AutoCAD ® Self-paced Learning Modules

AutoCAD 2D

Module 15

Offsetting Objects

Learning Outcomes

When you have completed this module, you will be able to:

1. Apply the OFFSET command to insert objects parallel to existing objects.
2. Apply the ID command to establish temporary reference locations.

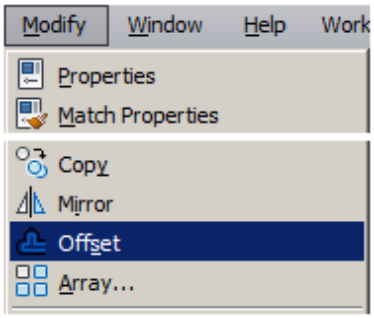
Offsetting

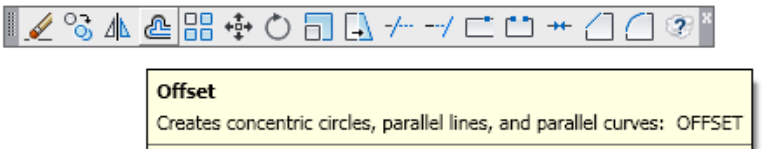
Offsetting is creating an object parallel to an existing object at a specified distance from the original object. This is done using the OFFSET command. It will change the way the user draws as demonstrated in this module. Lines, circles or arcs can be offset plus other drawing objects that will be taught in future AutoCAD 2D Modules.

AutoCAD Command: OFFSET

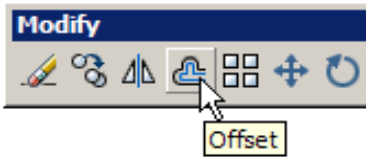
The OFFSET command is used to create an object parallel to an existing object at a specified distance from the original object.

Shortcut: **O**





2009-2010



2007-2008

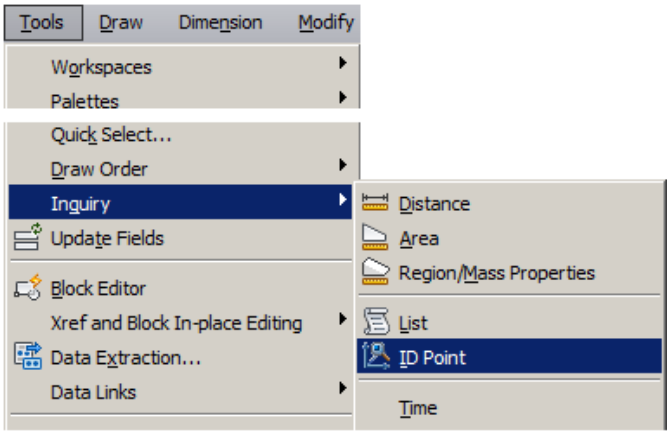
MUST KNOW

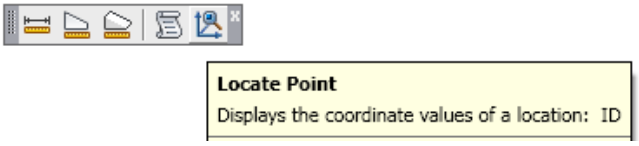
When an object is offset, the newly constructed offset object will reside on the same layer as the original object, regardless of the current layer. If you want the newly created object to be on a different layer than the original, you will have to change it's properties after the offset is completed.

AutoCAD Command: ID

The ID command is used to return the coordinate location for a point on the drawing.

Shortcut: none





2009-2010

2007-2008

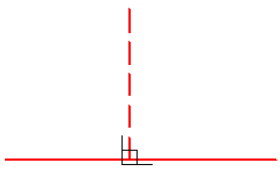
Object Snap Modes - Perpendicular				
Mode	**Abbreviations**	**Icon**	**Marker**	**The AutoCAD Object**
Perpendicular	perp			

Figure 15-1
Object Snap Mode - Perpendicular

MUST KNOW

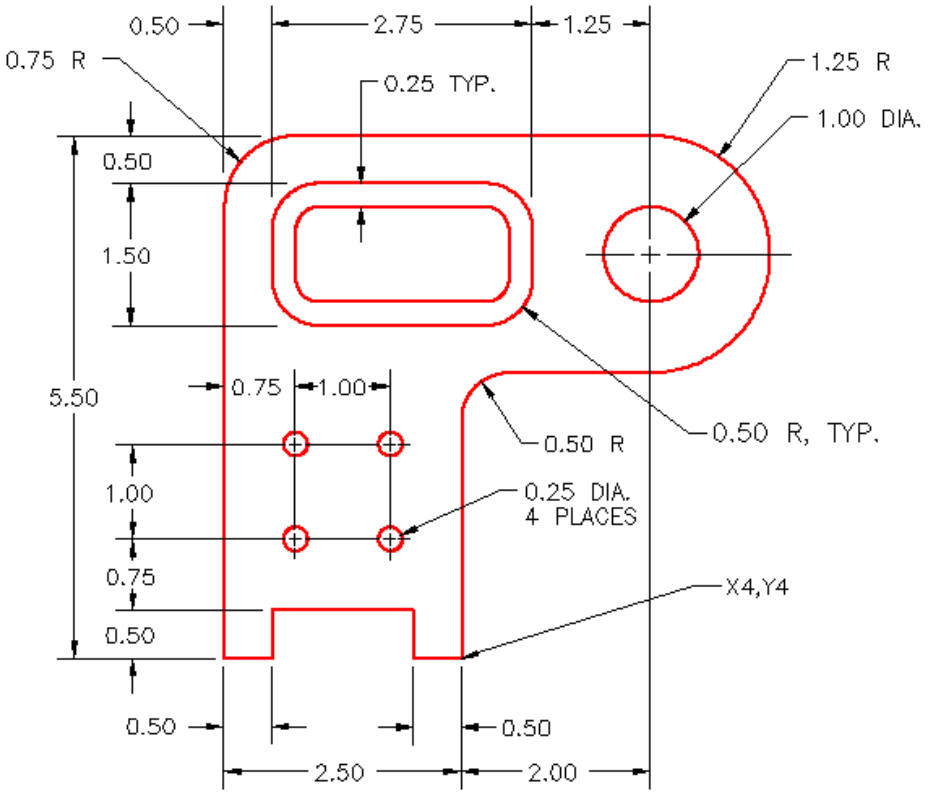
Using the ID command to set a reference point or the lastpoint is a useful drawing tool. Once you pick an ID point, ignore the actual coordinates. On the next command, use the @ to locate a coordinate location from the ID point.

Offsetting Objects

WORK ALONG

Step 1 Start a new drawing using the template 2D English.

Step 2 Save and name the drawing AutoCAD 2D Workalong 15-1.



Dimensioned Drawing

Step 3 Create layers Object and Construction. Set layer Construction as the current layer.

Step 4 Enter the LINE command, as shown below, to create the outline for the object. (Figure Step 4)

Command: **L**
Specify first point: **4,4**
Specify next point or [Undo]: @**-2.5,0**
Specify next point or [Undo]: @**0,5.5**
Specify next point or [Close/Undo]: @**4.5,0**
Specify next point or [Close/Undo]: @**0,-2.5**
Specify next point or [Close/Undo]: @**-2,0**
Specify next point or [Close/Undo]: **C**
Command:

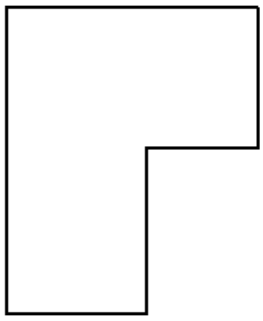


Figure Step 4

Step 5 Enter the commands, as shown below, to draw the circles and fillets. (Figure Step 5A and 5B)

