

Chapter 2

The Rectangular Problem

In this chapter, you will learn the following to World Class standards:

- **Use the Tools and Panels for Simple 2D Computer Aided Drafting (CAD)**
- **Use the Line Command to Draw a Closed Polygon**
- **Use the Line Command to Draw Single Line Segments**
- **Use the Intellisketch Icons for Accurate Graphical Selecting**
- **Use the Offset Command to Create New and Accurate Lines**
- **Use the Trim Command to Divide Lines into Two, Change Line Lengths and Create Arcs from Circles**
- **Use the Fillet Command to Trim Lines and Add Arcs**
- **Use the Circle Command to Make Circles with Radii and Diameters**
- **Use the Move Command to Change the Location of an Entity**
- **Use the Copy Command to Create a New Entity at Another Location on the Drawing**
- **Use the Rotate Command to Rotate a Group of Entities**
- **Use the Array Command to Create a Rectangular Pattern**
- **Achieve a High Industry Standard to be Carried throughout your Training**

Working with the Ribbon

The rectangle problem will familiarize you with the basic commands that a Solid Edge user will utilize everyday. When opening a new drawing in this CAD program, there are five tabs on the ribbon, along with several different panels, each containing the tools you will need to create this drawing, as well as future drawings. In this first exercise, you will be making use of the **Home** and **Sketching** tabs, as well as the **Draw** panel, **Line** tool, **Move** tool, **Fillet** tool, **Trim** tool, **Circle** tool and others.

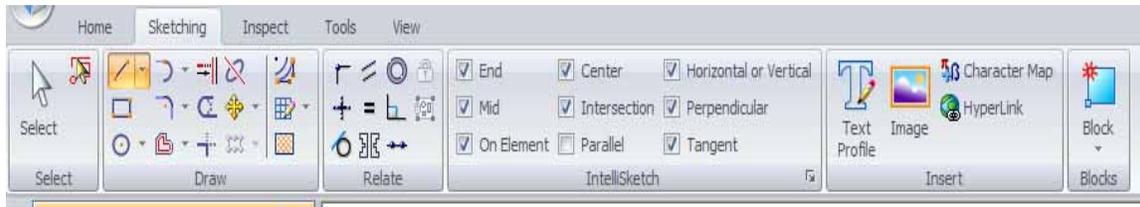


Figure 2.1 – The Solid Edge Ribbon

Drawing your First Lines

Your first experience with the **Line** command will be very simple. You will only be drawing a 6 by 4 rectangle. Select the **Line** tool from the **Draw** panel under the **Sketching** tab. To the left of the screen there will appear a window as shown in Figure 2.2 that will allow you to indicate the length and the angle of your line. When drawing a line, it is a continual function, so after drawing your first line a new line will be coming from the endpoint of the one you just finished.

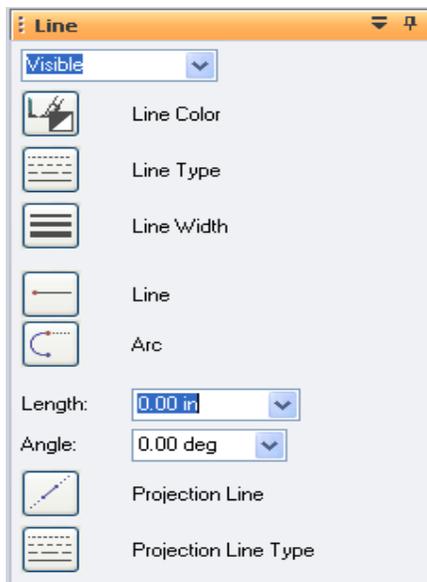
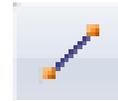


Figure 2.2 – Line Window

Pick a point on the screen to begin drawing the line. Type in “6” into the Length box on the Line Window and press **Enter**. The line will automatically snap straight at 0 degrees, so just left click and the line will be drawn (Figure 2.3). Next, the length of the second line will be 4, and the angle will be 90° (Figure 2.4). The third line has length 6 and an angle of 180° (Figure 2.5). To finish the rectangle, draw the fourth line straight downward until you see the endpoint IntelliSketch icon and click to close the rectangle. To stop a command, just right click with your mouse.

