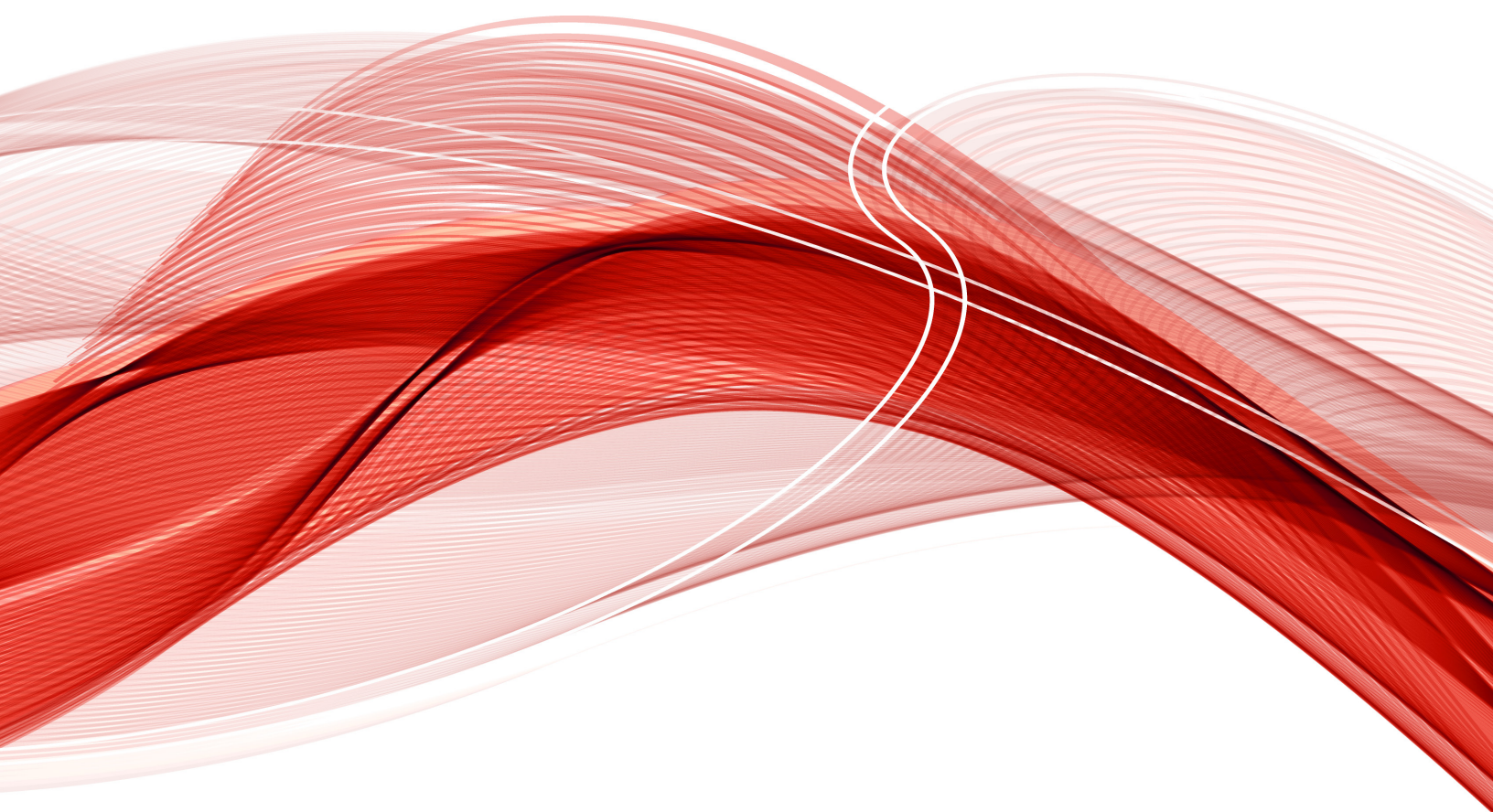William G. Wyatt, Ed.D., CET

Autodesk®

AutoCAD® Certified User Study Guide

AutoCAD® 2019 Edition

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Chapter 2

Drawing Objects

This chapter will review the basics of drawing including coordinate entry methods and creating basic entities with emphasis on Direct Distance Entry, Dynamic Input and Polar Tracking drawing techniques. Following the review material there are two tutorials to help you prepare for the test.

The student will be able to:
1. Draw lines using the following coordinate entry methods: absolute coordinates, relative coordinates, relative polar and direct distance entry
2. Create entities such as lines, arcs, circles, ellipses, rectangles and polygons using dynamic input and polar tracking tools
3. Create polygons using the following methods: Inscribed in circle, Circumscribed about circle and Edge

Coordinate Input Methods

The four methods of inputting locations in AutoCAD are absolute coordinate, relative coordinate, relative polar and direct distance. The most frequent method used on the test is direct distance. All methods reference the Cartesian coordinate system of horizontal axis of X values and the vertical axis of Y values.

Absolute Coordinates

When you enter values for a line using the absolute coordinates you must toggle off dynamic input since dynamic input applies relative polar. In Figure 2.1 the line segment shown started at 0,0 and ended at 2,2.
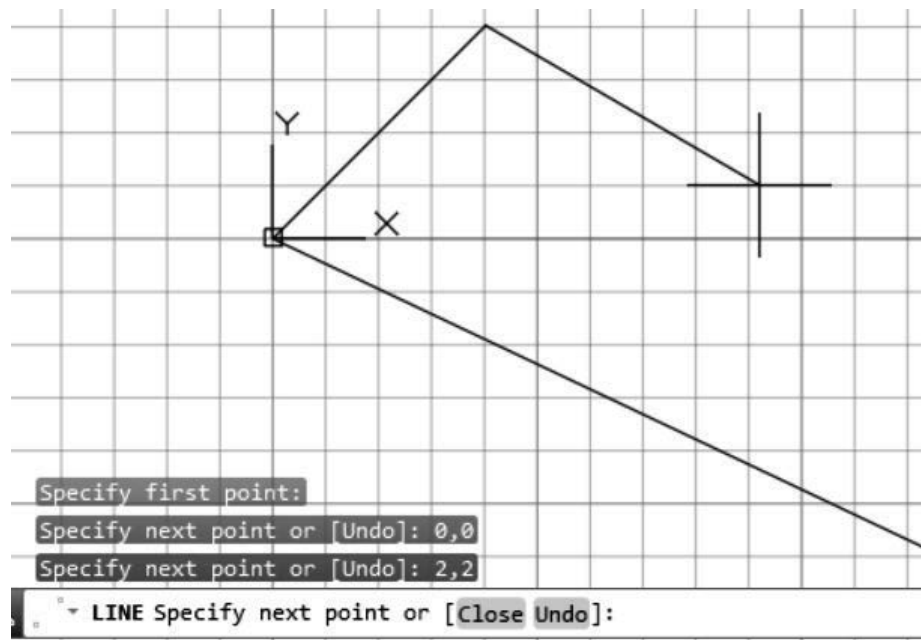

Specify first point:
Specify next point or [Undo]: 0,0
Specify next point or [Undo]: 2,2
- LINE Specify next point or [Close Undo]:

Figure 2.1

Relative Coordinates

When you specify a line using relative coordinates with dynamic input off and type the @ key the relative mode is turned on. In Figure 2-2 the first point of the line was specified at the absolute coordinate of 5,1 and the next point using relative coordinates typing @2,0. If dynamic input is toggled on, the prompts at the crosshairs are for direct distance entry; however, when you type @ and the comma the prompt changes to the relative coordinates.
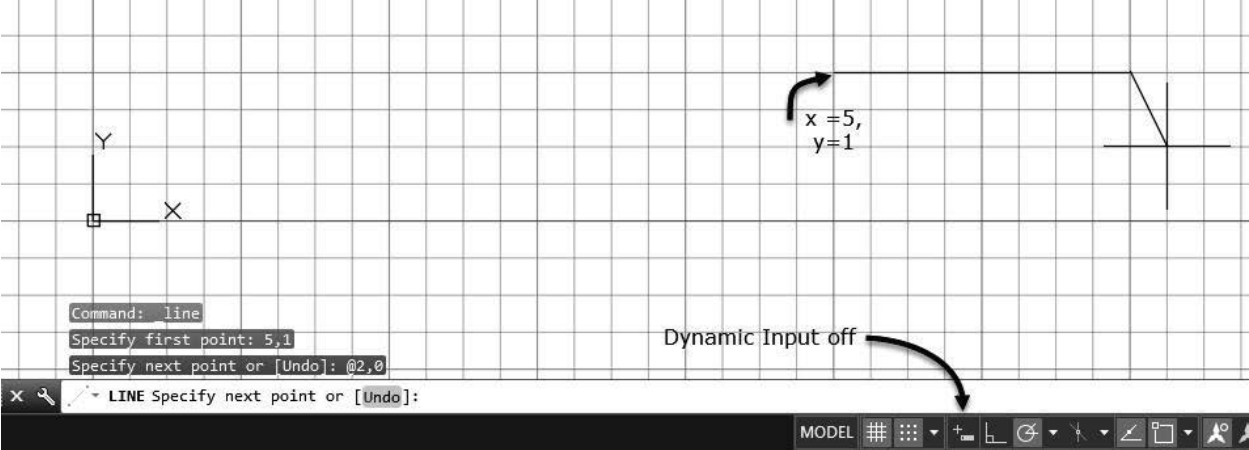
Figure 2.2

