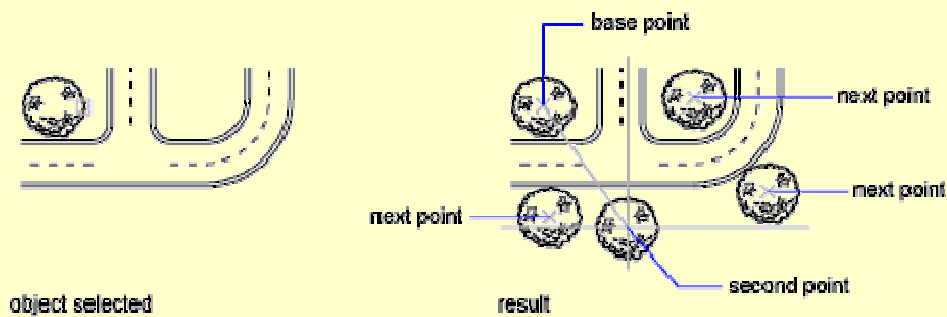
Mirror Objects

You can flip objects about a specified axis to create a symmetrical mirror image.

Mirroring is useful for creating symmetrical objects because you can quickly draw half the object and then mirror it instead of drawing the entire object.

Toolbar: Modify

Menu: Modify➤Mirror

Command entry: mirror

You flip objects about an axis called a mirror line to create a mirror image. To

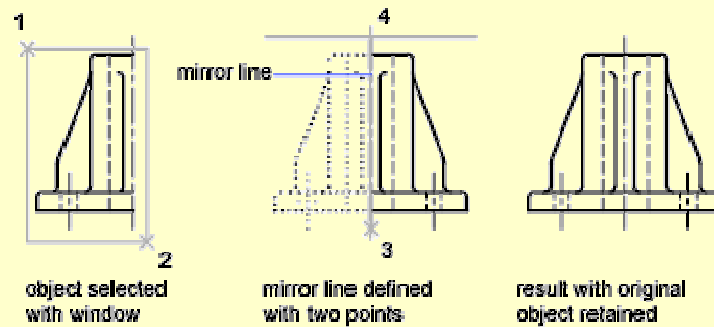specify this temporary mirror line, you enter two points. You can choose whether to erase or retain the original objects.

object selected with window

mirror line defined with two points

result with original object retained

By default, when you mirror text, attributes, and attribute definitions, they are not reversed or turned upside down in the mirror image. The text has the same alignment and justification as before the object was mirrored. If you do want text to be reversed, set the MIRRTEXT system variable to 1.

before MIRROR

after MIRROR (MIRRTEXT = 1)

after MIRROR (MIRRTEXT = 0)
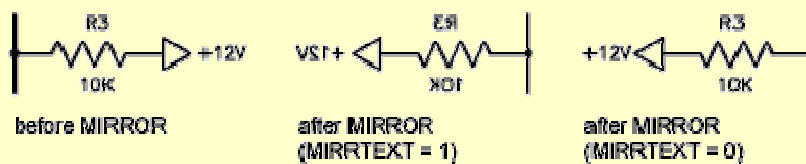
MIRRTEXT affects text that is created with the TEXT, ATTDEF, or MTEXT commands; attribute definitions; and variable attributes. Text and constant attributes that are part of an inserted block are reversed when the block is mirrored regardless of the MIRRTEXT setting.

Create an Array of Objects

You can create copies of objects in a rectangular or polar (circular) pattern called an array.

For rectangular arrays, you control the number of rows and columns and the

distance between each.

distance between rows

object selected

distance between columns
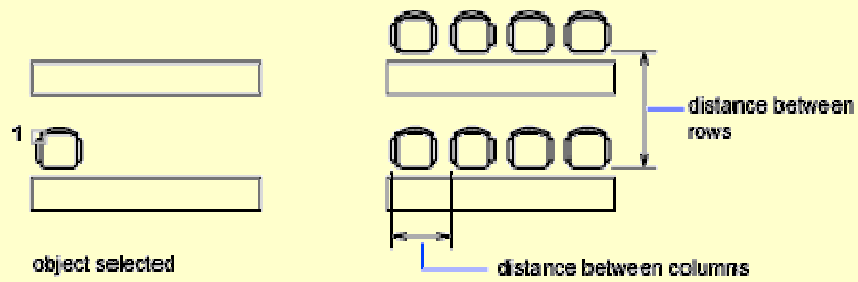
A rectangular array is built along a baseline defined by the current snap rotation angle. This angle is zero by default, so the rows and columns of a rectangular array are orthogonal with respect to the X and Y axes. The default angle 0 direction setting can be changed in UNITS.

