Editing 2D Objects

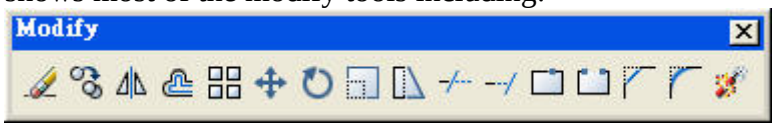
Objectives:

- To recognise the Modify toolbar.
- To use different methods of calling modify commands.
- To select objects for editing.
- To edit 2D objects by commonly used modify tools: erase, copy, mirror, move, rotate, trim, break, and fillet.

Subject Matters:

The Modify toolbar

When AutoCAD starts, the **Modify** toolbar usually docks against the left-hand side of the drawing window. This toolbar shows most of the modify tools including:



Erase	Copy Object
Mirror	Offset
Array	Move
Rotate	Scale
Stretch	Trim
Extend	Break at Point
Break	Chamfer
Fillet	Explode

Calling modify tools (commands)

Modify tools (commands) can be called for into action by different methods:

1. **Using the Modify toolbar**
   Left-click on a modify tool icon from the **Modify** toolbar to start the command, then select object or respond to the prompts displayed on the command line.
2. **Using the Modify pull-down menu**
   Left-click **Modify** on the menu bar to display the pull-down menu, click the appropriate modify command, then select object or respond to the prompts displayed on the command line.
3. **Using the command line**
   Enter the required modify command or its abbreviation on the command line, then respond either to select object or follow the prompts displayed on the command line.

Selecting objects

When a modify tool is called for into action, AutoCAD prompts to select object and replaces the cross hair cursor with a □ (**pick box**). Object or objects can be selected in different ways:

1. **Single object selection**
   Procedure:
   (i) Drag the pick box over the object.
   (ii) Left-click to select the object. The selected object is highlighted.
2. **Multiple object selection**
   Procedure:
   (i) Drag the pick box over the object, left-click to select the object.
   (ii) Drag the pick box over another object and left-click.
   (iii) Repeat (ii) to select objects.
   (iv) Those selected objects are highlighted.
3. **Using selection window**
   Procedure:
   - **Window selection**

   (i) When prompted to select objects, click two points, from ***left to right***, to form a rectangular window.
   (ii) Those objects **entirely** within the rectangular window are selected and highlighted.

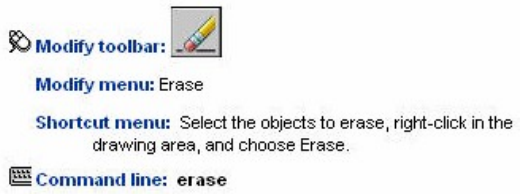
   or

   - **Crossing window selection**

   (i) When prompted to select objects, click two points, from ***right to left***, to form a rectangular window.
   (ii) Those objects **within and crossing** the rectangular window are selected and highlighted.
4. **Fence selection**
   Procedure:
   (i) When prompted to select objects, enter **F** on the command line.
   (ii) Draw a multi-segment line, like a **Polyline** (fence); all objects which **cross** the fence will be selected.
5. **Window polygon selection**
   Procedure:
   (i) When prompted to select objects, enter **WP** on the command line.
   (ii) Specify points forming an irregular polygon shape within which objects will be selected. Note that only objects which fall **entirely** within the polygon will be selected.
6. **Selecting all objects**
   Procedure:
   (i) When prompted to selected objects, enter **all** on the command line.
   (ii) No picking is required as all the objects in the drawing are selected.

Modify toolbar commands

Erase



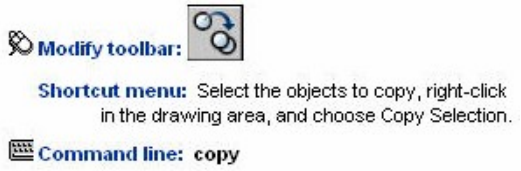
Function: It removes objects from a drawing.

Command sequence:

Command: **ERASE**
Select objects: **(pick an object to erase)**
Select objects: ↵**(to end the selection and erase the object)**

Tips: To get the deleted objects back by typing **U** to undo, from the **Standard** toolbar or by using the **OOPS** command.

Copy Object



Function: It duplicates objects. To copy objects within a drawing, specify a starting point and an endpoint of displacement.

Command Sequence:

Command: **COPY**
Select objects: **(pick object to copy)**
Select objects: ↵**(to end selection)**
Specify base point or displacement, or [Multiple]: **(pick a point or M for multiple copies)**
Specify second point of displacement or <use first point as displacement>: **(pick a point)**

Tips: The **multiple** option allows creating additional copies of the selected object(s) by picking as many points as required.