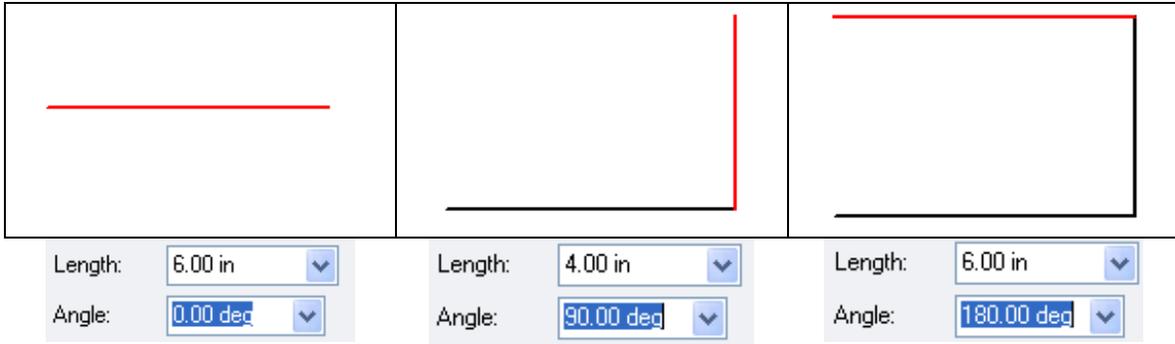


Figure 2.3

Figure 2.4

Figure 2.5

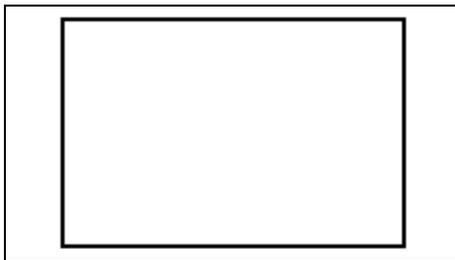


Figure 2.6 – Completed 6x4 Rectangle



* World Class CAD Challenge 22-01* (See End of Chapter)

Drawing Lines Using IntelliSketch Icons

Setting the IntelliSketch Icons will allow you to select points precisely. In the Solid Edge program, the basic IntelliSketch icons can be found on the **IntelliSketch** panel of the **Sketching** tab. However, a more advanced selection of the icons can be made by selecting the arrow in the lower right of the panel (Figure 2.7). As seen in Figure 2.8, the IntelliSketch icons can be selected under the **Relationships** tab of the window. All of these IntelliSketch tools will be a great help when creating drawings with Solid Edge.

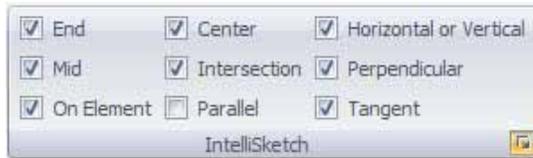


Figure 2.7 – IntelliSketch Panel

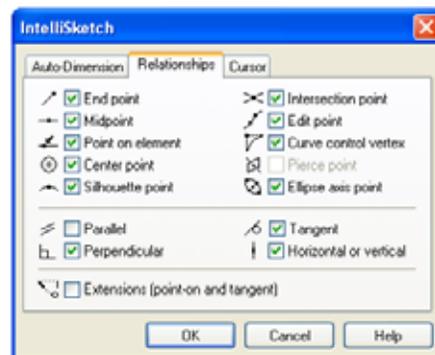


Figure 2.8 – IntelliSketch Window

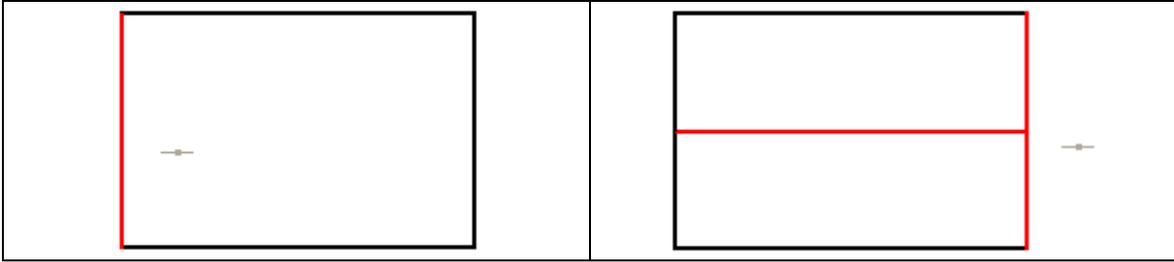


Figure 2.9 – Midpoint IntelliSketch

Figure 2.10 – Second Midpoint IntelliSketch

The next two lines that you will draw are the centerlines dividing the rectangle. Now that the IntelliSketch Icons are set, select the **Line** command a second time. Place the cursor next to the middle of the left vertical line and the midpoint symbol should appear (Figure 2.9). Select the midpoint of the line by clicking with the left mouse button. Move your mouse to the center of the right vertical line and when the midpoint symbol appears, select it by clicking with the left mouse button. End the **Line** command by right clicking. Draw a second centerline by repeating the sequence again.

Step 1. Move the cursor to the middle of the lower horizontal line and wait for the midpoint symbol to appear. Select the line with the left mouse button.

Step 2. Move the cursor to the middle of the upper horizontal line and wait for midpoint symbol to appear. Select the line with the left mouse button.

Step 3. Right click with the mouse to end the **Line** command.