Command: **C**
Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: *(mid)* **P1**
Specify radius of circle or [Diameter] <0.1000>: *(end)* **P2**
(When possible, it is always better to show AutoCAD a distance rather then entering it on the keyboard.)
Command: **C**
Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: *(mid)* **P1**
Specify radius of circle or [Diameter] <0.7500>: **D**
Specify diameter of circle <1.5000>: **1**
Command: **F**
Current settings: Mode = TRIM, Radius = 0.0000
Select first object or [Undo/Polyline/Radius/Trim/Multiple]: **R**
Specify fillet radius <0.0000>: **0.75**
Select first object or [Undo/Polyline/Radius/Trim/Multiple]: **P3**
Select second object or shift-select to apply corner: **P4**
Command: **F**
Current settings: Mode = TRIM, Radius = 0.7500
Select first object or [Undo/Polyline/Radius/Trim/Multiple]: **R**
Specify fillet radius <0.7500>: **.5**
Select first object or [Undo/Polyline/Radius/Trim/Multiple]: **P5**
Select second object or shift-select to apply corner: **P6**
Command:

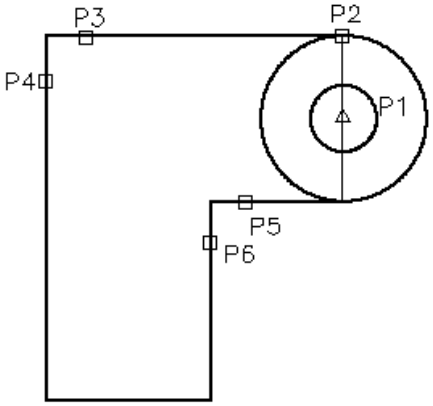


Figure Step 5A

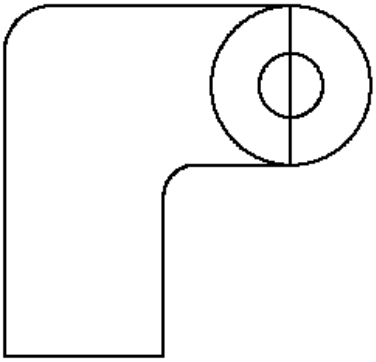


Figure Step 5B

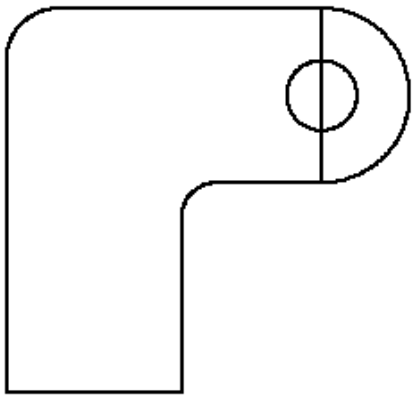


Figure Step 6

Step 6 Use the TRIM command to trim the circle. (Figure Step 6)

Step 7 Enter the OFFSET commands as shown below. (Figure Step 7)

Command: **OFFSET**
Current settings: Erase source=No Layer=Source OFFSETGAPTYPE=0
Specify offset distance or [Through/Erase/Layer] <Through>: **.5**
(Set the offset distance.)
Select object to offset or [Exit/Undo] <Exit>: **P10**
(Select the object to offset.)
Specify point on side to offset or [Exit/Multiple/Undo] <Exit>: **P11**
(Select which side of the object to offset it on.)
Select object to offset or [Exit/Undo] <Exit>: **P12**
Specify point on side to offset or [Exit/Multiple/Undo] <Exit>: **P13**
Select object to offset or [Exit/Undo] <Exit>:
Command: **OFFSET**
Current settings: Erase source=No Layer=Source OFFSETGAPTYPE=0
Specify offset distance or [Through/Erase/Layer] <0.5000>: **1.5**
(Set the offset distance.)
Select object to offset or [Exit/Undo] <Exit>: **P14**
(Select the object to offset.)
Specify point on side to offset or [Exit/Multiple/Undo] <Exit>:**P15**
(Select which side of the object to offset it on.)
Select object to offset or [Exit/Undo] <Exit>:
Command: **OFFSET**
Current settings: Erase source=No Layer=Source OFFSETGAPTYPE=0
Specify offset distance or [Through/Erase/Layer] <1.5000>: **2.75**
Select object to offset or [Exit/Undo] <Exit>: **P16**
Specify point on side to offset or [Exit/Multiple/Undo] <Exit>:**P17**
Select object to offset or [Exit/Undo] <Exit>:
Command:

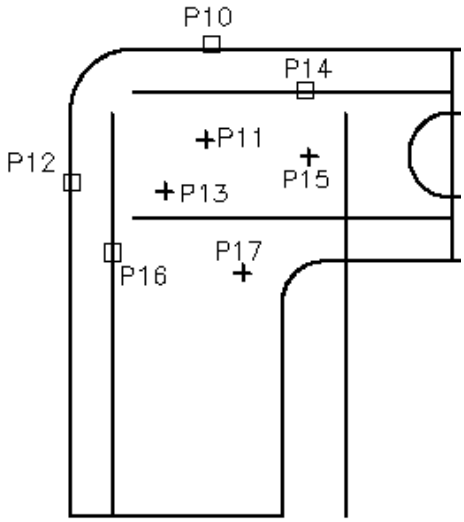


Figure Step 7

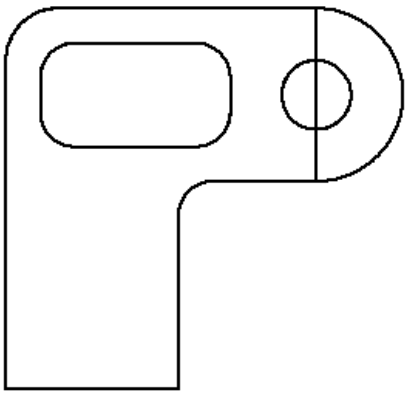


Figure Step 8

Step 8 Using the FILLET command, insert a 0.5 radius fillet on all four corners. (Figure Step 8)

Step 9 Enter the OFFSET command as shown below. (Figure Step 9)

Command: **O**
Current settings: Erase source=No Layer=Source
OFFSETGAPTYPE=0
Specify offset distance or [Through/Erase/Layer] <Through>: **0.5**
Select object to offset or [Exit/Undo] <Exit>: **P26**
Specify point on side to offset or [Exit/Multiple/Undo] <Exit>: **P27**
Select object to offset or [Exit/Undo] <Exit>: **P28**
Specify point on side to offset or [Exit/Multiple/Undo] <Exit>: **P29**
Select object to offset or [Exit/Undo] <Exit>: **P30**
Specify point on side to offset or [Exit/Multiple/Undo] <Exit>: **P31**
Select object to offset or [Exit/Undo] <Exit>:
Command:

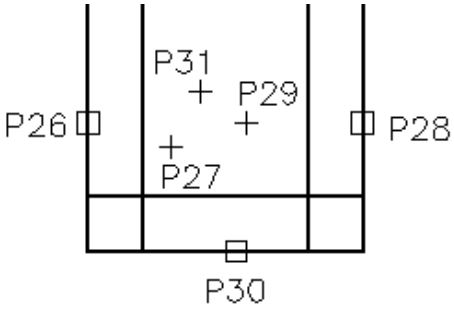


Figure Step 9

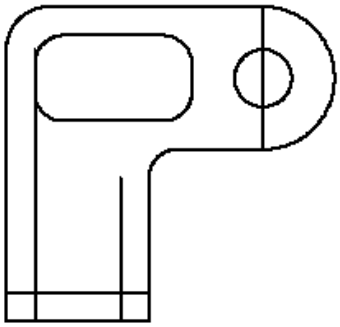


Figure Step 10A

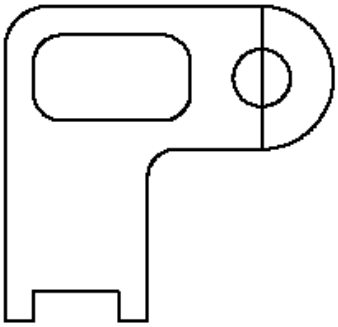


Figure Step 10B

Step 10 Using what you already learned, trim the lines to finish the bottom cutout. (Figure Step 10A and 10B)

Step 11 Enter the OFFSET command, as shown below, to offset the inside feature. (Figure Step 11A and 11B)