Relative Polar Entry

Relative Polar is the default system in place when dynamic input is on; therefore, you type the distance and press tab to type the angle. If dynamic input is off type the @ to toggle relative and enter the distance followed by < angle.

Direct Distance Entry

Direct Distance entry applies relative polar for the distance and you press tab to type the angle or just use the mouse to set the angle. The angle can be controlled by Ortho or Polar Tracking. If you toggle polar tracking on ortho is turned off. The Polar Tracking flyout menu includes preset angles shown in Figure 2-3. Select the Track Setting from the flyout menu to open the Drafing Settings dialog box to the Polar Tracking tab as shown in Figure 2-4.
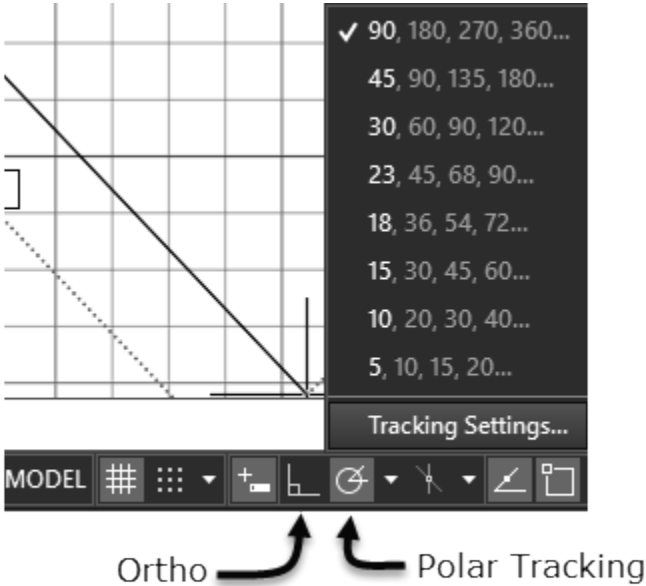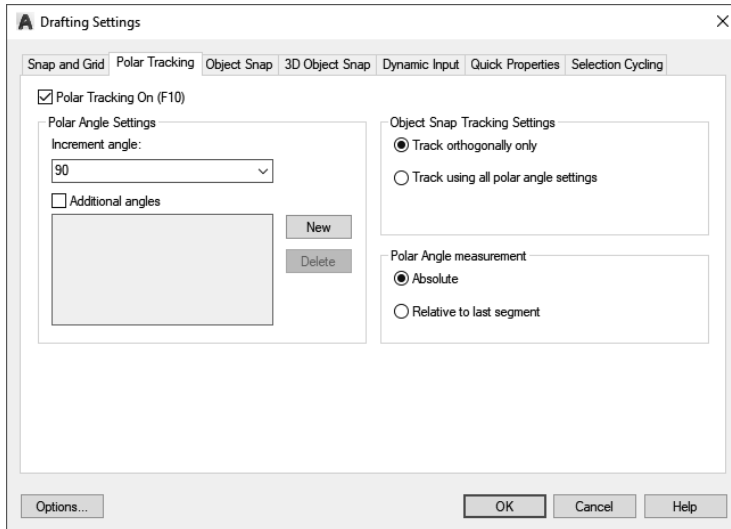

Figure 2.3

Figure 2.4

Drawing Basic Shapes

The basic shapes of the Draw panel in Home tab of the Ribbon include the Line, Circle, Arc, Rectangle, Polygon, and Ellipse commands. The tutorial at the end of the chapter includes an example of each basic shape using the ribbon. The following is a short summary of how to access the command and the workspace prompts.

Line

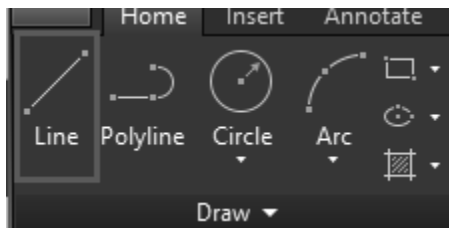Choose the Line command from the Home tab, Draw panel as shown in Figure 2-5.

Figure 2-5

Although you may have used this command, try the following description that uses Dynamic Input. Toggle ON Dynamic Input and Polar Tracking in the status bar to show the workspace prompts at the crosshairs. Respond to the workspace prompts as shown below.

> Command: _line
> Specify first point: (Overtype 1,1 and press Enter in the dynamic input fields as shown at p1 in Figure 2-6. Move the crosshairs to a location near p2.)

Specify next point: (Overtype 2 in the dynamic dimension as shown at p3 in Figure 2-6. Press Tab to move focus to p4. Overtype 0 in the dynamic dimension as shown at p4 in Figure 2-6.)

Specify next point: Press Enter to end the command and view the line as shown at p5 in Figure 2-6.

Note: If you press Enter twice or the Space bar you will repeat the command.

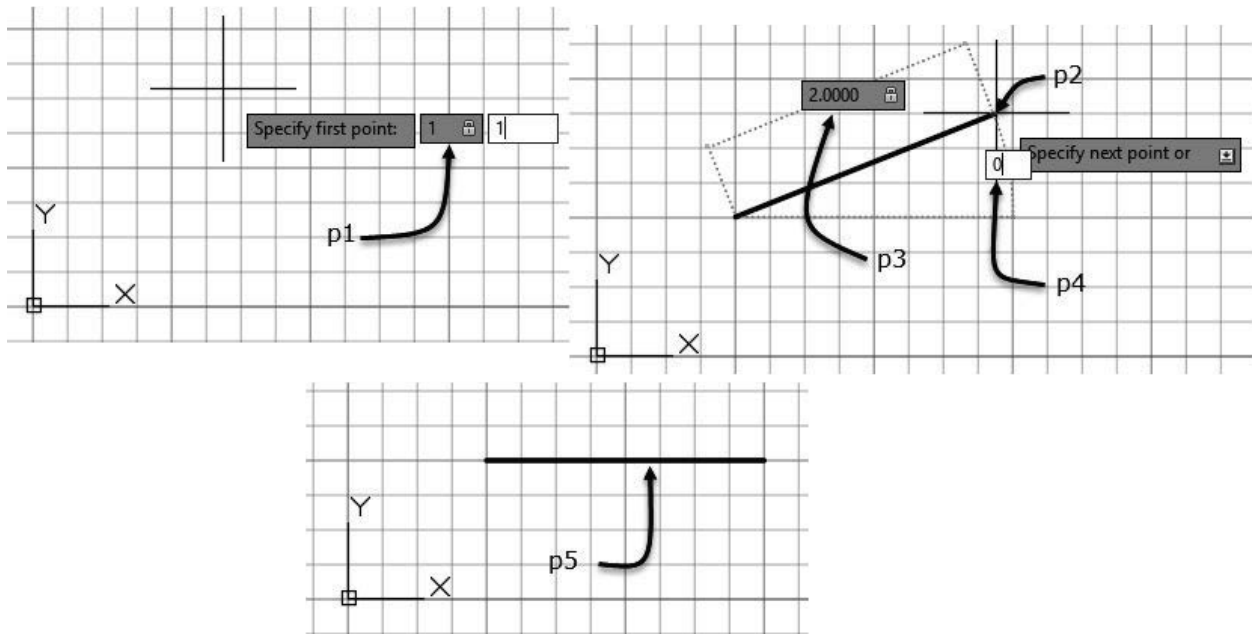Press Enter three times to end the command, repeat the command and lock the crosshairs to the endpoint of the last line segment.