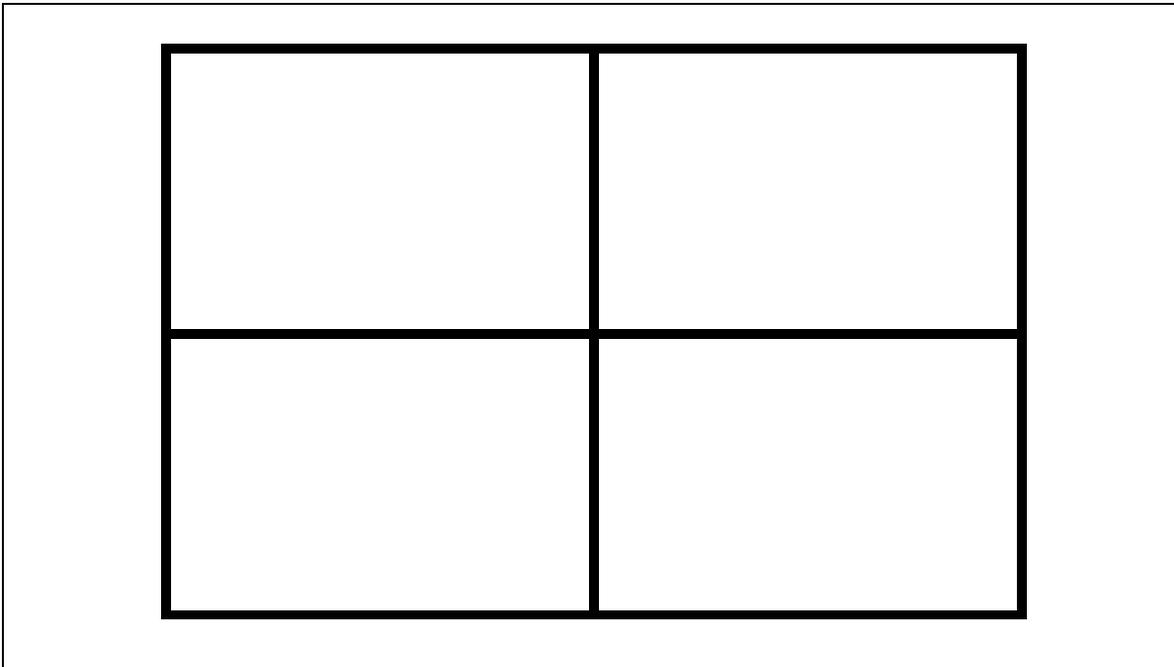


Figure 2.11 – 6x4 Rectangle with 2 Centerlines Exactly in the Middle

*** World Class CAD Challenge 22-02 * (See End of Chapter)**

Using the Offset Command

The **Offset** command is used to add lines to a drawing without selecting points to define the initial and terminal points of the line. In your problem, you will choose the **Offset** tool from the **Draw** panel. Once again, a window on the left of the screen will appear. In the box that allows you to indicate the distance of the offset, type in “**0.25**.” In the drop down box below the distance box, select the single offset, as opposed to the chain option (Figure 2.12). Next, select the line that you want to offset. After selecting the line, click the **Accept** button (Figure 2.13) on the Offset Window and then indicate the direction in which you want the offset line to be drawn. In your case, the offset will be drawn inside the rectangle (Figure 2.14). To draw the line, click with the left mouse button and then click with the right mouse button to end the command (Figure 2.15).

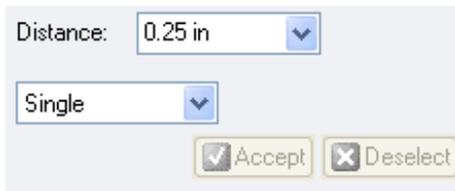


Figure 2.12 – Offset Distance and Type

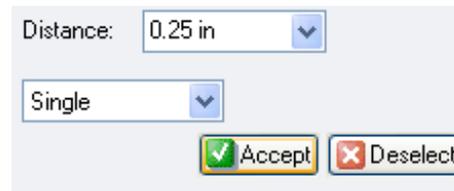


Figure 2.13 – Selecting the Accept Button

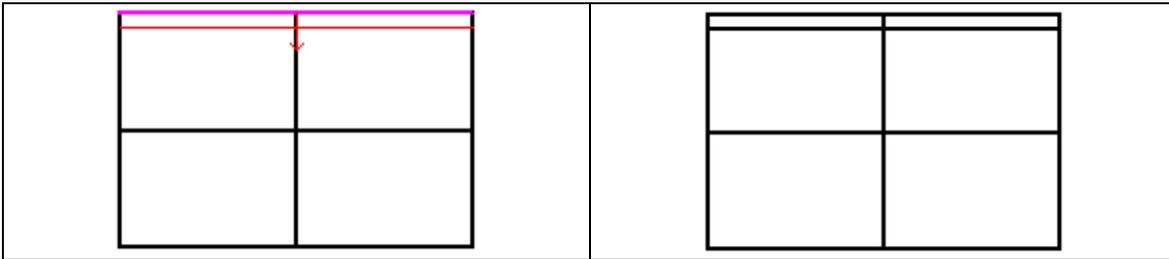


Figure 2.14 – Selecting Offset Direction

Figure 2.15 – Finished Offset Line

Continue to offset the other perimeter lines of the rectangle until the drawing looks like Figure 2.16.

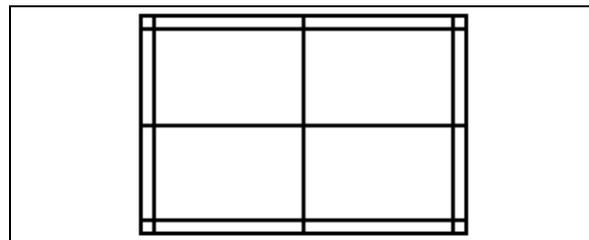


Figure 2.16 – Finished 0.25 Offsets

Next you want to offset the vertical center line to the left and right a distance of **1.5** inches. You can do this by changing the Offset Distance in the Offset Window to **1.5** and then follow the same set of steps to draw two offset lines from the vertical center line (Figure 2.17).