Command: **O**
Current settings: Erase source=No Layer=Source
OFFSETGAPTYPE=0
Specify offset distance or [Through/Erase/Layer] <Through>: **0.25**
Select object to offset or [Exit/Undo] <Exit>: **P32**
Specify point on side to offset or [Exit/Multiple/Undo] <Exit>: **P33**
Select object to offset or [Exit/Undo] <Exit>: **P34**
Specify point on side to offset or [Exit/Multiple/Undo] <Exit>: **P33**
Select object to offset or [Exit/Undo] <Exit>: **P35**
Specify point on side to offset or [Exit/Multiple/Undo] <Exit>: **P33**
Select object to offset or [Exit/Undo] <Exit>: **P36**
Specify point on side to offset or [Exit/Multiple/Undo] <Exit>: **P33**
Select object to offset or [Exit/Undo] <Exit>: **P37**
Specify point on side to offset or [Exit/Multiple/Undo] <Exit>: **P33**
Select object to offset or [Exit/Undo] <Exit>: **P38**
Specify point on side to offset or [Exit/Multiple/Undo] <Exit>: **P33**
Select object to offset or [Exit/Undo] <Exit>: **P39**
Specify point on side to offset or [Exit/Multiple/Undo] <Exit>: **P33**
Select object to offset or [Exit/Undo] <Exit>: **P40**
Specify point on side to offset or [Exit/Multiple/Undo] <Exit>: **P33**
Select object to offset or [Exit/Undo] <Exit>:

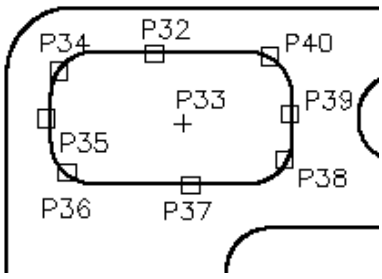


Figure Step 11A

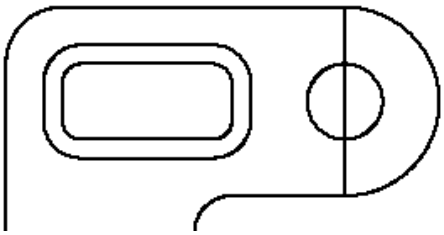


Figure Step 11B

Step 12 Use the ID command to establish a lastpoint. Enter the CIRCLE command immediately following to insert the four circles using the lastpoint as a reference. (Figure Step 12)

Command: **ID**
Specify point: *(end)* **P41**
X = 1.5000 Y = 4.000 Z = 0.0000
(The ID command establishes a known reference point or an @ or lastpoint.)
Command: **C**
CIRCLE Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: **@0.75,1.25**
(Now the @ can be used to measure the center of the circle from the end of the selected line.)
Specify radius of circle or [Diameter]: **D**
Specify diameter of circle: **0.25**
Command: **C**
CIRCLE Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: **@1,0**
Specify radius of circle or [Diameter] <0.1250>:
(Accept the default.)
Command: **C**
CIRCLE Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: **@0,1**
Specify radius of circle or [Diameter] <0.1250>:
Command: **C**
CIRCLE Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: **@-1,0**
Specify radius of circle or [Diameter] <0.1250>:
Command:

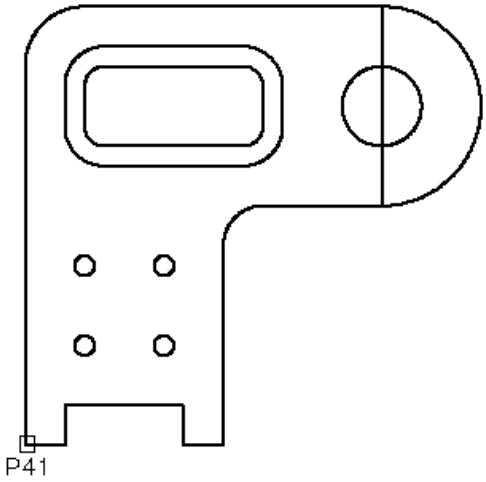


Figure Step 12

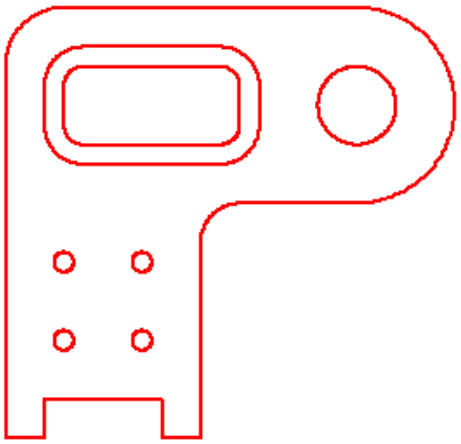


Figure Step 14

Step 13 Change the layer of the objects that you want to reside on layer Object.

Step 14 Freeze layer Construction and your drawing should appear as shown in the figure. (Figure Step 14)

Step 15 Save and close the drawing.

USER TIP

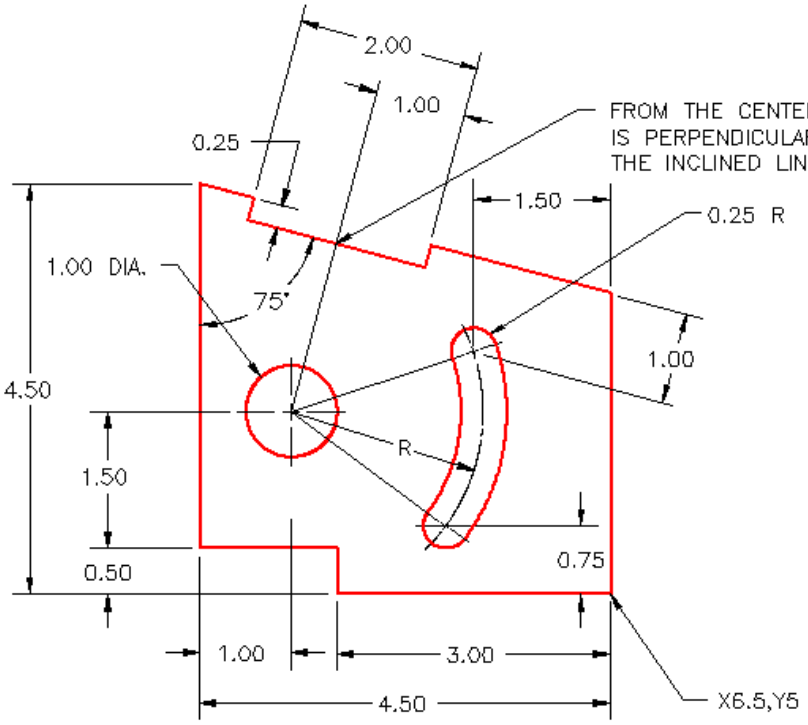
It is faster to draw circles then it is to draw arcs. To improve your drawing speed, draw a circle instead of an arc when an arc is required and then trim the circle to complete the required arc.

WORK ALONG

Drawing Construction Techniques

Step 1 Start a new drawing using the template 2D English.

Step 2 Save and name the drawing AutoCAD 2D Workalong 15-2.



Dimensioned Drawing

Step 3 Create the layers Object and Construction. Set layer Construction as the current layer.