Figure 2-6

Circle

The Circle command is located on the Draw panel in the Home tab as shown in Figure 2-7. If you choose the Circle command you are prompted to specify the Center and the radius to create a circle. If you select an option from the flyout this command option stays on top for the Circle command. The flyout of the Circle command includes options to create a circle through 2 points and three points without specifying a center. Two additional options are available to create a circle using the tan object snap to create the points that define a circle.
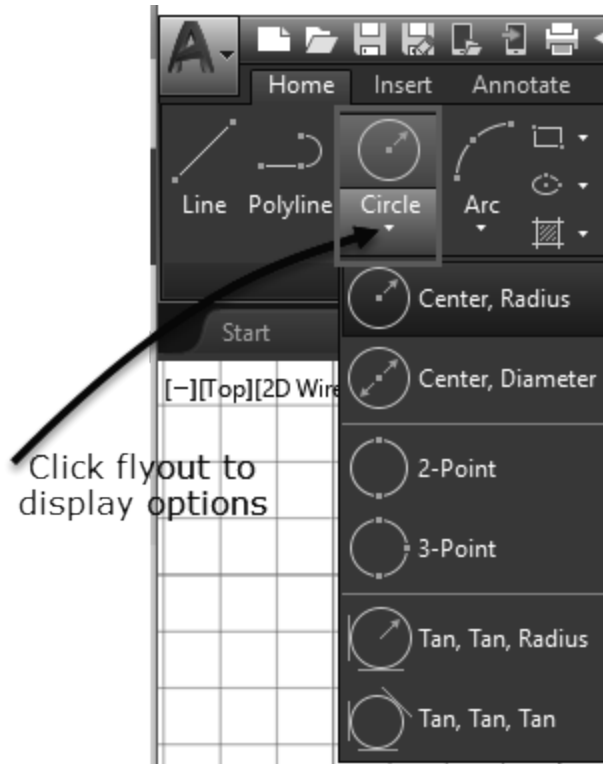
Figure 2-7

Although you may have used this command, try the following description that creates a circle through 2 points using Dynamic Input. Toggle ON Dynamic Input and Polar Tracking in the status bar to show the workspace prompts at the crosshairs. Choose the Circle flyout to display options, select 2-Point and respond to the workspace prompts as shown below.

Command: _circle
Specify first end point of circle's diameter: (Overtype 1,1 and press Enter in the dynamic dimension as shown at p1 in Figure 2-8. Note you are entering first end point using absolute coordinates.)
Specify second end point of circle's diameter: (Overtype @1,1 and press Enter in the dynamic dimension as shown at p2 in Figure 2-8. Note you are entering second end point using relative coordinates.)
The circle is shown in Figure 2-9.

Specify second end point of circle's diameter: @   1   🔒 1

p2

Specify first end point of circle's diameter: 1   🔒 1

p1
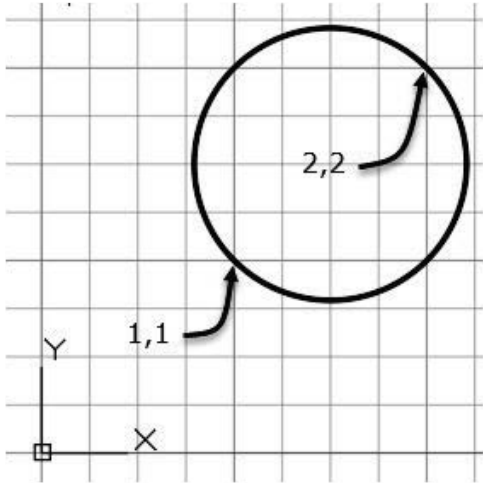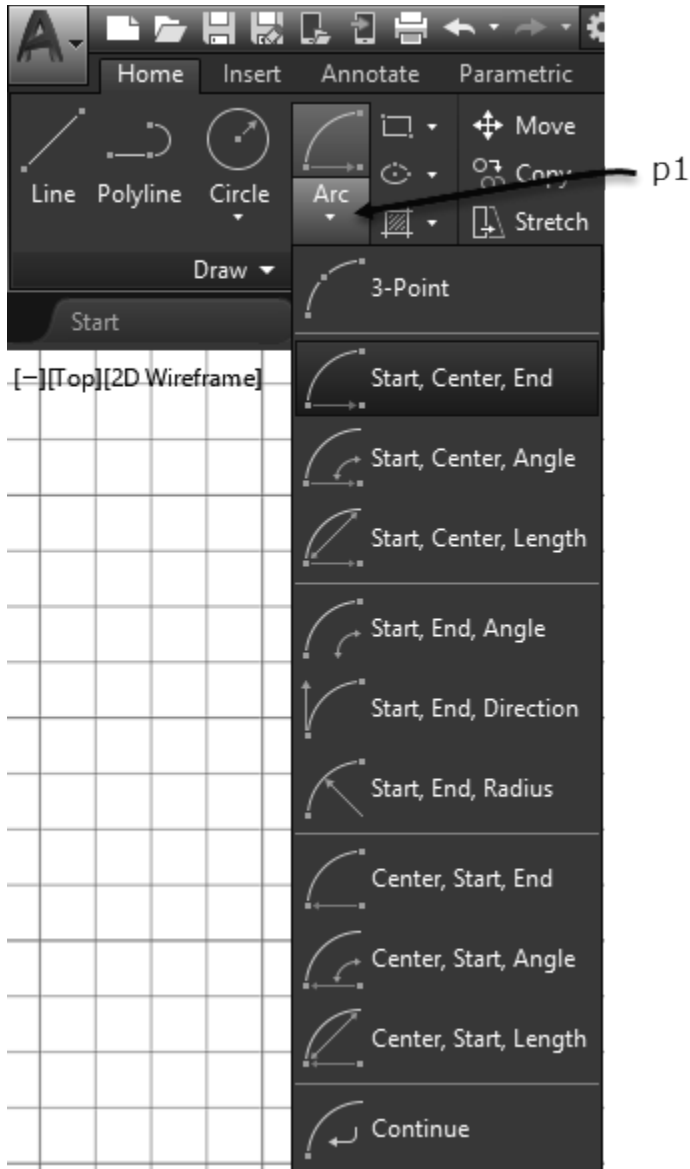
Figure 2-8

2,2

1,1
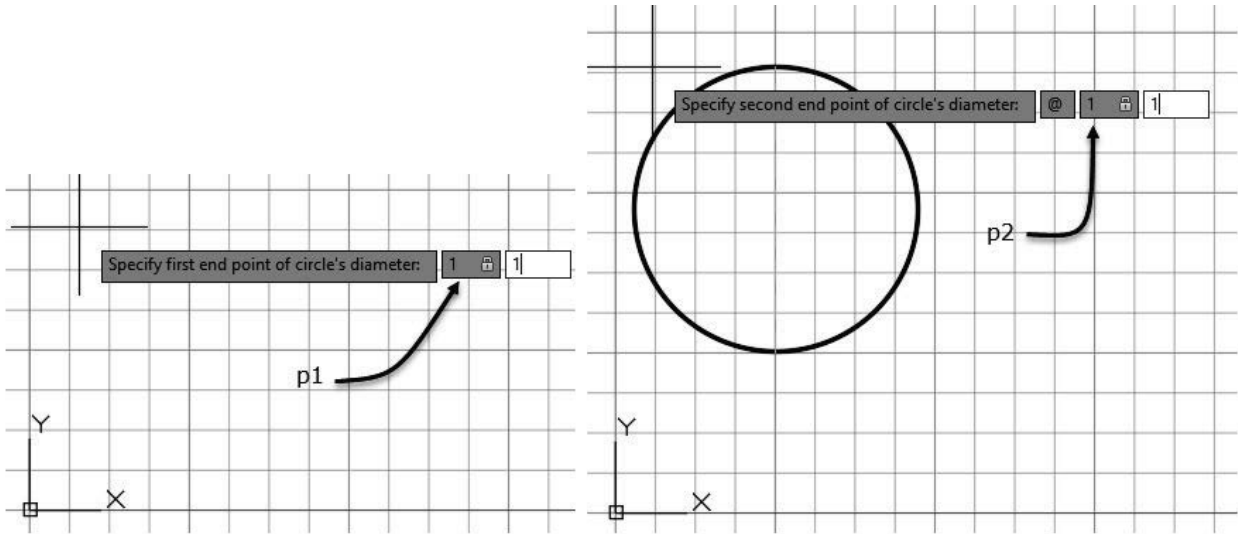
Figure 2-9

Arc

Choose the Arc command from the Home tab, Draw panel as shown in Figure 2-10. The Arc button can be preset any one of eleven methods of placing an arc. Each method presets the prompts. Arcs are drawn in a counter-clockwise direction from the start point; however, you can press the CTRL key to switch directions.