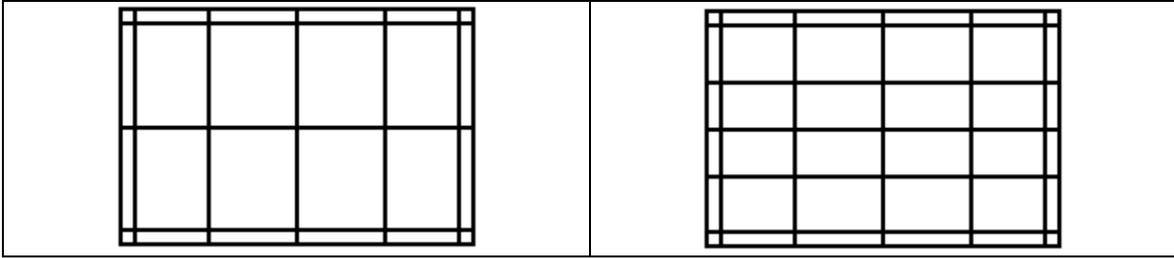


Figure 2.17 – Finished 1.5 Offsets

Figure 2.18 – Finished .8 Offsets

Finally, you want to offset the horizontal center line. In the Offset Window, set the Offset Distance to **0.8**. After selecting the center line, offset it up once above and once below so that your drawing looks like Figure 2.18.

*** World Class CAD Challenge 22-03 * (See End of Chapter)**

Using the Trim Command

Your first use of the **Trim** command allows you to divide and remove unwanted portions of existing lines. Select the **Trim** tool from the **Draw** panel and you can begin removing the line segments that you do not want in the drawing. You should begin by removing the middle perimeter lines (Figure 2.20).

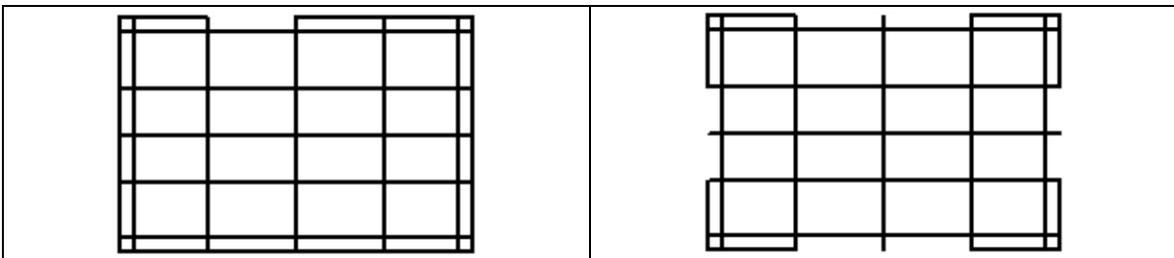


Figure 2.19 – First Trimmed Line

Figure 2.20 – Trimmed Perimeter

When you are finished trimming all the exterior lines from the drawing, your rectangle should look like Figure 2.21. The purpose of breaking lines in this exercise is to create two lines where one line existed. In this way, you can use the Fillet command to both trim and add an arc on the inside of the slotted exterior. If the lines are not broken into two segments, you would discover this fault when next using the Fillet command.

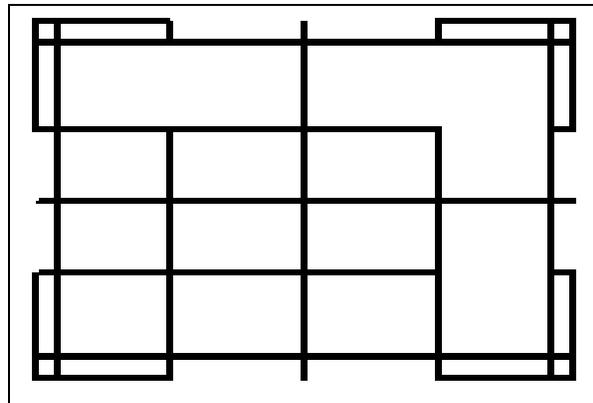


Figure 2.21 – Rectangle with all Lines Trimmed

Using the Fillet Command

The **Fillet** command allows you to trim and add sharp corners (radius of 0) or arcs to the intersection of two lines. First, select the **Fillet** command from the **Draw** panel. The Fillet Window will appear to the left. In the window there is a box where you can select the radius of the fillet (Figure 2.22). In the box, type in “**0.06**”, strike **Enter** and that will give you the $\frac{1}{16}$ inch radius that you want. Next select the two lines to which you want to add the radius and indicate the direction of the fillet by choosing the quadrant that is outside of the rectangle (Figure 2.23). Click with your left mouse button to draw the fillet. Continue to repeat the process until your drawing looks like Figure 2.24. When placing the Fillets on the drawing follow a clockwise or counterclockwise pattern to stay consistent.