Step 4 Using the dimensioned drawing as an reference, draw lines to construct the perimeter of the object. (Figure Step 4)

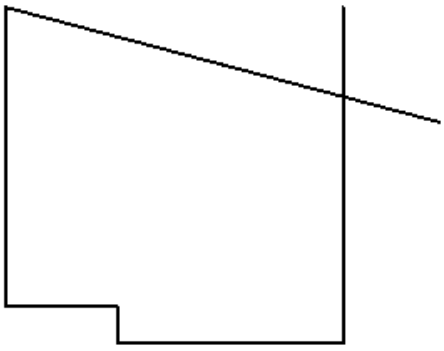


Figure Step 4

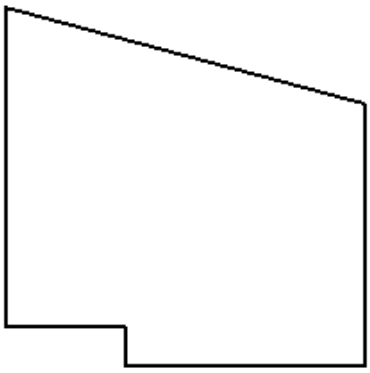


Figure Step 5

Step 5 Using what you already learned, trim the lines to finish the outline. (Figure Step 5)

Step 6 Enter the ID command, as shown below, to establish a lastpoint. Draw the circle using the reference point you established with the ID command. (Figure Step 6)

Command: **ID**
Specify point: *(end)* **P1**
X = 2.0000 Y = 5.5000 Z = 0.0000
(The lastpoint or the @ being established.)
Command: **C**
Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: **@1,1.5**
(The center of the circle is now located using the reference point established in the ID command above. These commands must be entered back to back.)
Specify radius of circle or [Diameter] <2.6770>: **D**
Specify diameter of circle <5.3539>: **1**
Command:

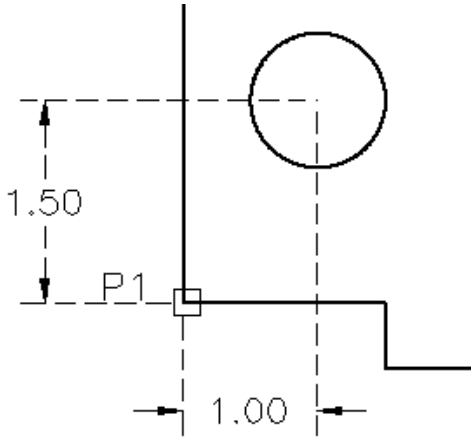


Figure Step 6

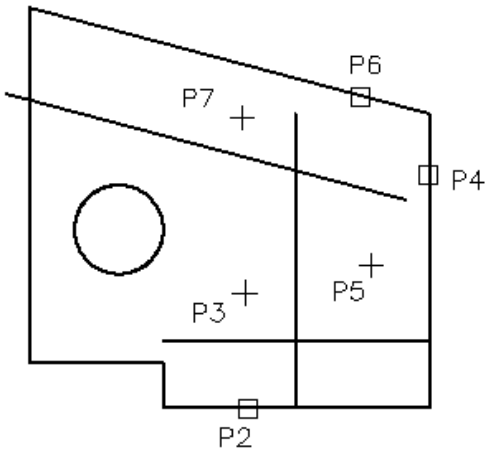


Figure Step 7

Step 7 Enter the OFFSET command, as shown below, to insert the inside offsets. (Figure Step 7)

Command: **O**
(Shortcut for the OFFSET command)
Current settings: Erase source=No Layer=Source
OFFSETGAPTYPE=0
Specify offset distance or [Through/Erase/Layer] <0.00>: **0.75**
(Setting the offset distance.)
Select object to offset or [Exit/Undo] <Exit>: **P2**
Specify point on side to offset or [Exit/Multiple/Undo] <Exit>: **P3**
(First the object is selected (P2) and then the side of the object (P3) to place the offset. The location for P3 can be anywhere as long as it is above the line to be offset.)
Select object to offset or [Exit/Undo] <Exit>:
(With what you already learned, finish the other two offsets as shown in Figure Step 7.)
Command:

Step 8 Enter the CIRCLE command, as shown below, to insert a circle by snapping its center to the intersection of the offset lines. (Figure Step 8)

Command: **C**
Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: *(int)* **P8**
(Snap to locate the center of the circle at the intersection of the two offset lines.)
Specify radius of circle or [Diameter] <0.5000>: **.25**
Command:

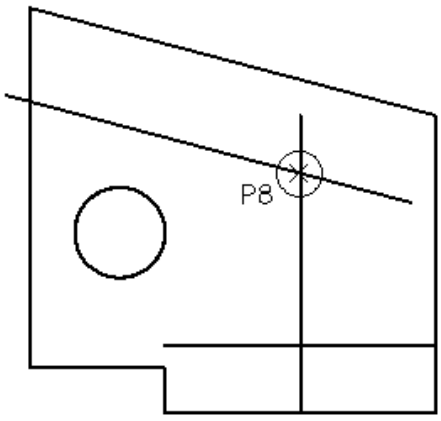


Figure Step 8

Step 9 Draw a line between the centers of the circles. (Figure Step 9)

Command: **L**
Specify first point: *(cen)* **P9**
Specify next point or [Undo]: *(cen)* **P10**
(Draw a construction line by snapping to center point of the circles.)
Specify next point or [Undo]:
Command:

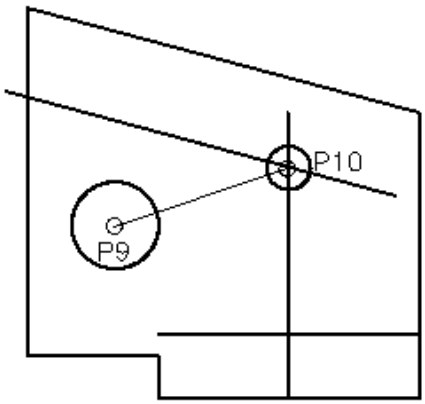


Figure Step 9

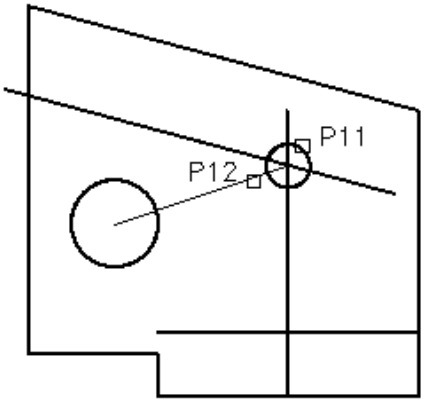


Figure Step 10A

Step 10 Extend the construction line to the circle`s circumference. (Figure Step 10A and 10B)

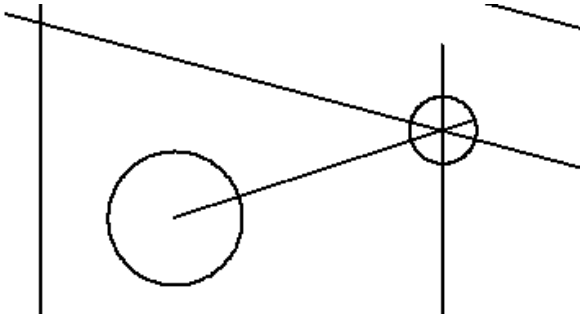


Figure Step 10B

Command: **EX**
Current settings: Projection=UCS, Edge=Extend
Select boundary edges ...
Select objects or <select all>: **P11** 1 found
Select objects:
(Press enter or space.)
Select object to extend or shift-select to trim or [Fence/Crossing/Project/Edge/Undo]: **P12**
Select object to extend or shift-select to trim or [Fence/Crossing/Project/Edge/Undo]:
Command:

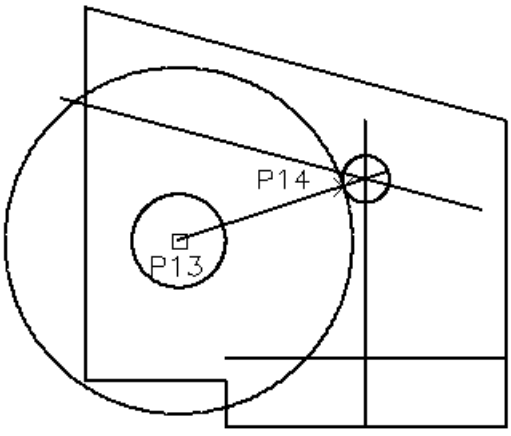


Figure Step 11

Author's Comments: The construction line was drawn from center to center and then extended to the circumference of the circle to locate the tangent point for the arc to be inserted next. A line between centers is the closest distance between circles and also locates the tangent point of the arcs.