Figure 2-10

Command: _arc
Specify start point of arc or [Center]: (Move crosshairs to end of line shown at p1 in Figure 2-11; click when Endpoint object snap marker is displayed to select the endpoint of a line.)
Specify center point of arc: .5 (Move cursor left, type .5, and press Enter to locate center as shown at p2 in Figure 2-11.)
Specify included angle (hold Ctrl to switch direction): 90 (Type 90 in polar angle dynamic dimension as shown at p3 in Figure 2-11.)
The ½" radius arc is shown at p4 in Figure 2-11.
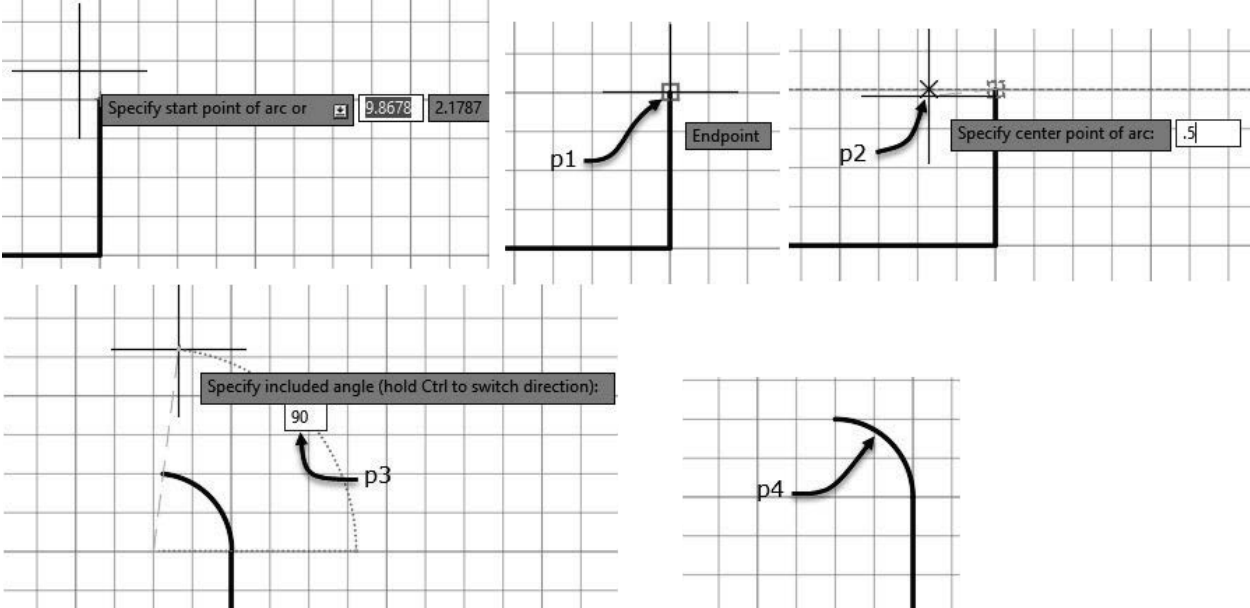
Figure 2-11

Rectangle

Choose the Rectang command from the Home tab, Draw panel as shown in Figure 2-12. The Rectang command creates a polyline in the shape of a rectangle; therefore, there are options to set Width and apply fillets or chamfers for all corners. The rectangle size can be specified by entering locations of the diagonal corners of the rectangle or typing the dimensions of width and length.
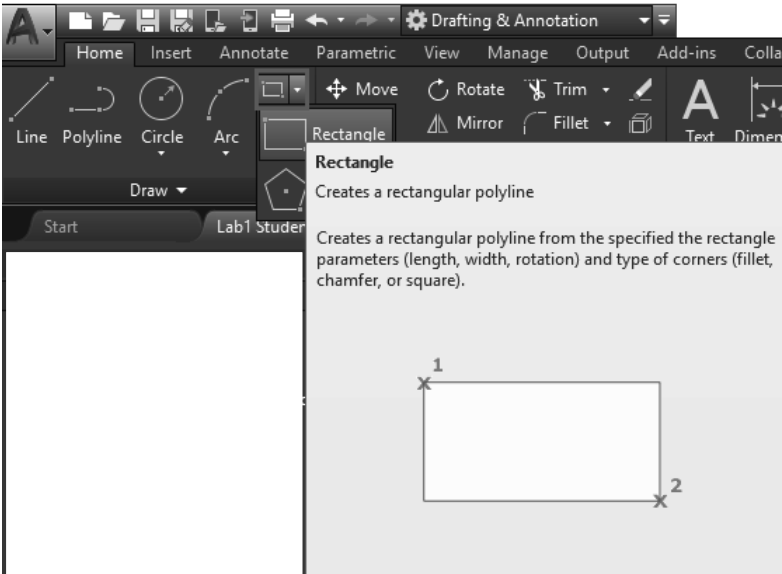

Figure 2-12

Although you may have used this command, try the following description that creates a 2" long and 1" wide rectangle. Toggle ON Dynamic Input and Polar Tracking in the status bar. Choose

the Rectangle command from the Rectangle flyout and respond to the workspace prompts as shown below.

> Command: _Rectang
> Specify first corner point: *(Overtype .5, .5 and press Enter in the dynamic input prompt as shown at p1 in Figure 2-13).*
> Move the cursor to a point near p2 as shown in Figure 2-13 to specify the direction to create the rectangle relative to the first corner.
> Specify the other corner point or: *(Overtype 2, 1 and press Enter in the dynamic input prompt as shown at p3 in Figure 2-13.)*
> The rectangle is shown at p4 as shown in Figure 2-13.
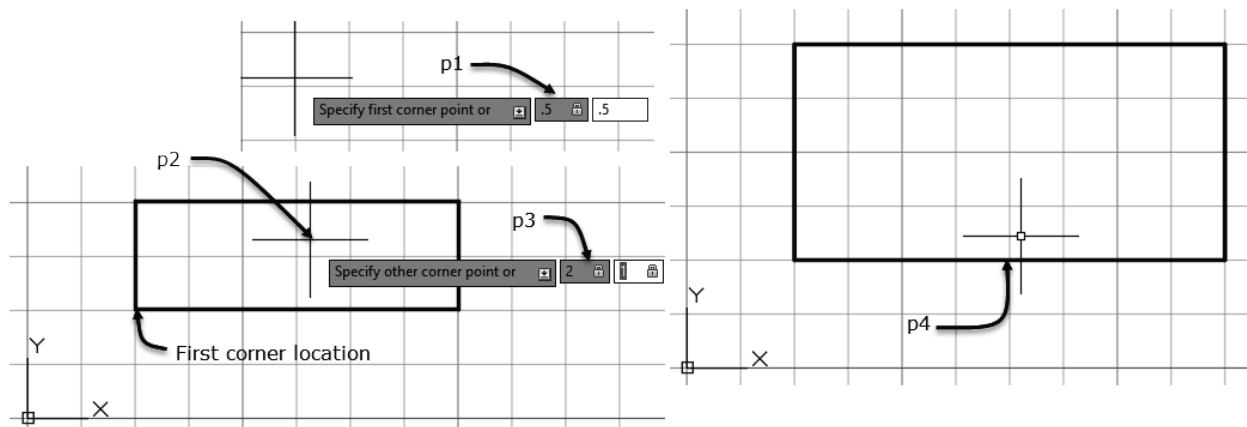
Figure 2-13