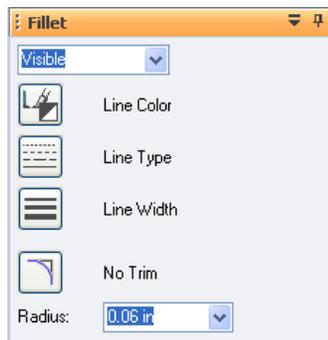


Figure 2.22 – Selecting the 0.06 Radius

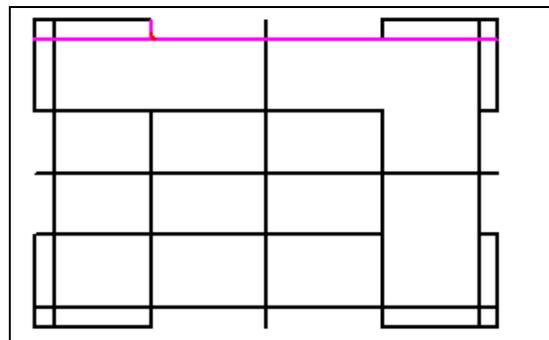


Figure 2.23 – Selecting Fillet Lines and Direction

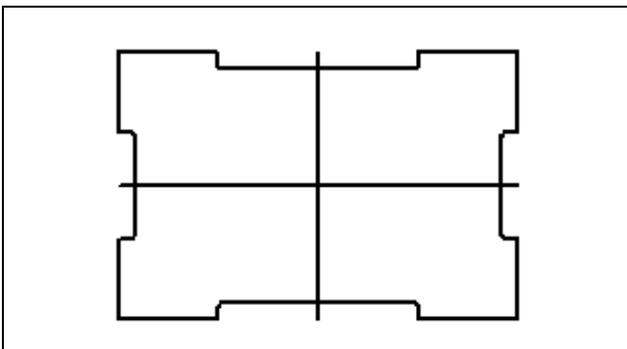


Figure 2.24 – Finished 0.06 Fillets

With the **Fillet** command still selected, change the radius to **0.50**. Pick the two lines that make up the corner of the rectangle and the sharp corner will now have an arc with a $\frac{1}{2}$ inch radius (Figure 2.25). Continue to add a radius to the other corners of the rectangle until your drawing looks like Figure 2.26.

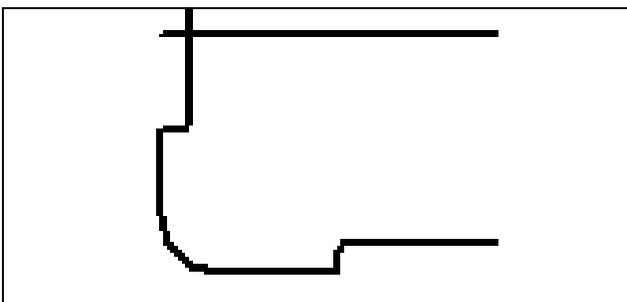


Figure 2.25 – 0.50 Radius on the Corner

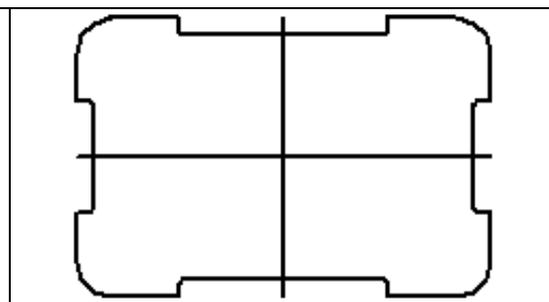


Figure 2.26 – Finished 0.50 Fillets

You are totally finished with the perimeter of your first problem. You have used the **Line**, **Offset**, **Trim** and **Fillet** commands and have gained speed and efficiency through repetition. Many projects that you will do throughout your entire CAD experience will revolve around the creation of a perimeter that is functional and meets the needs of your project. In future projects, you will find that associate World Class CAD users follow these same processes to create any residential floor plan in less than one hour, hours ahead of the standard industry rate.

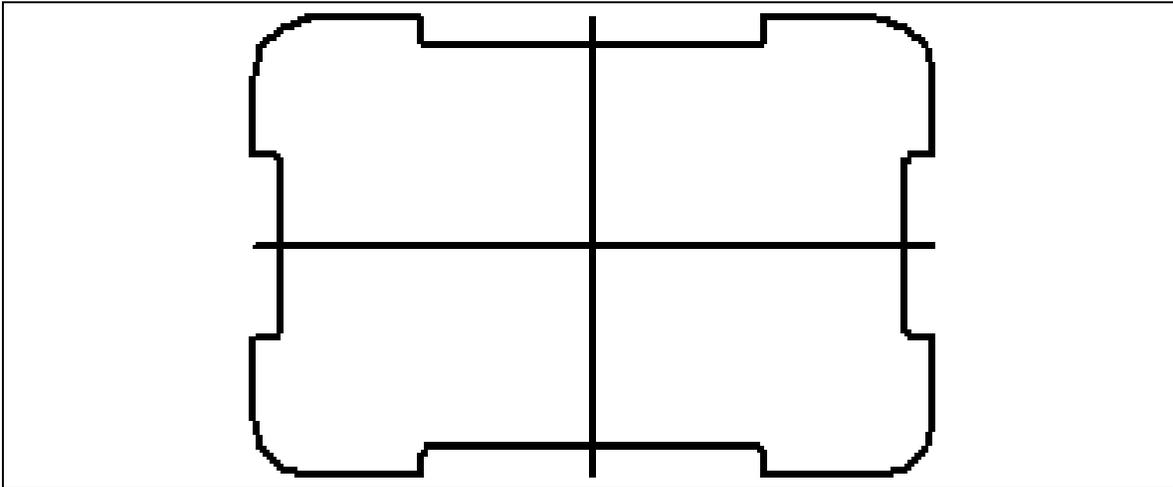


Figure 2.27 – The Finished Perimeter of your Part with Two Centerlines

*** World Class CAD Challenge 22-04 * (See End of Chapter)**

Drawing your First Circles

To add circles to your drawing, select the **Circle by Center Point** command on the **Draw** panel. A Circle by Center Point Window will appear to the left. Inside the window you can indicate either the diameter or radius of the circle as you choose. With your mouse, find the midpoint of one of your centerlines. Use the IntelliSketch Icon to tell when you are at the midpoint (Figure 2.28). Select the point with your mouse. After picking the point, type in a diameter of **2.0**. The circle will appear as in Figure 2.29. Right click with your mouse to end the command. Reselect the midpoint of one of the center lines and draw a circle with diameter **0.75** (Figure 2.30). Right click to end the command.