Step 11 Draw a circle snapping to the center of the large circle for its center location and snapping to the intersection of the construction line and the lower circumference of the small circle for the radius. (Figure Step 11)

Command: **C**
Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: *(end)* **P13**
Specify radius of circle or [Diameter]: *(int)* **P14**
Command:

Step 12 Using the same principle that you learned in Step 11, insert the other two circles. Make sure that you snap one circle to the center of the small circle and the other to the intersection of the tangent line and circle circumference. (Figure Step 12A and 12B)

Author's Comments: In Step 11 and 12 you are showing AutoCAD the radius of the circles by snapping to the intersection of the construction line and circle. Whenever you can, always show AutoCAD and distance rather then typing it on the keyboard.

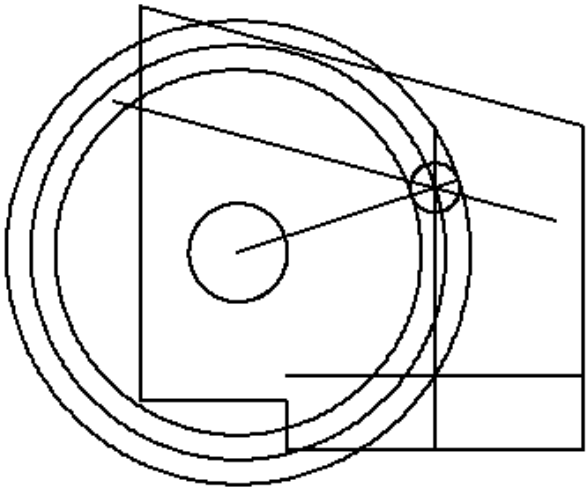


Figure Step 12A

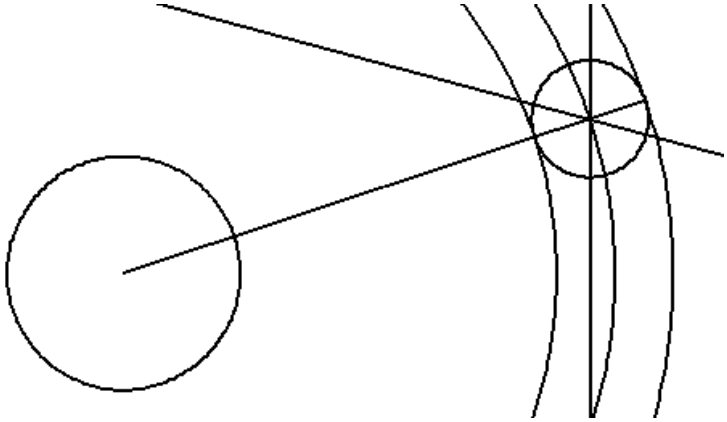


Figure Step 12B

Author's Comments: Circles were used rather then arcs because it is easier to draw circles than arcs. Once the circle is drawn, it can easily be trimmed to complete the arc. This is a much faster drawing technique.

Step 13 Draw a circle locating its center at the intersection of large circle centerline and the horizontal construction line. (Figure Step 13)

Command: **C**
Specify center point for circle or [3P/2P/Ttr (tan tan radius)]:
(int) **P15**
Specify radius of circle or [Diameter]: **.25**
Command:

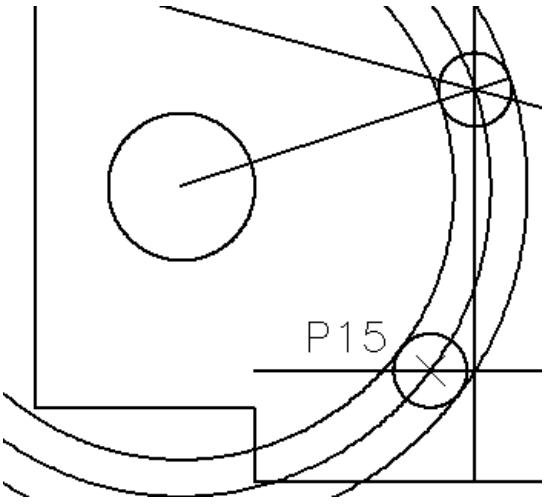


Figure Step 13

Step 14 Using what you already learned, trim the circles to complete the slot. (Figure Step 14)

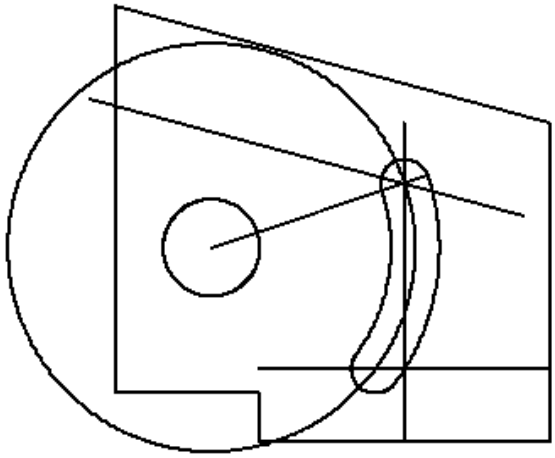


Figure Step 14

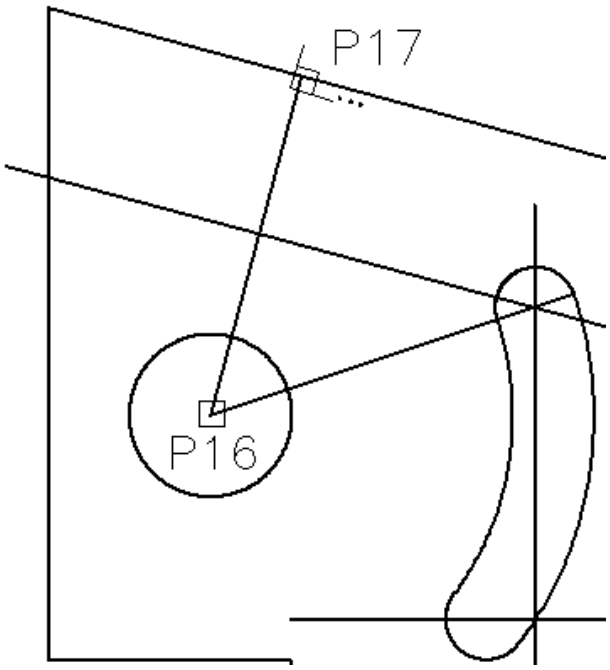


Figure Step 15

Step 15 Enter the LINE command, as shown below, to draw a line from the center of the larger circle and snapping perpendicular to the inclined line. (Figure Step 15)

Command: **L**
Specify first point: (cen) **P16**
Specify next point or [Undo]: **perp** to **P17**
(It is much faster to type in the osnap mode perp then setting it in Autosnap.)
Specify next point or [Undo]:
Command:

Step 16 Using what you already learned, offset the lines to create top feature. (Figure Step 16)

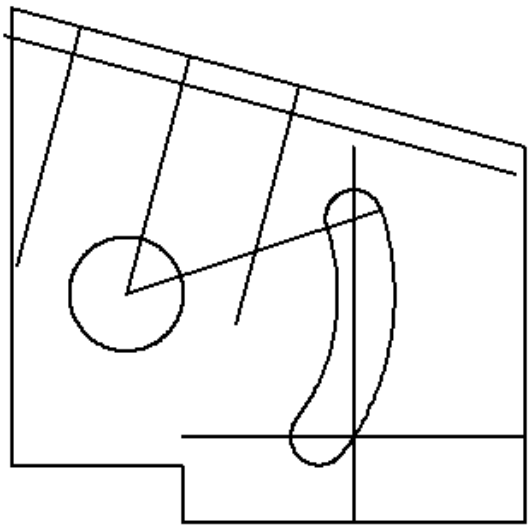


Figure Step 16

Step 17 Trim the lines to complete the top cutout. (Figure Step 17)