angle of rotation

object selected
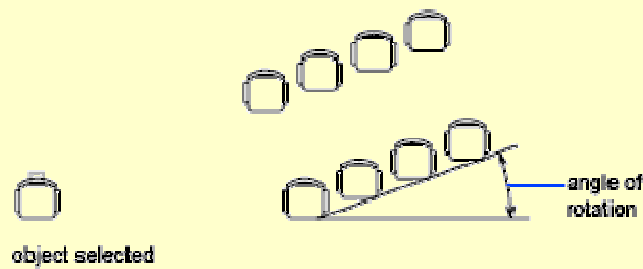
For polar arrays, you control the number of copies of the object and whether the copies are rotated. To create many regularly spaced objects, arraying is faster than copying.

polar array with objects rotated

polar array angle to fill=180; objects not rotated
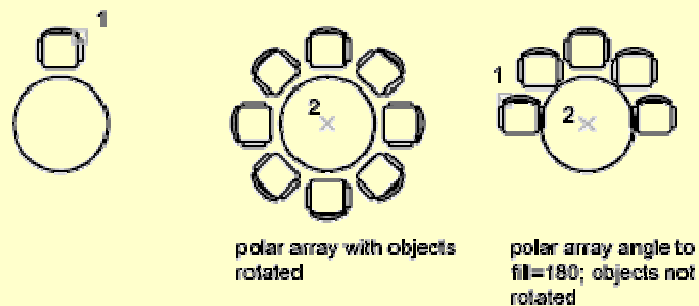
Toolbar: Modify

Menu: Modify ► Array

Command entry: array

The Array dialog box is displayed. You can create rectangular or polar arrays by choosing the appropriate option. Each object in an array can be manipulated independently. If you select multiple objects, the objects are treated as one item to be copied and arrayed.

If you enter -array at the command prompt, options are displayed at the command prompt.

Use the Rectangular Array option to create an array of rows and columns of copies of the selected object. Use the Polar Array option to create an array by copying the selected objects around a center point.

Other options: Select Objects, Preview Area, Preview.

Select Objects

Specifies the objects used to construct the array. You can select objects before or after the Array dialog box is displayed. To select objects when the Array dialog box is displayed, choose Select Objects. The dialog box temporarily closes. When you finish selecting objects, press ENTER. The Array dialog box is redisplayed, and the number of objects selected is shown below the Select Objects button.

Note. If you select multiple objects, the base point of the last selected object is used to construct the array.

Preview Area

Shows a preview image of the array based on the current settings in the dialog box. The preview image is dynamically updated when you move to another field after changing a setting.

Preview

Closes the Array dialog box and displays the array in the current drawing. Choose Modify to return to the Array dialog box to make changes.

Rectangular Array

Creates an array of rows and columns of copies of the selected object.
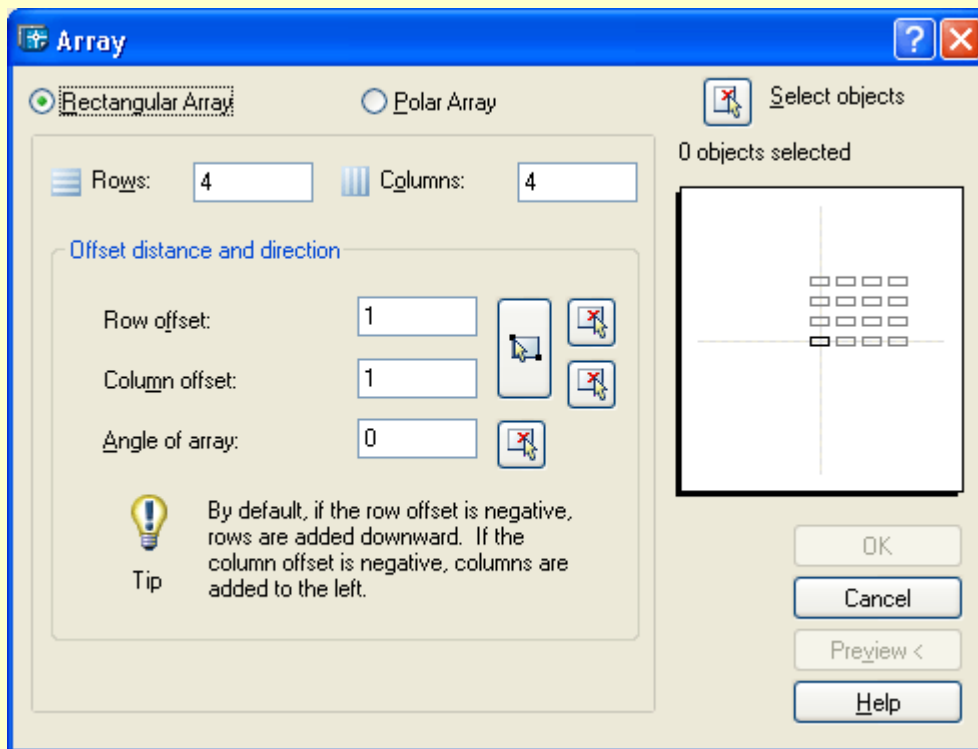
Rows – specifies the number of rows in the array.