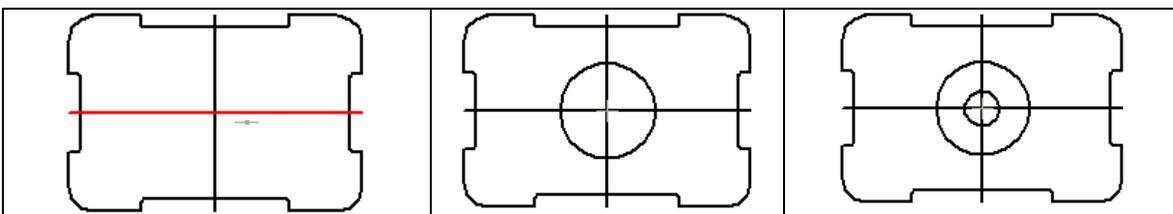


Figure 2.28

Figure 2.29

Figure 2.30

Continuing with the **Circle** command, you will now draw a circle in the lower left corner of the rectangle. Again, the IntelliSketch settings will help you in finding the center of the radius that was drawn previously at the corner of the rectangle. When you specify the center for your circle, use your mouse to place the cursor over the arc in the lower left hand corner of the drawing (Figure 2.31). The Center IntelliSketch Icon will appear at the center point of the arc. Select the center with the left mouse button. Then, type in **0.5** for the diameter in the Circle Window. The circle will appear as in Figure 2.32. Right click to end the command.

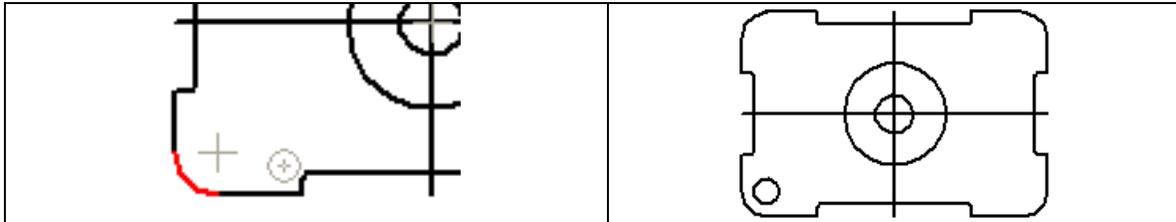


Figure 2.31 – Center IntelliSketch **Figure 2.32 – Circle in Lower Left Corner**

Using the Move and Copy Commands

The **Move** command is located on the **Draw** panel and the **Copy** command is a tool within the **Move** command. These commands are separated into two parts, the first being the selection process and the second being the function of the command itself, in this case **Move**. Select the **Move** tool and the Move Window will appear to the left. Next, select the smaller circle in the middle of the rectangle like in Figure 2.33. After selecting the circle, the **PromptBar** will tell you to select the point to move from, so pick the north quadrant of the circle. Then, moving the circle to the right as in Figure 2.34, type “**1.5**” into the box that indicates the change in the **x**-coordinate (Figure 2.35). Click with the left mouse button to finish moving the circle.

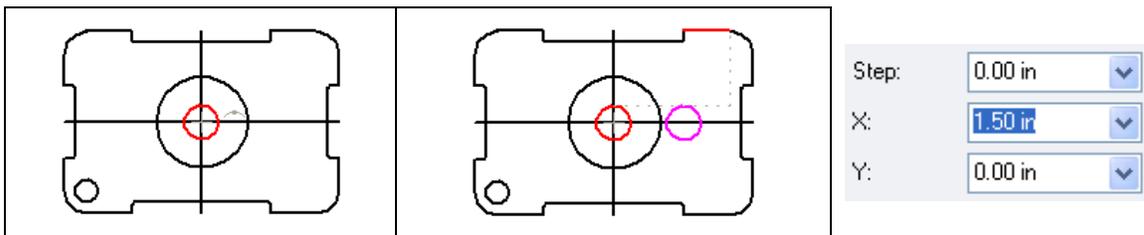


Figure 2.33 – Center Circle **Figure 2.34 – Moving Circle Right** **Figure 2.35 – 1.5 Change in X**