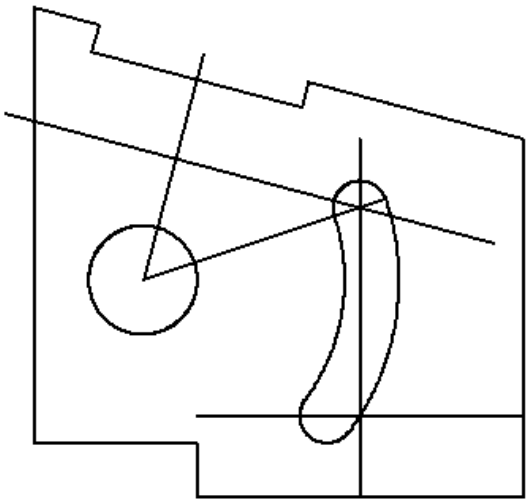


Figure Step 17

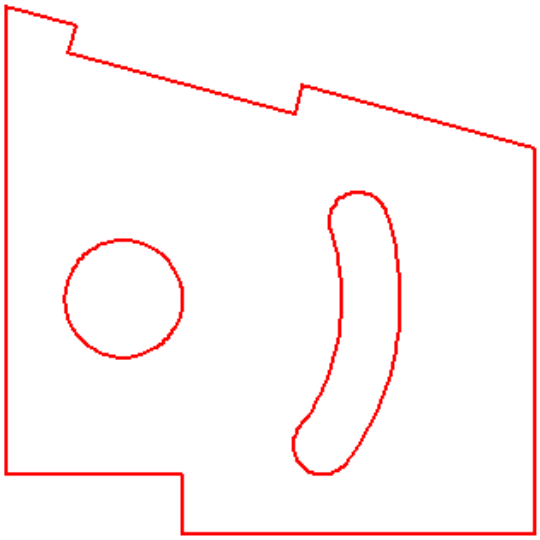


Figure Step 18

Step 18 Change the layer of the objects to layer Object. Freeze layer Construction to complete the drawing. (Figure Step 18)

Step 19 Save and close the drawing.

The Key Principles in Module 15

1. The OFFSET command is an important command. When used at the right times, it will improve the users drawing speed and change the ways they draws.

2. When and object is offset, the newly constructed offset object will reside on the same layer as the original object, regardless of the current layer.

3. The ID command can be used to established a known reference point or an @. The reference point can then be used in the next command to measure from.

Lab Exercise 15-1		**Time Allowed: 40 Min.**
Name	**Template**	**Units**
AutoCAD 2D Lab 15-1	2D English	Inches
Layering Scheme		
Name	**Objects on Layer**	**Color**
Construction	Construction objects	253
Object	All objects	Red

Instructions:

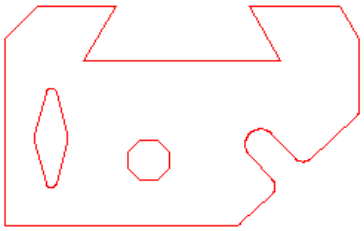
Step 1 Start a new drawing using the template shown above. Draw the object shown in the dimensioned drawing using the layering scheme.

Step 2 Set the insertion units and check your drawing with the key.

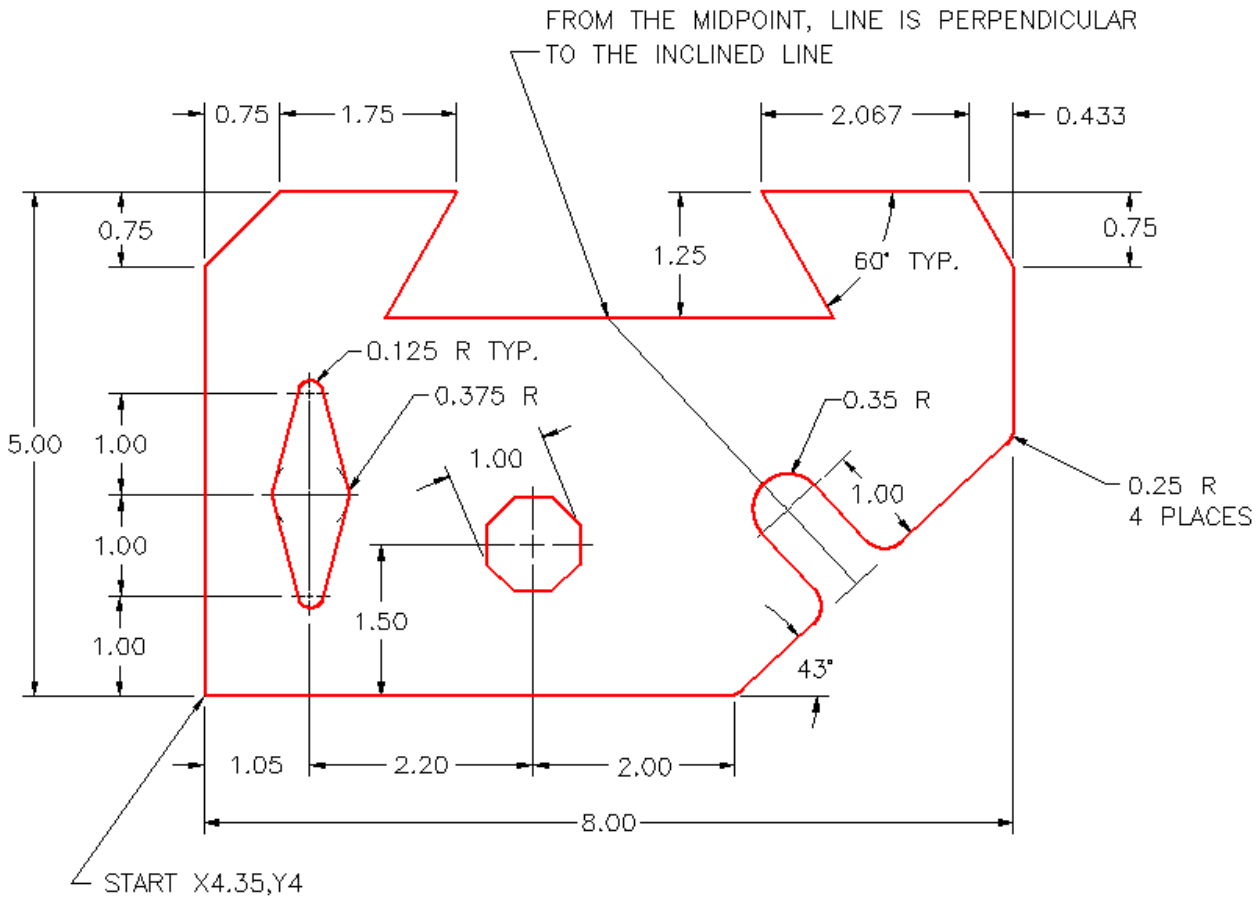
Step 3 Turn layer Key off and freeze layer Construction.

Step 4 Save and close the drawing.

Author's Comments: Do not delete the construction lines.