If you specify one row, you must specify more than one column. If you specify a large number of rows and columns for the array, it might take a while to create the copies. By default, the maximum number of array elements that you can generate in one command is 100,000. The limit is set by the MAXARRAY setting in the registry. To reset the limit to 200,000, for example, enter (setenv "MaxArray" "200000") at the Command prompt.

Columns – specifies the number of columns in the array.

If you specify one column, you must specify more than one row. If you specify a large number of rows and columns for the array, it might take a while to create the

copies. By default, the maximum number of array elements that you can generate in one command is 100,000. The limit is set by the MAXARRAY setting in the registry. To reset the limit to 200,000, for example, enter (setenv "MaxArray" "200000") at the Command prompt.

Offset Distance and Direction – provides a space for you to specify the distance and direction of the array's offset.

- <u>Row Offset</u> specifies the distance (in units) between rows. To add rows downward, specify a negative value. To specify row spacing with the pointing device, use the Pick Both Offsets button or the Pick Row Offset button.

- <u>Column Offset</u> specifies the distance (in units) between columns. To add columns to the left, specify a negative value. To specify column spacing with the pointing device, use the Pick Both Offsets button or the Pick Column Offset button.

- <u>Angle of Array</u> specifies the angle of rotation. This angle is normally 0, so the rows and columns are orthogonal with respect to the X and Y drawing axes of the current UCS. You can change the measurement conventions for angles using UNITS. The ANGBASE and ANGDIR system variables affect the angle of arrays.

- <u>Pick Both Offsets</u> temporarily closes the Array dialog box so that you can use the pointing device to set the row and column spacing by specifying two diagonal corners of a rectangle.

- <u>Pick Row Offset</u> temporarily closes the Array dialog box so that you can use the pointing device to specify the distance between rows. ARRAY prompts you to specify two points and uses the distance and direction between the points to specify the value in Row Offset.

- <u>Pick Column Offset</u> temporarily closes the Array dialog box so that you can use the pointing device to specify the distance between columns. ARRAY prompts you to specify two points and uses the distance and direction

between the points to specify the value in Column Offset.

- Pick Angle of Array temporarily closes the Array dialog box so that you can specify the angle of rotation by entering a value or using the pointing device to specify two points. You can change the measurement conventions for angles using UNITS. The ANGBASE and ANGDIR system variables affect the angle of arrays.

Polar Array

Creates an array by copying the selected objects around a specified center point.

Center Point

Specifies the center point of the polar array. Enter coordinate values for X and Y, or choose Pick Center Point to use the pointing device to specify the location.

Pick Center Point

Temporarily closes the Array dialog box so that you can use the pointing device to specify the center point in the drawing area.

Method and Values

Specifies the method and values used to position objects in the polar array.

- Method sets the method used to position objects. This setting controls which of the Method and Value fields are available for specifying values. For example, if the method is Total Number of Items & Angle to Fill, the related fields are available for specifying values; the Angle Between Items field is not available.

- Total Number of Items sets the number of objects that appear in the resultant array. The default value is 4.

- Angle to Fill sets the size of the array by defining the included angle between the base points of the first and last elements in the array. A positive value specifies counterclockwise rotation. A negative value specifies clockwise rotation. The default value is 360. A value of 0 is not permitted.

- <u>Angle Between Items</u> sets the included angle between the base points of the arrayed objects and the center of the array. Enter a positive value. The default direction value is 90. You can choose the Pick buttons and use the pointing device to specify the values for Angle to Fill and Angle Between Items.