Polygon

Choose the Polygon command from the Rectang flyout in the Home tab, Draw panel as shown in Figure 2-14. There are three options to the command: Inscribed in circle, Circumscribed about circle and Edge. The Inscribed in circle method creates a polygon inside of circular shape used to specify the size of the polygon. The Inscribed in circle method specifies the polygon distance across corners. The Circumscribe about circle method sizes the polygon based on the distance across flats since the polygon surrounds the circle. The Edge method sizes the polygon based on the length of a side and the number of sides.
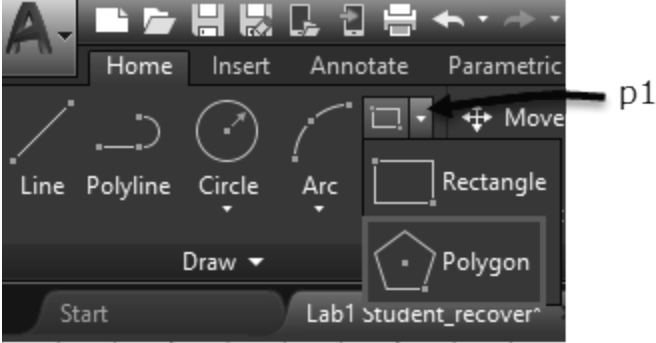
Figure 2-14

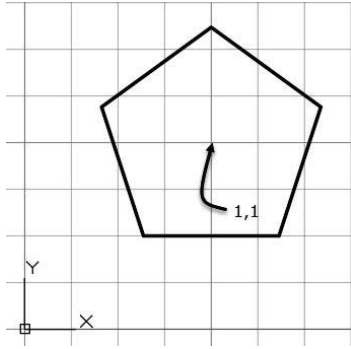Although you may have used this command, try the following description that creates a 5-sided polygon using the Circumscribe about circle using Dynamic Input. Toggle ON Dynamic Input and Polar Tracking in the status bar. Choose the Polygon command from the Rectangle flyout and respond to the workspace prompts as shown below.

> Command: _Polygon
> Enter number of sides <4>: *(Overtype 5 and press Enter in the dynamic input prompt as shown at p1 in Figure 2-15.)*
> Specify center of polygon or: *(Overtype 1,1 and press Enter in the dynamic input prompt as shown at p2 in Figure 2-15.)*
> Enter an option: *(Press the down arrow key of the keyboard to select the Circumscribed about circle; press Enter as shown at p3 in Figure 2-15.)*
> Specify radius of circle: *(Overtype .5 and press Enter in the dynamic input prompt as shown at p4 in Figure 2-15.)*
> Note the polygon is shown in Figure 2-16.
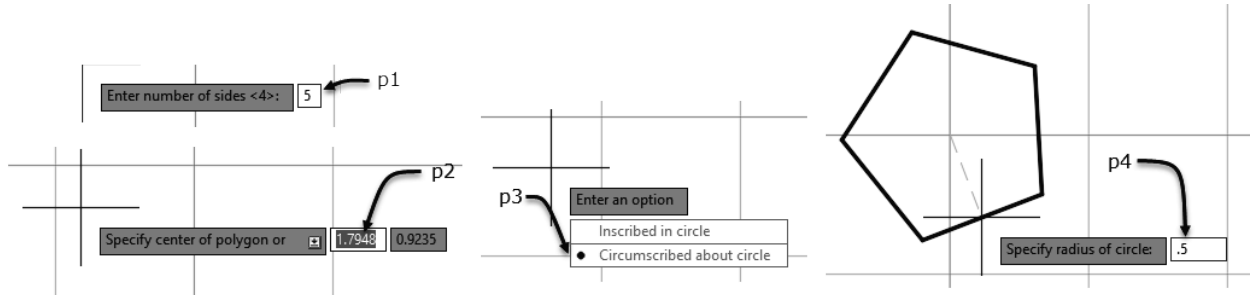
Figure 2-15

Figure 2-16

Try the following description that creates a 5-sided polygon using the Edge method using Dynamic Input. Toggle ON Dynamic Input and Polar Tracking in the status bar. Choose the Polygon command from the Rectangle flyout and respond to the workspace prompts as shown below.

Command: _Polygon
Enter number of sides <4>: *(Overtype 5 and press Enter in the dynamic input prompt as shown at p1 in Figure 2-17.)*
Specify center of polygon or: *(Choose the down arrow twice on the keyboard to display and select the Edge option as shown at p2 in Figure 2-17.)*
Specify the first endpoint of edge: *(Overtype .5,.5 and press enter to specify the coordinates as shown at p3 in Figure 2-17.)*
Specify the second endpoint of edge: *(Overtype 1, press Tab, overtype 0 and press enter to specify the length of the edge as shown at p4 in Figure 2-17.)*
The completed polygon is shown at p5 in Figure 2-17.
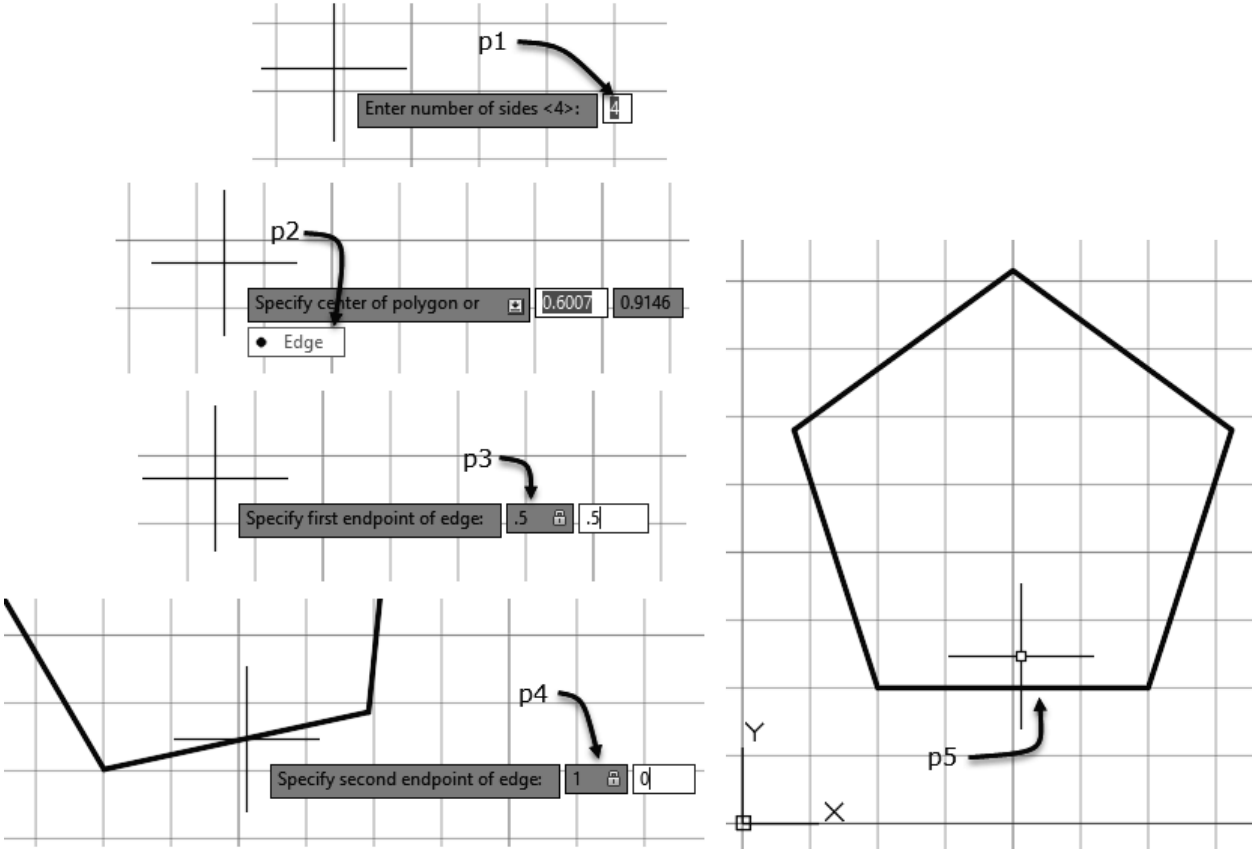
Figure 2-17