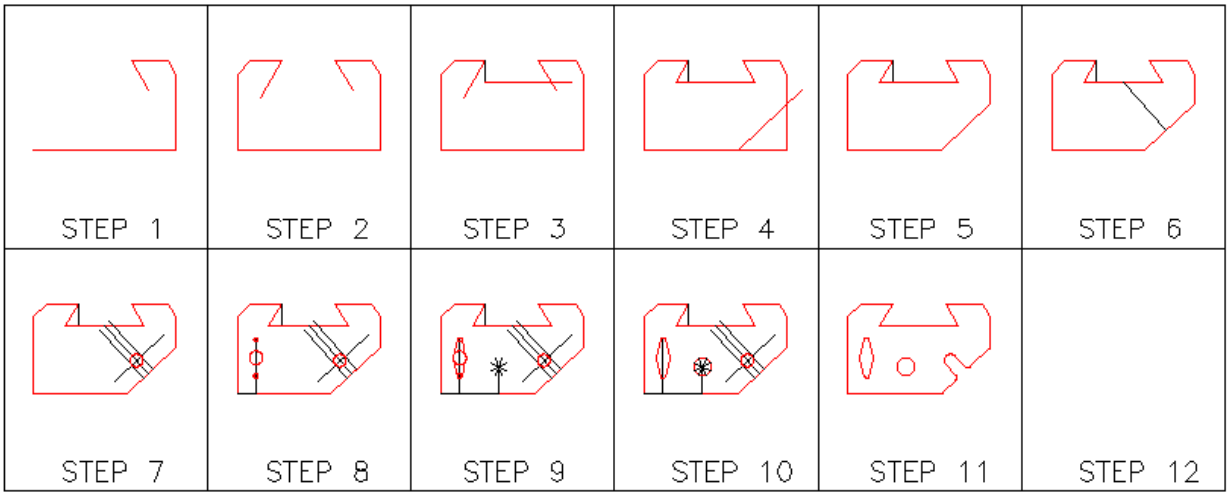


Completed Drawing



Dimensioned Drawing

Author's Construction Techniques: The following steps are the construction technique suggested by the author to help you learn how to construct objects using AutoCAD. It is only the suggested method and if you can complete the drawing accurately using a different construct technique, that is what is important. You may want to compare your construction technique with the authors.



Author's Construction Hints: Do your best to complete the lab exercise drawing without using the following hints. If you get stuck and cannot complete it on your own, use the following hints to help you.

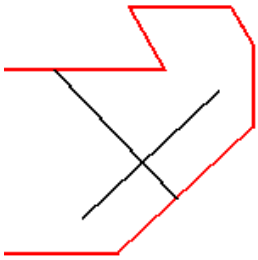


Figure Hint 1A

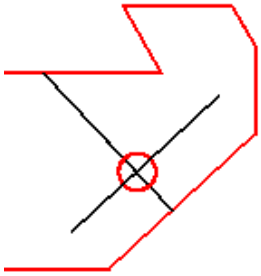


Figure Hint 1B

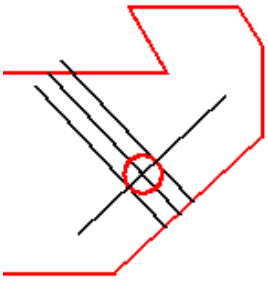


Figure Hint 1C

Hint 1 Draw the line perpendicular to inclined line and then offset the inclined line. Draw a circle with its center located at the intersection of the lines. Offset the perpendicular line using the radius of the circle as the distance and trim. (Figure Hint 1)

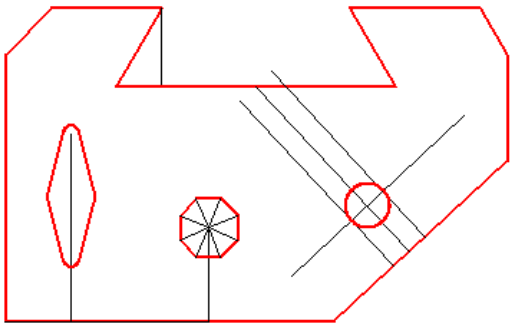


Figure Hint 3

Hint 2 Insert offset lines as construction lines to locate the centers of the three circles. Then draw the lines tangent to the circles. (Figure Hint 2)

Hint 3 The figure shows the construction lines. (Figure Hint 3)

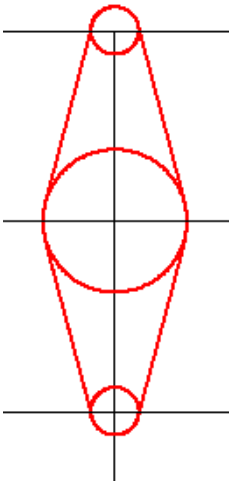


Figure Hint 2

Lab Exercise 15-2		**Time Allowed: 60 Min.**
Name	**Template**	**Units**
AutoCAD 2D Lab 15-2	2D Metric	Millimeters
Layering Scheme		
Name	**Objects on Layer**	**Color**
Construction	Construction objects	253
Object	All objects	Red

Instructions:

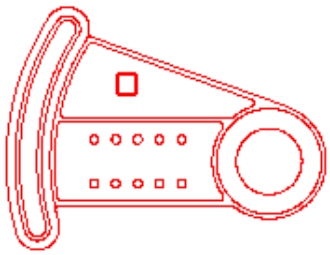
Step 1 Start a new drawing using the template shown above. Draw the object shown in the dimensioned drawing using the layering scheme.

Step 2 Set the insertion units and check your drawing with the key.

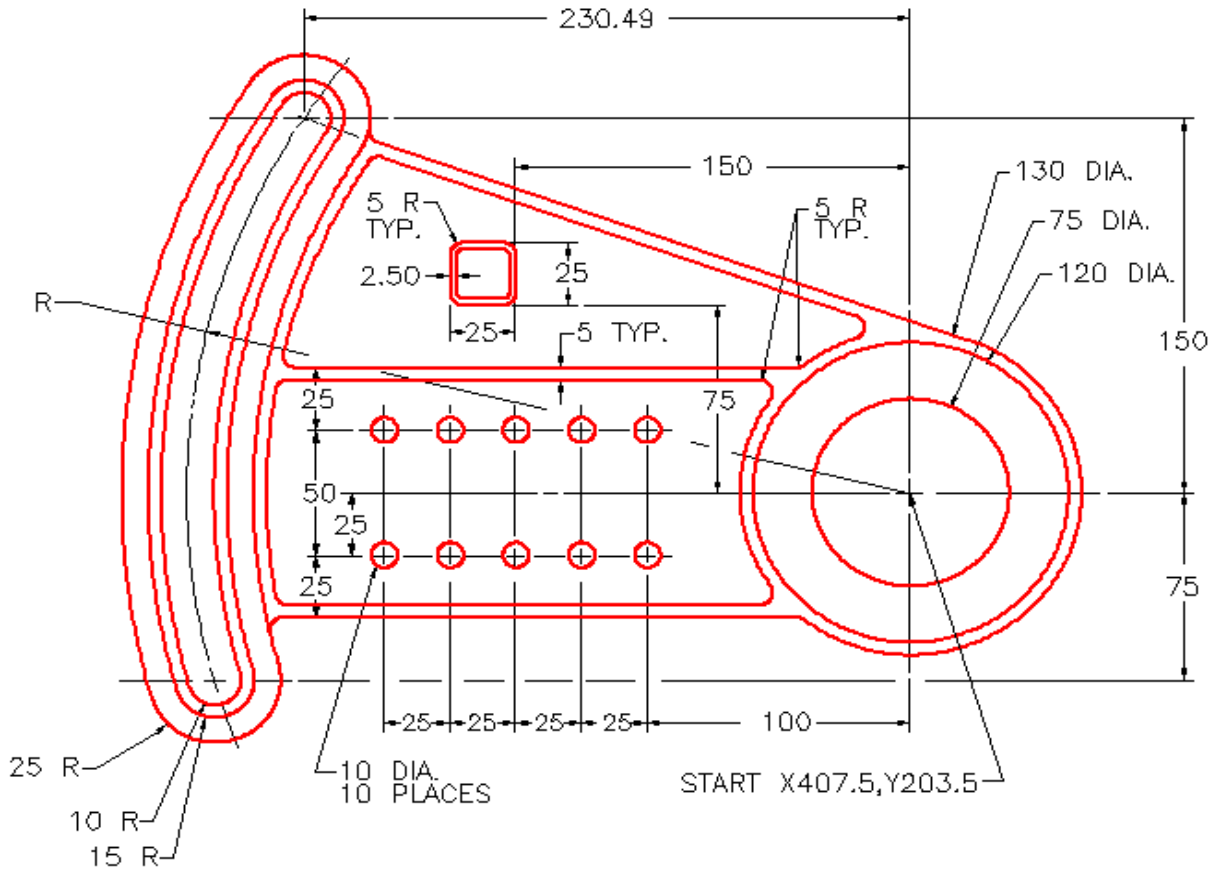
Step 3 Turn layer Key off and freeze layer Construction.

Step 4 Save and close the drawing.