Mirror

Function: It creates a mirror image copy of objects around a mirror line, which is specified by two points. The original objects can be deleted or retained

Command Sequence:

Command: **MIRROR**
Select objects: **(pick object to mirror)**
Select objects: ↵**(to end selection)**
Specify first point of mirror line: **(pick a point)**
Specify second point of mirror line: **(pick a point)**
Delete source objects? [Yes/No] <N>: ↵**(for No to keep original object)**

Tips: Use **Ortho** to create perfectly horizontal or vertical mirror lines.

Offset

Modify toolbar: 
Modify menu: Offset
Command line: offset

Function: It creates new objects that are parallel to or concentric with a selected object. The new object is drawn at a user defined distance (the offset) from the original and in a direction chosen by the user with a pick point.

Command Sequence:

Command: **OFFSET**
Specify offset distance or [Through]<1.0000>: **(specify distance)**
Select object to offset or <exit>: **(select an object)**
Specify point on side to offset: **(pick a direction)**
Select object to offset or <exit>: ↵ **(to end or select another object to offset)**

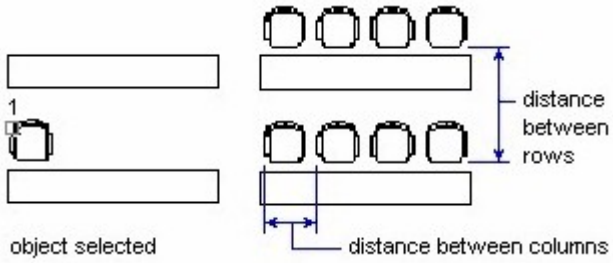
Array

Modify toolbar: 
Modify menu: Array
Command line: array

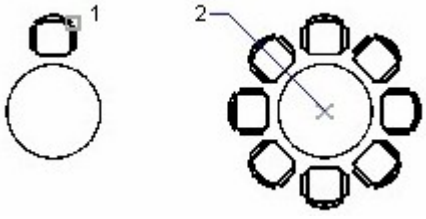
Function: It creates a multiple copies of the selected objects in a rectangular matrix (columns and rows) or a circular/polar pattern.

Types of array:

A **rectangular array** is defined by a number of rows and columns of copies of the selected objects and the distance between rows and columns. The copies of the selected objects are arranged vertically upward and horizontally rightward. If opposite direction is required, the distance of rows and columns must be preceded with a –ve sign.



A **polar array** is defined by specifying a centre point (2) about which the selected object (1) is replicated, number of items and angle to fill. A positive angle value specifies counter-clockwise rotation and a negative value specifies clockwise rotation.



Command Sequence:

Command: **ARRAY**

The **Array** dialogue box is invoked. Select the radio button for rectangular array or polar array.

- **For rectangular array**:

(i) Click the **Select objects** button  and select objects.
(ii) Press **Enter** ↵ to complete the selection.
(iii) Specify the number of row and column in the edit box.
(iv) Specify the row and column offset distance in the edit box.
(v) Specify the angle of array, if necessary.
(vi) Click on the **Preview** button.
(vii) If the display array is acceptable, click the **Accept** button. If not, click **Modify** to edit the array parameters.

- **For polar array:**

(i) Click the **Select objects** button  and select objects.
(ii) Specify the centre point for the array by either entering the x and y co-ordinates into the edit boxes or clicking the **Pick Center Point** button to pick a point from the drawing area.
(iii) Enter a value for the total number of items.
(iv) Specify or accept the value of angle to fill.
(v) Make sure that the **Rotate items as copied** checkbox is checked.
(vi) Click on the **Preview** button.
(vii) If the display array is acceptable, click the **Accept** button. If not, click **Modify** to edit the array parameters.

Move

Function: It moves the selected objects from one location to another. To move objects, specify two points to define a displacement vector that indicates how far the selected objects are to be moved and in what direction.