Ellipse

Choose the Ellipse command from the Home tab, Draw panel as shown in Figure 2-18. The Ellipse command creates an ellipse by specifying the center and the distances from the center to axis 1 and axis 2 as shown at right below.
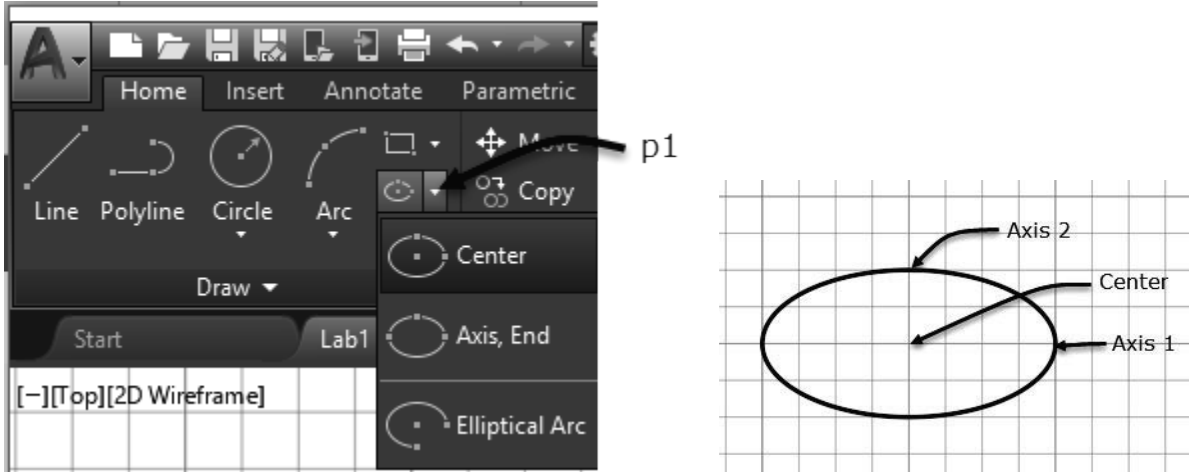
Figure 2-18

Although you may have used this command, try the following description that creates an ellipse using Dynamic Input. Toggle ON Dynamic Input and Polar Tracking in the status bar to show the workspace prompts at the crosshairs. Choose the Ellipse Center command and respond to the workspace prompts as shown below.

> Command: _Ellipse
> Specify center of ellipse: *(Overtype 2,1 and press Enter in the dynamic dimension as shown at p1 in Figure 2-19. Move the crosshairs to the right as shown at p2 in Figure 2-19.)*
> Specify endpoint of axis: *(Overtype 1 in the distance field of the dynamic dimension as shown at p3 in Figure 2-19. Press Tab and enter 0 in the polar angle, press Enter.)*
> Specify distance to other axis or: *(Type .5 in the distance field as shown at p4 in Figure 2-19; press Enter to complete the command.)*
> The completed Ellipse is shown at p5 in Figure 2-19.
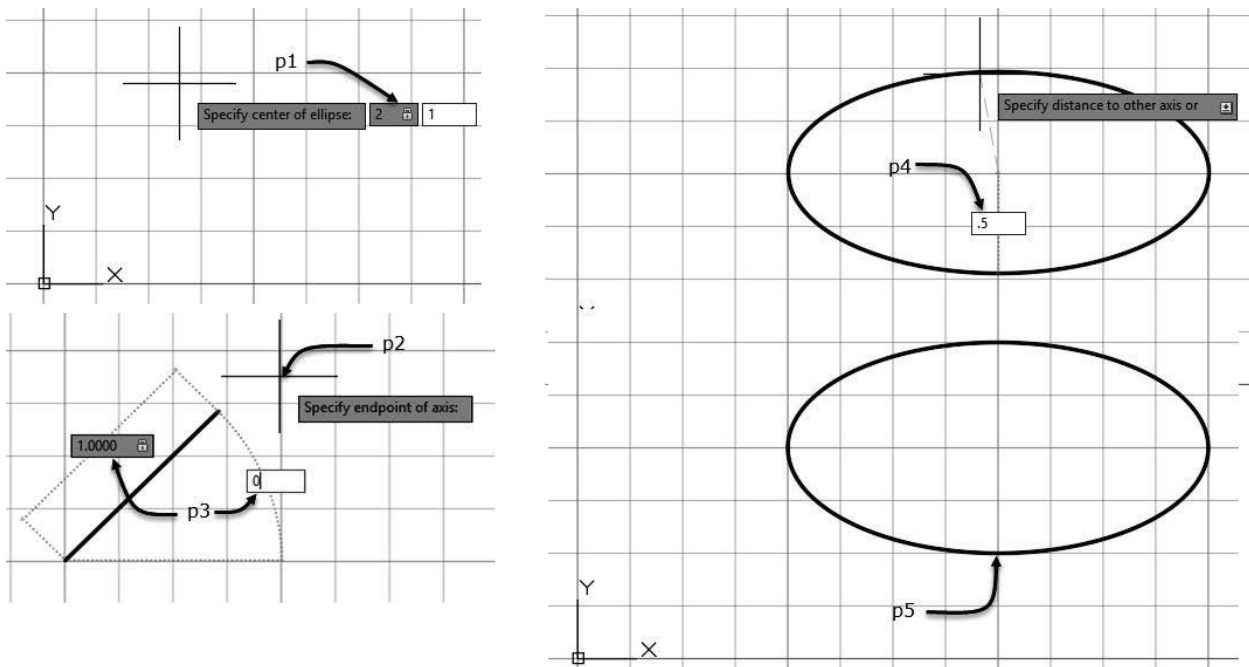
Figure 2-19

2.1 Creating Drawings Using Direct Distance Entry Tutorial

The following tutorial applies the use of Direct Distance Entry to set the angle and direction using the mouse and enter the distance from the start point to draw lines. Press the Tab key to change the focus to the field of dynamic input. Press Shift Tab change the focus to the previous field.

1. Open AutoCAD 2019 from the Desktop shortcut.
2. Choose **New** from the Quick Access toolbar.

3. Choose **SaveAs** from the Quick Access toolbar to save the drawing to your student folder. Name the file **2.1 Direct Distance Your Name.dwg.**

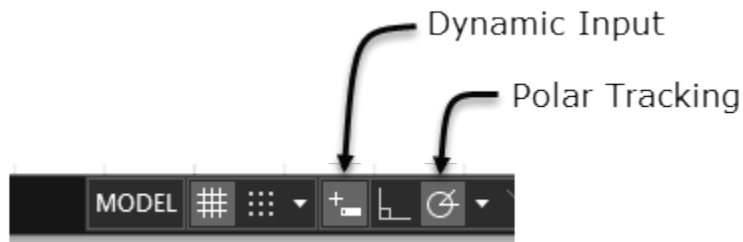4. Toggle ON Polar and Dynamic Input in the Status bar shown in Figure 2-20.

Figure 2-20

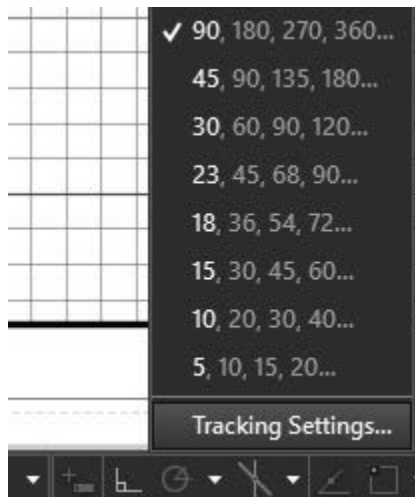5. Right-click the Polar Tracking toggle of the Status bar, choose Tracking Settings as shown in Figure 2-21.