-
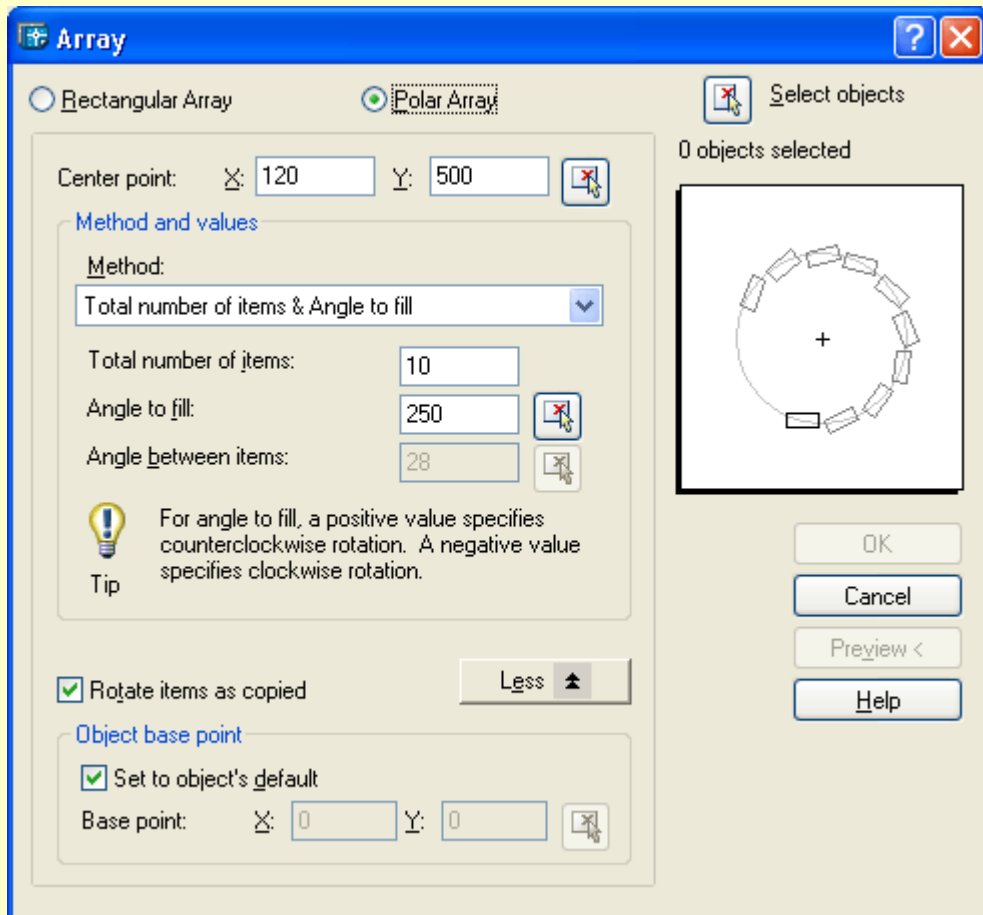
- <u>Pick Angle to Fill</u> temporarily closes the Array dialog box so that you can define the included angle between the base points of the first and last elements in the array. ARRAY prompts you to select a point relative to another point in the drawing area.
- <u>Pick Angle Between Items</u> temporarily closes the Array dialog box so that you can define the included angle between the base points of the arrayed objects and the center of the array. ARRAY prompts you to select a point relative to another point in the drawing area.

Rotate Items as Copied

Rotates the items in the array, as shown in the preview area.

More/Less

Turns the display of additional options in the Array dialog box on and off. When you choose More, additional options are displayed, and the name of this button changes to Less.

Object Base Point

Specifies a new reference (base) point relative to the selected objects that will remain at a constant distance from the center point of the array as the objects are arrayed. To construct a polar array, ARRAY determines the distance from the array's center point to a reference (base) point on the last object selected. The point used depends on the type of object, as shown in the following table.

Object type	Default base point
Arc, circle, ellipse	Center point
Polygon, rectangle	First corner
Donut, line, polyline	Starting point

Set to Object's Default

Uses the default base point of the object to position the arrayed object. To manually set the base point, clear this option.

Base Point

Sets a new X and Y base point coordinate. Choose Pick Base Point to temporarily close the dialog box and specify a point. After you specify a point, the Array dialog box is redisplayed.

NoteTo avoid unexpected results, set the base point manually if you are constructing a polar array and do not want to rotate the objects.

Навчальне видання

Editing the AutoCAD entities: constructing a summer theater and circus plan

Guidance for laboratory works for "Informatics and computer modeling basics" course /for foreign students of 2nd year studying by orientation 6.060102 «Architecture»/

Укладачі: Борис Петрович Бочаров,
Ігор Леонідович Яковицький,
Марія Юріївна Воєводіна,
Юрій Володимирович Левіков