Command Sequence:

Command: **MOVE**
Select objects: **(pick object to move)**
Select objects: ↵ **(to end selection)**
Specify base point or displacement: **(pick a point)**
Specify second point of displacement or <use first point as displacement>: **(pick a point)**

Rotate

Function: It rotates objects about a base point. Two methods of rotation are available:

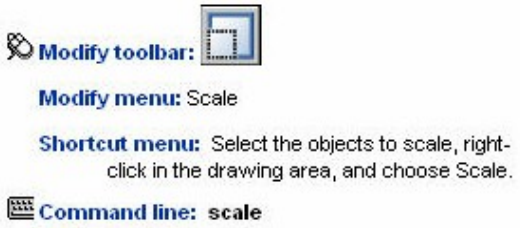
1. Entering an angle of rotation (anti-clockwise by default) from the current position of the selected objects
2. Specifying a reference (angle or points)

Command Sequence:

Command: **ROTATE**
Current positive angle in UCS: ANGDIR=counterclockwise ANGBASE=0
Select objects: **(pick object to rotate)**
Select objects: ↵ **(to end selection)**
Specify base point: **(pick base point)**
Specify rotation angle or [Reference]: **(pick second point or enter an angle)**

Tips: By default, AutoCAD angles start at 3 o'clock and increase in an anti-clockwise direction.

Scale



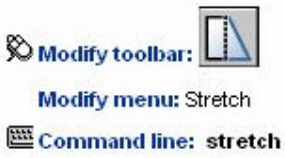
Function: It enlarges or reduces selected objects equally in the X, Y, and Z-axes. To scale objects, specify a base point and a scale factor after selecting the objects. A scale factor greater than 1 enlarges the objects, while a scale factor between 0 and 1 shrinks the objects.

Command Sequence:

Command: **SCALE**
Select objects: **(pick objects to be scaled)**
Select objects: ↵ **(to end selection)**
Specify base point: **(pick base point)**
Specify scale factor or [Reference]: **(pick second point or enter scale factor)**

Tips: To scale an object precisely, it is much easier to enter a scale factor.

Stretch



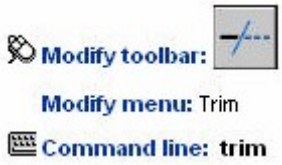
Function: It moves or stretches one or more vertices of an object whilst leaving the rest of the object unchanged. When selecting objects, use **crossing window selection** only. If the object is entirely within the window, the object is moved according to the points of displacement. Keep the unchanged part of the object outside the window.

Command Sequence:

Command: **STRETCH**
Select objects to stretch by crossing window or crossing-polygon….
Select objects: **(pick first point of crossing window)**
Specify opposite corner: **(pick second point of window)**
Select object: ↵ **(to end selection)**
Specify base point or displacement: **(pick base point)**
Specify second point of displacement or <use first point as displacement>: **(pick a second point)**

Tips: To stretch an object using grips is easier. Simply select the object by clicking on it and the object becomes highlighted with small square grips at each vertex and various snap points. Click a grip to activate it and click again to reposition it. Press **<Esc>** to deselect the object and release grips.

Trim



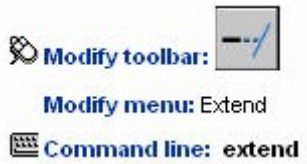
Function: It cuts an object at an edge defined by other object(s). To trim an object, specify a cutting edge before selecting the desired cut object.

Command Sequence:

Command: **TRIM**
Current settings: Projection=UCS, Edge=None
Select cutting edges ...
Select objects: **(select the cutting edge)**
Select object: ↵ **(to end cutting edge selection)**
Select object to trim or shift-select to extend or [Project/Edge/Undo]: **(pick the part of the object to trim)**
Select object to trim or shift-select to extend or [Project/Edge/Undo]: ↵ **(to end)**

Tips: At each trimming step there is option to undo the previous trim.

Extend



Function: It extends an object to meet another object precisely. To extend an object, specify boundary edge(s), the edge extension mode if necessary, before selecting the desired object.

Command Sequence:

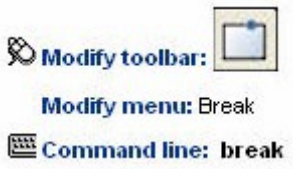
Command: **EXTEND**
Current settings: Projection=UCS, Edge=None
Select boundary edges ...
Select objects: **(select the boundary edge)**
Select objects: ↵ **(to end boundary edge selection)**

Select object to extend or shift-select to trim or [Project/Edge/Undo]: **(pick the object to extend)**
Select object to extend or shift-select to trim or [Project/Edge/Undo]: ↵ **(to end)**

Tips: If a message "**Object does not intersect an edge**", it means that either the wrong end of the object is picked or the object will not meet the boundary edge. The solution is either to pick the right end of the object or change the edgemode to "**Extend**" when prompted to select object to extend, i.e. when prompted to select object to extend:

Select object to extend or shift-select to trim or [Project/Edge/Undo]: **(enter E for the Edge option)**
Enter an implied edge extension mode [Extend/No extend] <No extend>: **(enter E to set Edgemode to Extend)**
Select object to extend or shift-select to trim or [Project/Edge/Undo]: **(pick the object to extend)**
Select object to extend or shift-select to trim or [Project/Edge/Undo]: ↵ **(to end)**

Break at Point



Function: It breaks an object at a point.