Figure 2-21

6. Edit the Increment angle to 15 degrees as shown below. Verify the remaining settings as shown in Figure 2-22. Choose OK to dismiss the dialog box.
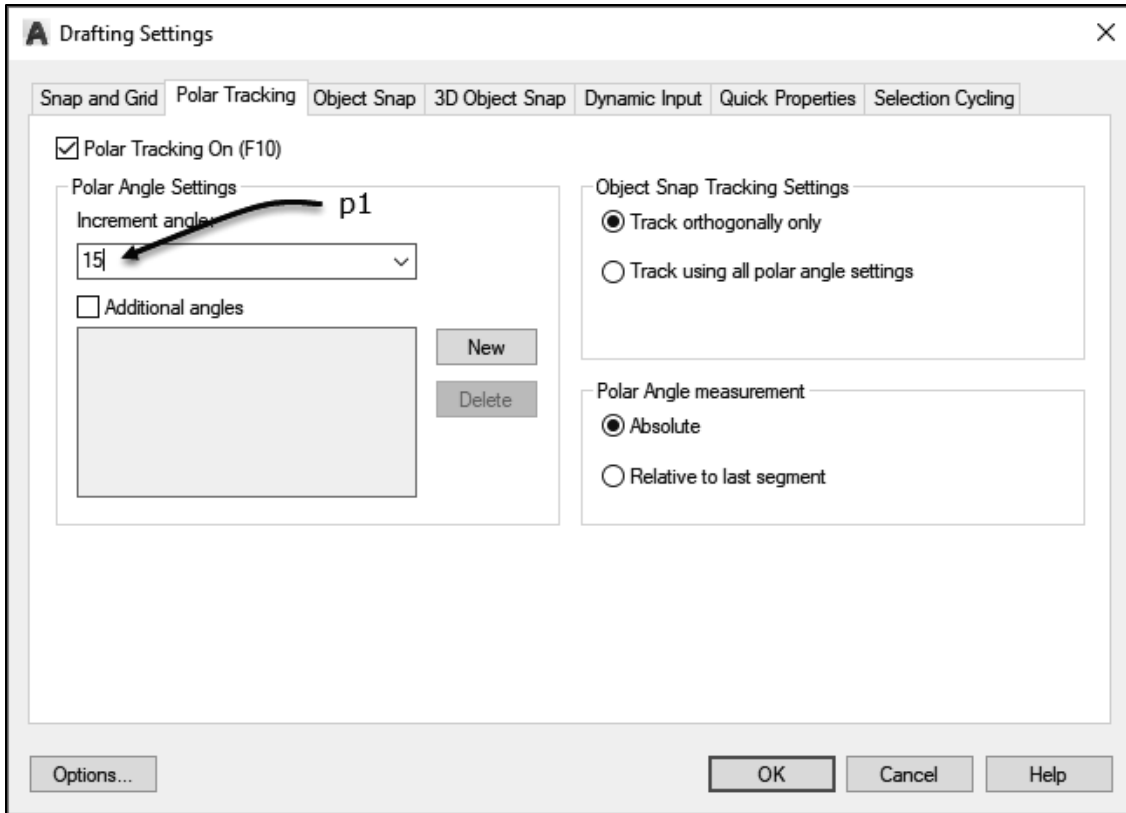
Figure 2-22

7. Choose the Home tab. Choose the Line command of the Draw panel as shown in Figure 2-23.
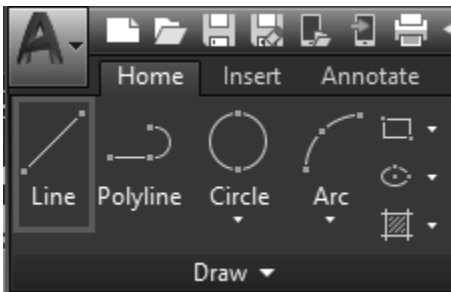
Figure 2-23

8. Respond to the workspace prompts as shown in Figure 2-24. Type 2, press tab, type 2, press Enter to set the start point to 2,2 using absolute coordinates.

Figure 2-24

9. Move the crosshairs to set the angle to 15 degrees and type 2 in the length field as shown in Figure 2-25, press Enter.
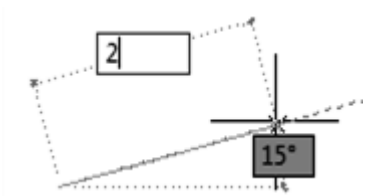
Figure 2-25

10. Move the cursor to set the angle to 90, type 1 in the length field as shown in Figure 2-26, press Enter.
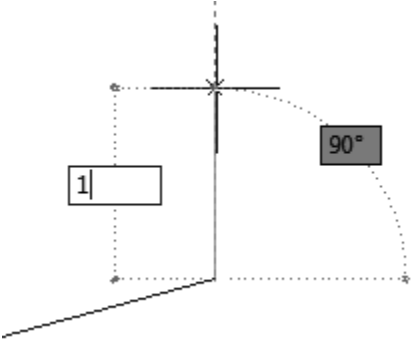
Figure 2-26

11. Move the cursor to the right to display the zero angle, type .5 in the length field as shown in Figure 2-27, press Enter.
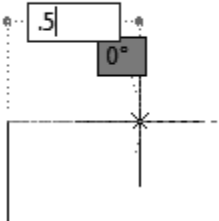
Figure 2-27

12. Move the cursor to display the 45-degree angle from the horizontal, type 2 in the distance field as shown in Figure 2-28, press Enter.
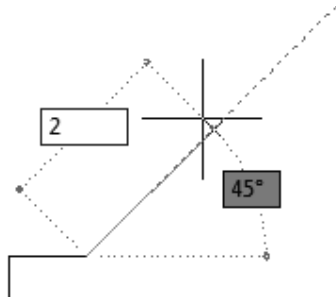
Figure 2-28

13. Continue with the line command to complete the line string as shown in Figure 2-29.
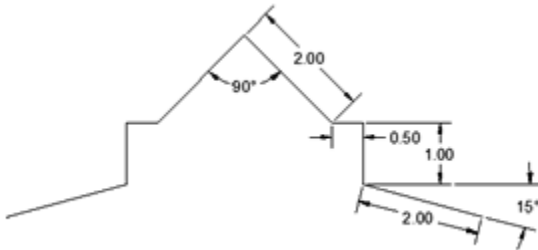
Figure 2-29

14. Verify the Home tab is current.
15. Right click Object Snap toggle in the Status bar. Choose Endpoint to set the Endpoint object snap mode current as shown in Figure 2-30.
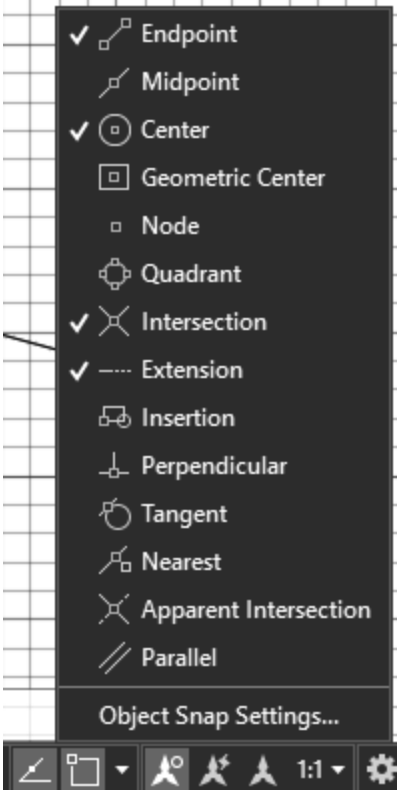
Figure 2-30

16. Choose the Distance command from the Measure flyout of the Utilities panel as shown in the Home tab at p1 in Figure 2-31.
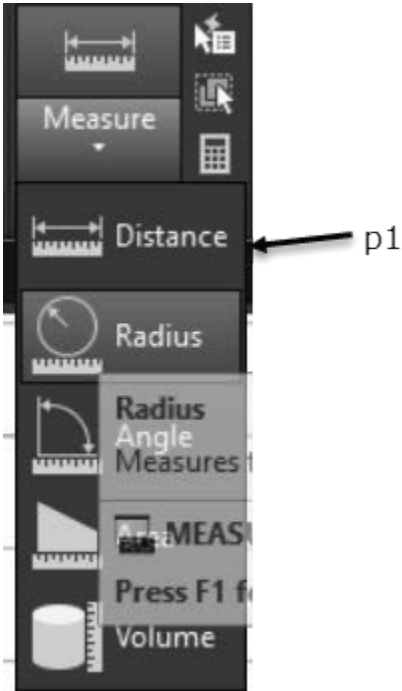

Figure 2-31

17. Select the start and end of the line string created in the previous steps as shown in Figure 2-32.

Figure 2-32

18. The distance value is displayed in the workspace. The distance is 7.6921 as shown in Figure 2-33.
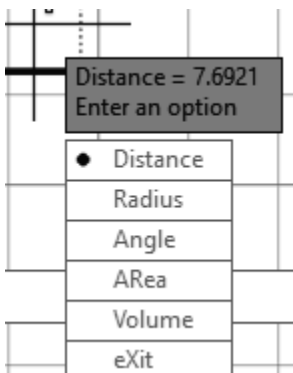

Figure 2-33

19. Press F2 function key to display the text of the command window.
    Specify first point:
    Specify second point or [Multiple points]:
    Distance = 7.6921, Angle in XY Plane = 0, Angle from XY Plane = 0
    Delta X = 7.6921, Delta Y = 0.0000,   Delta Z = 0.0000

20. Now that you have turned on object snap and the endpoint mode, choose the line command and draw 2" lines vertically from the endpoints as shown in Figure 2-34.