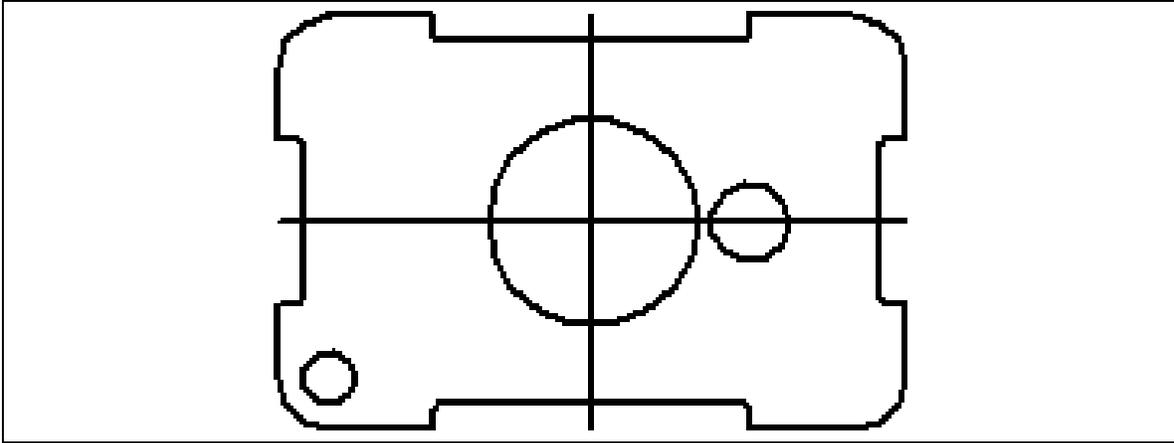


Figure 2.36 – Your First Movement of an Entity Completed

Using the Copy Command

To copy a Solid Edge entity, such as the circle you just moved, select the **Copy** tool on the Move Window (Figure 2.40). In Solid Edge, the **Copy** tool functions through the **Move** command. Reselect the **Move** command and click on the **Copy** tool on the Move Window. Once again, pick the circle that you just moved and then pick the north quadrant as the point from which you want to move it (Figure 2.37). Going to the left, type “3.0” as the distance traveled along the x-coordinate (Figures 2.38 & 2.39). Click with your left mouse button to draw the circle and then right click to end the command (Figure 2.41).

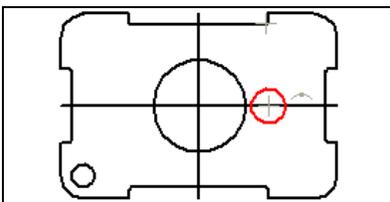
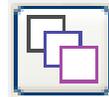


Figure 2.37

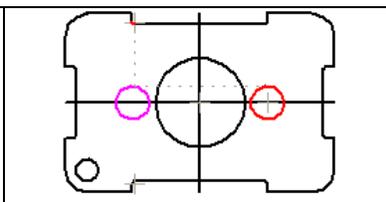


Figure 2.38

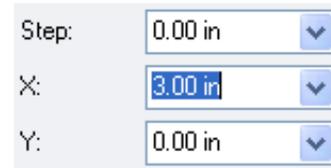


Figure 2.39

Notice that since the **Copy** command is part of the **Move** command, the procedure for both is the same. The only difference is that with the **Move** command, a copy of the object is not left in its original position like it is with the **Copy** command. As with all modifying commands in Solid Edge, these are more powerful than the original Line or Circle tools when creating new entities in your drawing.

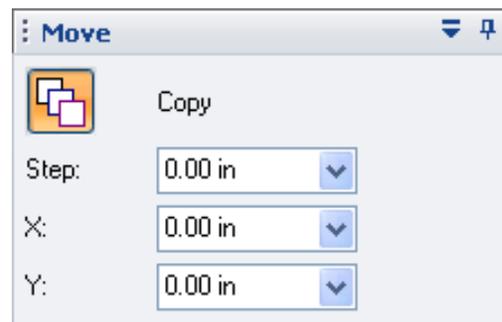


Figure 2.40 – Copy tool in Move Window

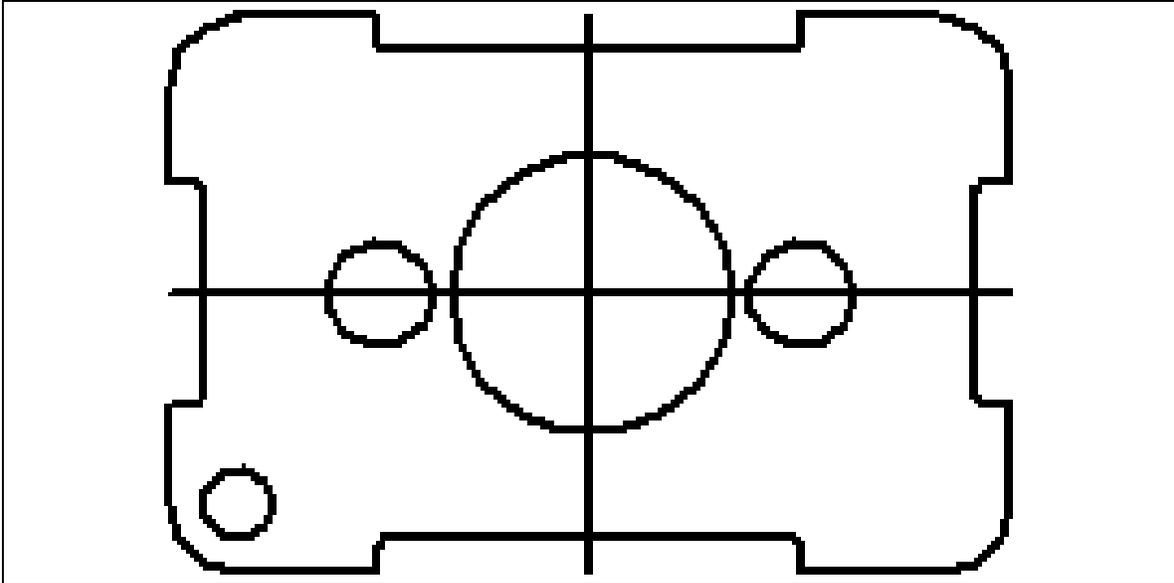


Figure 2.41 – Completed Copy Command, Resulting in Two Circles

* World Class CAD Challenge 22-05 * (See End of Chapter)