Command Sequence:

Command: **BREAK**
Select object: **(select the object)**
Specify second break point or [First point]: f
Specify first break point: **(select the break point)**
Specify second break point: @

Tips: The command breaks an object into two without removing any part of it.

Break

Function: It removes part of an object or splits an object into two, i.e. it erases portion of the object between two points. If splitting an object into two without erasing a portion of it, specify the same point for the first and second points or using **Break at Point**.

Command Sequence:

Command: **BREAK**
Select object: **(select the object using the first point)**
Specify second break point or [First point]: **(pick the second break point)**

Tips: By default, AutoCAD assumes that the point used to select the object is the first break point. As an alternative, the object can be selected first and then specify the two break points.

Command: **BREAK**
Select object: **(select the object)**
Specify second break point or [First point]: **(enter F to specify the First point option)**
Specify first break point: **(pick the first break point)**
Specify second break point: **(pick the second break point)**

Chamfer

Function: It creates a chamfer between any two non-parallel lines or any two adjacent polyline segments. Usually the chamfer command is used to set the chamfer distances before drawing the chamfer. There are a number of options which can be used to control the way the chamfer command behaves: polyline, distance, angle, trim and method.

Command Sequence:

Command: **CHAMFER**
(TRIM mode) Current chamfer Dist1 = 10.0000, Dist2 = 10.0000
Select first line or [Polyline/Distance/Angle/Trim/Method/mUltiple]: **(enter D to specify the Distance option)**
Specify first chamfer distance <10.0000>: **(enter required distance)**
Specify second chamfer distance <10.0000>: (↵ **specifying the first distance value or enter a different value)**
Select first line or [Polyline/Distance/Angle/Trim/Method/mUltiple]: **(pick an object)**
Select second line: **(pick the other object)**

Tips: The other options of the **chamfer** commands are used as follows:

- The **Polyline** option can be used to chamfer all vertexes of a polyline simultaneously.
- The **Angle** option allows the angle between the first line and the chamfer to be specified.
- The **Trim** option controls whether the original lines are trimmed to the chamfer or remain as they are.
- The **Method** option toggles the command between Distance and Angle mode.
- The **Multiple** option bevels the edges of more than one set of objects.

Fillet

Function: It connects two objects with a smoothly fitted arc of a specified radius. To fillet objects, specify the radius and change the trimmode if necessary before selecting the objects.

Command Sequence:

Command: **FILLET**
Current settings: Mode = TRIM, Radius = 10.0000
Select first object or [Polyline/Radius/Trim/mUltiple]: **(enter r to specify radius)**
Specify fillet radius <10.0000>: **(enter the radius value)**
Select first object or [Polyline/Radius/Trim/mUltiple]: **(pick the first object)**
Select second object: **(pick the second object)**

Tips: Make sure that the radius specified will fit the selected objects, otherwise the **fillet** command will not work. The other options of the **fillet** commands are used as follows:

- The **Polyline** option allows all vertices of a polyline to be filleted with a single command.
- The **Trim** option controls whether the original lines are trimmed to the fillet or remain as they are.
- The **Multiple** option rounds the edges of more than one set of objects.

Explode

Function: It converts or breaks a compound object (e.g. block, polyline, etc.) into its component objects.

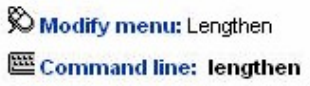
Command Sequence:

Command: **EXPLODE**
Select objects: **(pick an object)**
Select objects: ↵ **(to end)**

Tips: Except polylines, there is no visible effect on using the command. For polylines, the width and tangent information will be discarded.

Other modify command

Lengthen



Function: It changes the length of lines, open polylines, arcs and open splines and the included angle of arcs. To lengthen an object, either specify:

1. an incremental length **(DElta)**
2. a percentage of its total length **(Percent)**
3. the total absolute length **(Total)**
4. drag the object's end point to the desired length **(DYnamic)**

Command Sequence:

Command: **LENGTHEN**

- **DElta option**

  Select an object or [DElta/Percent/Total/DYnamic]: **DE**
  Enter delta length or [Angle] <0.0000>: **(specify the incremental length)**
  Select an object to change or [Undo]: **(select a line or arc)**
  Select an object to change or [Undo]: ↵ **(to end)**