Author's Comments: Do not delete the construction lines.

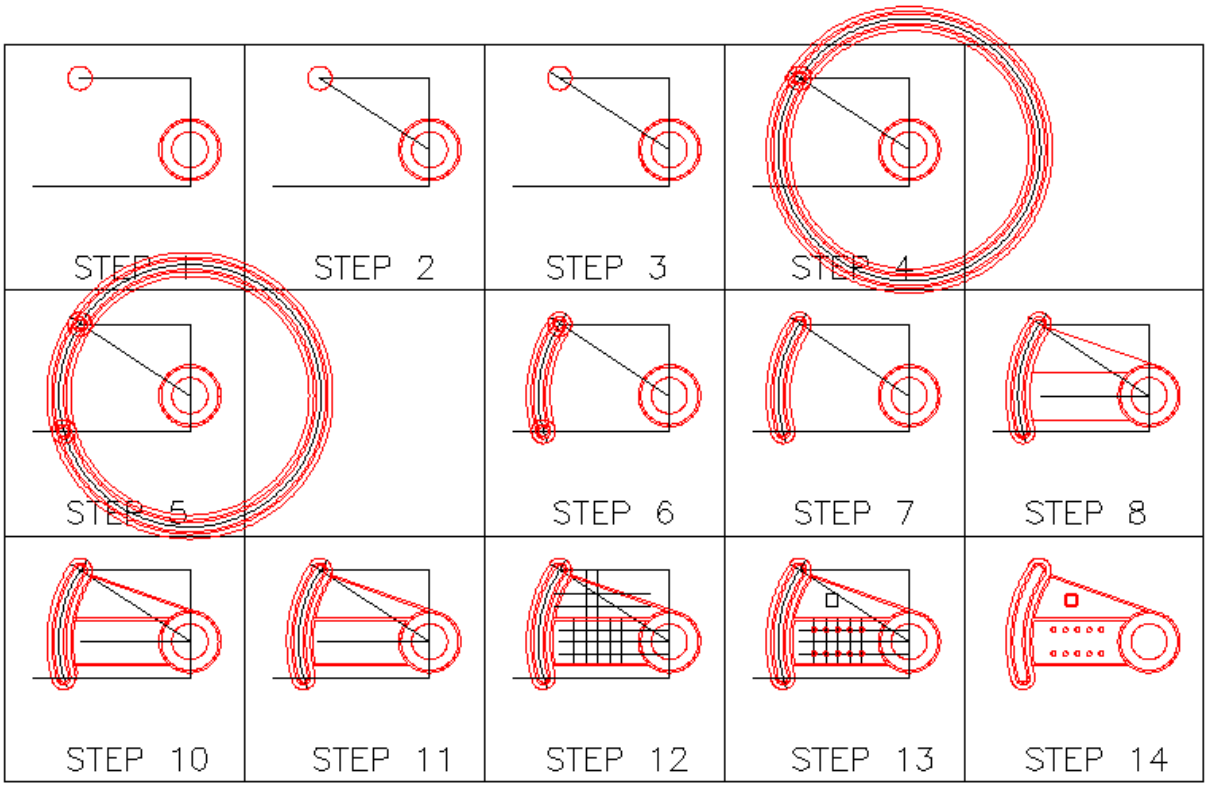


Completed Drawing



Dimensioned Drawing

Author's Construction Techniques: The following steps are the construction technique suggested by the author to help you learn how to construct objects using AutoCAD. It is only the suggested method and if you can complete the drawing accurately using a different construct technique, that is what is important. You may want to compare your construction technique with the authors.



Author's Construction Hints: Do your best to complete the lab exercise drawing without using the following hint. If you get stuck and cannot complete it on your own, use the following hint to help you.

Hint 1 See the figure and the following seven step:

1. Draw a construction line from the center of the bottom circle to the center of the upper circle.
2. Extend the line to the upper circumference of the circle.
3. Draw circles using the intersection of the tangent line and circle to show AutoCAD the radius.
4. Draw the bottom circle at the intersection of the construction circle and line.
5. Trim the circles.
6. Draw the inner circles.
7. Offset the arcs and trim to complete. (Figure Hint 1)

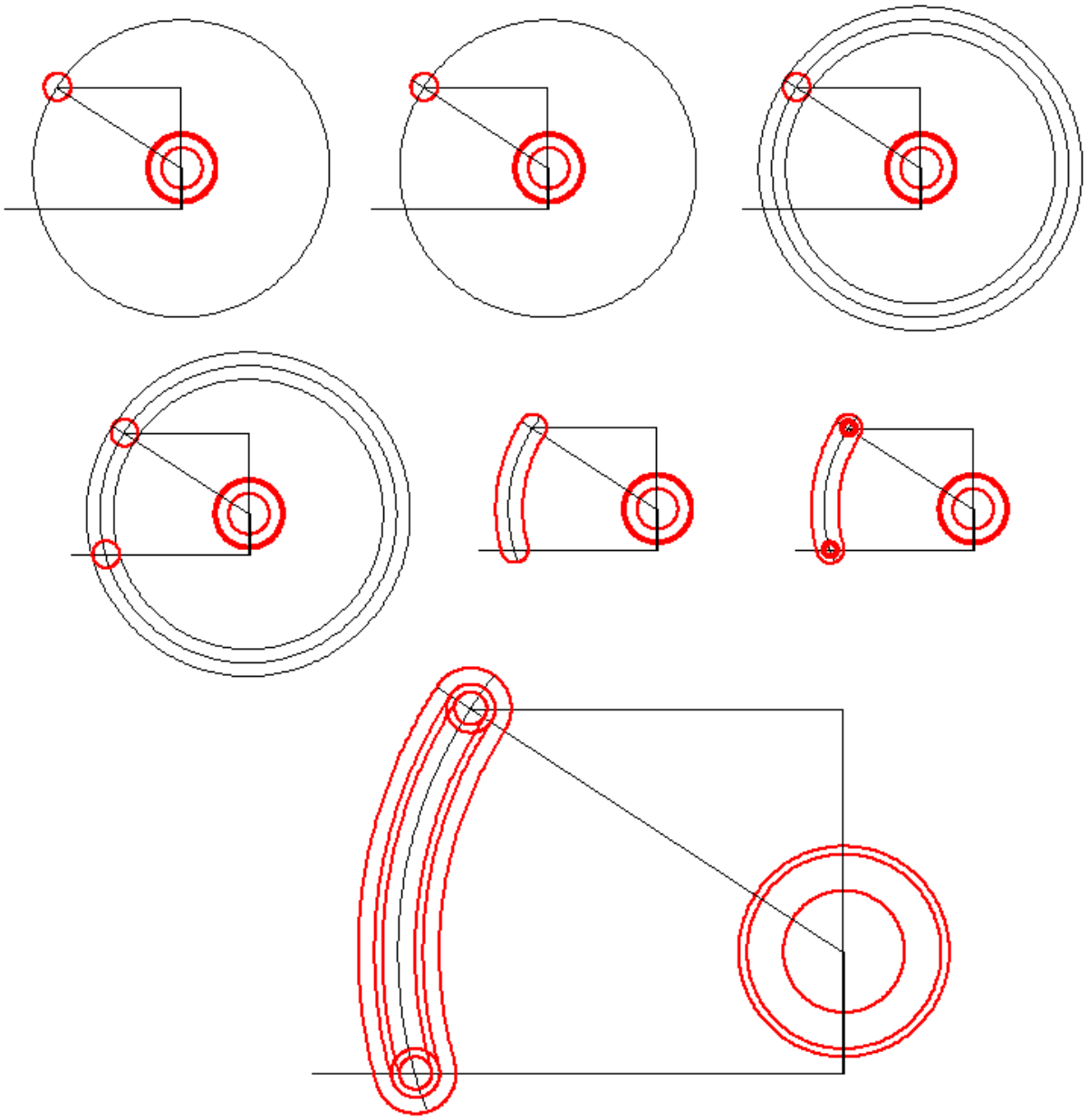


Figure Hint 1