Figure 2-34

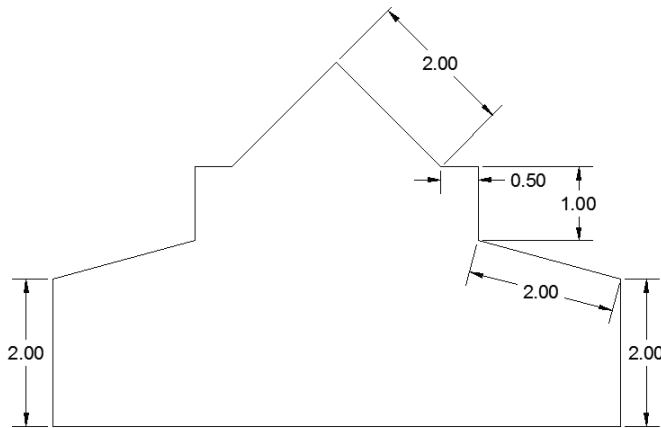21. Draw a line connecting the two lines as shown in Figure 2-35.

Figure 2-35

22. Choose **Save** from the Quick Access toolbar.

2.2 Drawing Basic Shapes Tutorial

The following tutorial includes practice using Dynamic Input to draw the Circle, Ellipses, Rectangle, Hexagon, Octagon, Square and other shapes.

1. Choose **New** from the Quick Access toolbar.
2. Choose SaveAs from the Quick Access toolbar to save the file as **2.2 Basic Shapes Your Name** to your student directory.
3. Verify Dynamic Input is toggled ON in the Status bar.
4. Choose the Rectangle command from the Draw panel of the Home tab as shown in Figure 2-36.
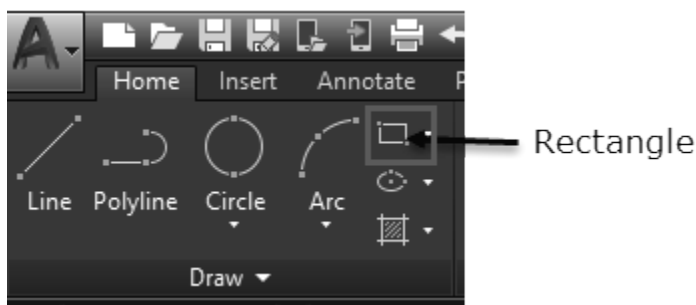
Figure 2-36

5. Draw the rectangle shown in Figure 2-37 using Dynamic Input.
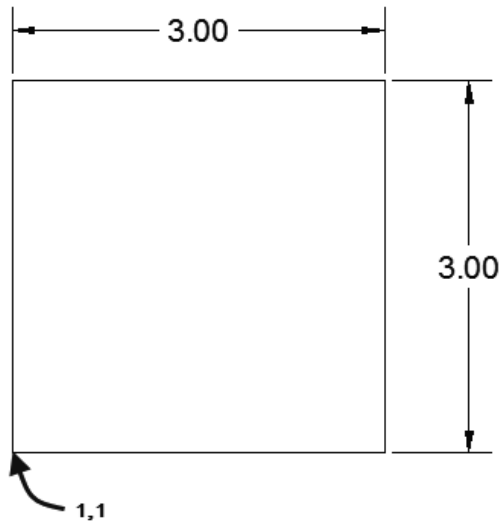
Figure 2-37

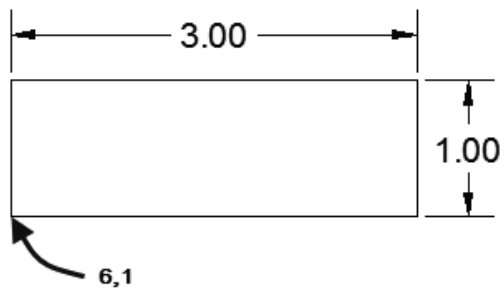6. Draw a rectangle as shown in Figure 2-38 using Dynamic Input.

Figure 2-38

7. Choose Center, Diameter tool from the Circle flyout and draw the circle as shown in Figure 2-39.
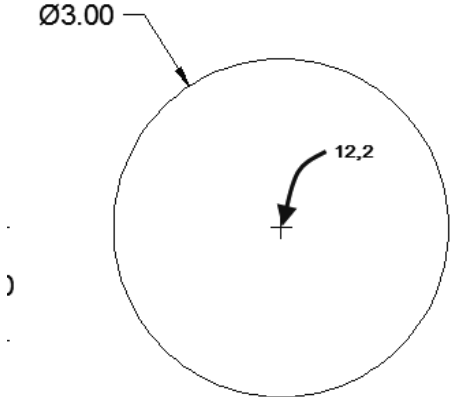
Ø3.00

12,2

Figure 2-39

8. Choose the Polygon command from the Rectangle flyout of the Draw panel in the Home tab shown in Figure 2-40.

Figure 2-40

9. Draw hexagon with its center located at 3,7 as shown in Figure 2-41. Tip: you will use the Circumscribed about circle option.

1.00
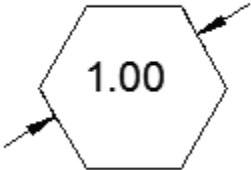
Figure 2-41

10. Draw an Octagon with its center located at 5,7 as shown in Figure 2-42. Tip: you will use the Inscribed in circle option.
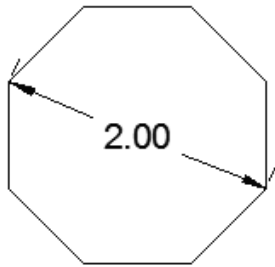
Figure 2-42

11. Draw a pentagon with sides 0.75 in length with one side located at 7,7 shown in Figure 2-43. Tip: you will use the Edge option of the polygon command.
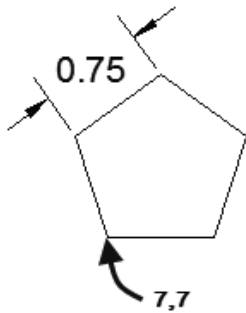

Figure 2-43

12. Choose the Ellipse Center command from the Ellipse flyout of the Draw panel shown at p1 in Figure 2-44.
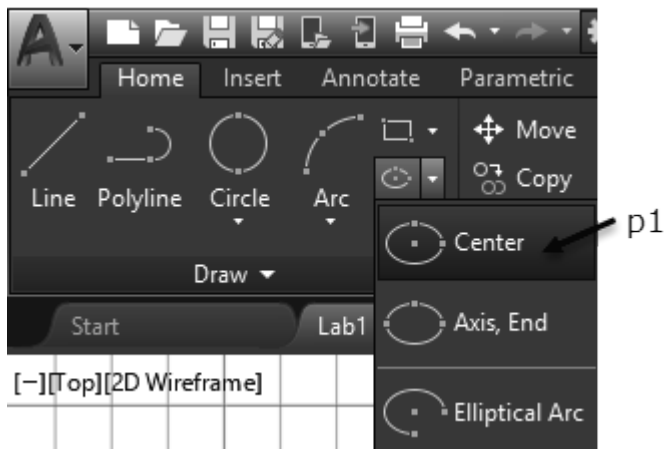

Figure 2-44

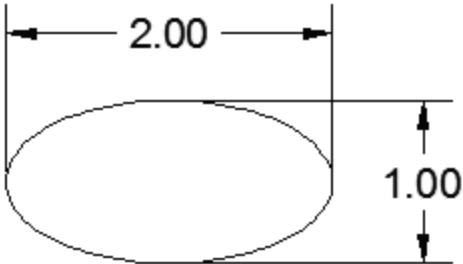13. Draw an ellipse with its center at 10,7 as shown in Figure 2-45.

Figure 2-45

14. Draw an arc with its start point at 10,2, radius equal to .5 and angle equal to 90 as shown in Figure 2-46.
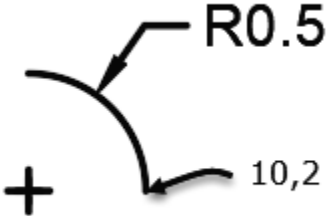

Figure 2-46

15. Save and Close the drawing.