- **Percent option**
  Select an object or [DElta/Percent/Total/DYnamic]: **P**
  Enter percentage length <100.0000>: **(specify the percentage of the original length)**
  Select an object to change or [Undo]: **(select a line or arc)**
  Select an object to change or [Undo]: ↵ **(to end)**
- **Total option**
  Select an object or [DElta/Percent/Total/DYnamic]: **T**
  Specify total length or [Angle] <1.0000>: **(specify the total length)**
  Select an object to change or [Undo]: **(select a line or arc)**
  Select an object to change or [Undo]: ↵ **(to end)**
- **DYnamic option**
  Select an object or [DElta/Percent/Total/DYnamic]: **DY**
  Select an object to change or [Undo]: **(select a line or arc)**
  Specify new end point: **(pick new end point)**
  Select an object to change or [Undo]: ↵ **(to end)**

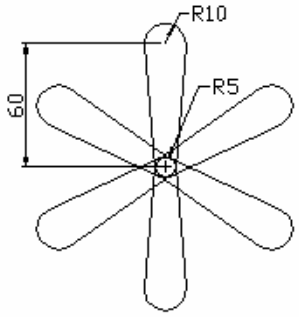
Editing hints

1. For convenience, always dock the modify toolbar on the left-hand side of the drawing window.
2. After selecting a modify tool, always look at the command window for instructions or editing mode (e.g. trimmode, method, etc.) and follow the instructions accordingly.
3. The command window displays 3 lines of text by default. It can be changed by dragging the top of the window frame.
4. For precisely locating a point of an object, always use object snap tools to accurately snapping objects to various parts of other objects.

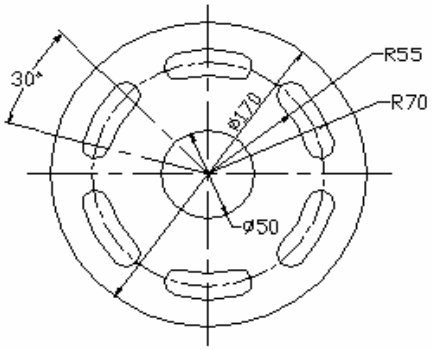
Hands on practice

Use the appropriate draw and modify tools to construct the following figures. Do not include any of the dimensions.

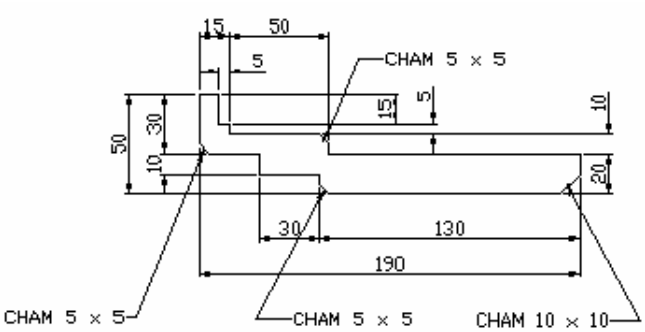
1.



2.



3.


15
50
5
CHAM 5 x 5
15
5
10
50
30
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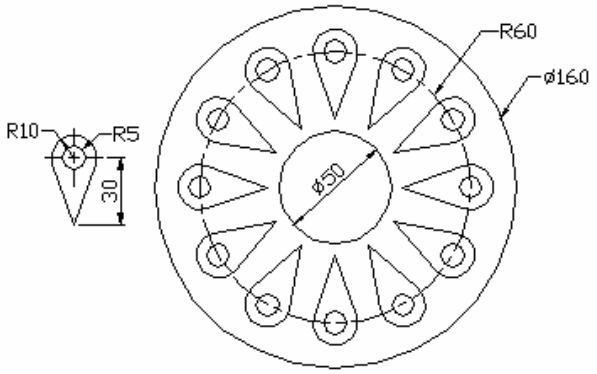
20
30
130
190
CHAM 5 x 5
CHAM 5 x 5
CHAM 10 x 10

4.


R60
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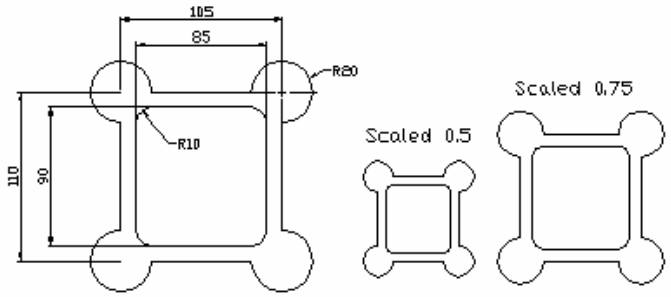
5.


105
85
R20
R10
110
90
Scaled 0.5
Scaled 0.75