Using the Line Command with the Quadrant IntelliSketch

You need to add two lines connecting the upper and lower quadrants of each 0.75 diameter circle. Select the **Line** tool from the **Draw** panel. Each circle is broken into four quadrants: north, south, east and west. Place the cursor over the north quadrant of the left circle and the Quadrant IntelliSketch will appear (Figure 2.42). Select the quadrant with the left mouse button and then select the north quadrant of the right circle (Figure 2.43). Right click with your mouse to end the command. You now have a single line segment connecting the north quadrants of both circles. With the **Line** command still selected, draw a second line connecting the south quadrants of the two circles. Your drawing should now look like Figure 2.44.

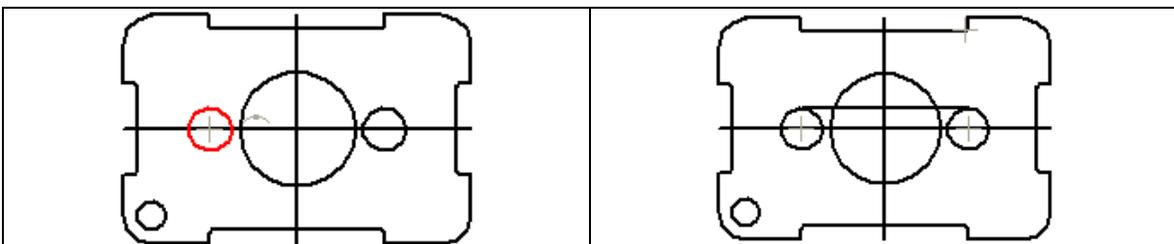
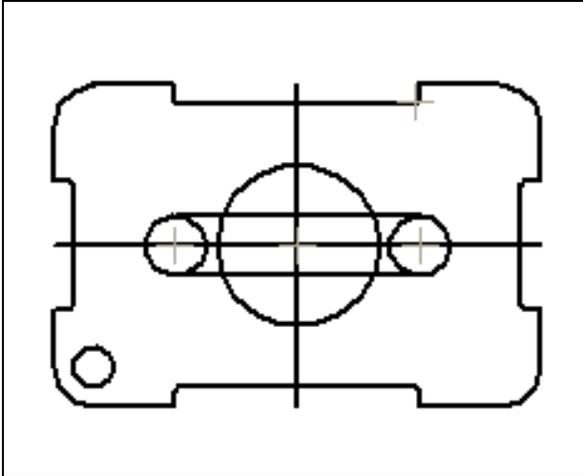


Figure 2.42 – Selecting the North Quadrant

Figure 2.43 – Connecting the Circles



The Quadrant IntelliSketch is a very powerful tool that creates four reference points to a circle, as compared to the single reference point obtained from the Center IntelliSketch. Notice the complexity of your part is increasing and we have allowed the computer to compute the complicated geometry for you by referencing off endpoints, midpoints, centers and quadrants. World Class trained CAD operators, which include Architects, Designers and Engineers can put their calculators away.

Figure 2.44 – Finished Lines

Reinforce Using the Trim Command

The second use of the **Trim** command allows you to divide a line or remove an unwanted portion of an existing line or circle. Select the **Trim** tool from the **Draw** panel. You will have 12 lines to trim on the interior of the three circles and two lines. Begin by trimming the right half of the left circle (Figure 2.45). Continue to trim all the lines (except for the original center lines) until you have created a perimeter that looks like Figure 2.46.

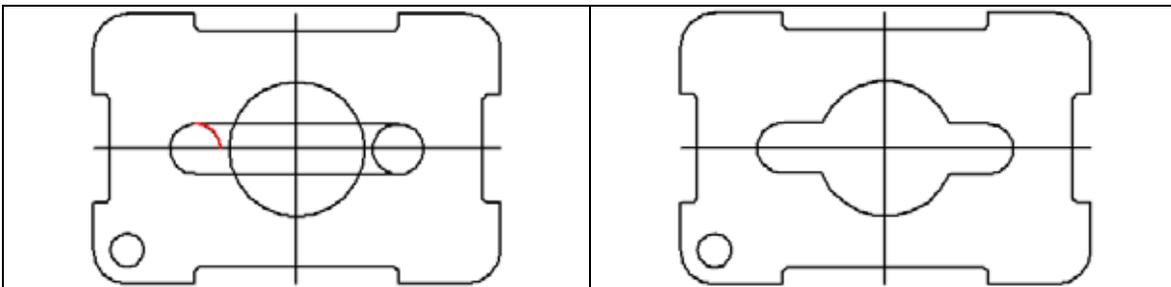
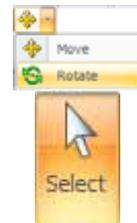


Figure 2.45 – Trimming Left Circle

Figure 2.46 – Completed Trimming

Using the Rotate and Select Commands

The **Rotate** command will allow you to rotate entities around a base or center point. Before selecting the Rotate tool, you need to select the entity to be rotated. Click on the **Select** tool on the **Select** panel of the **Sketching** tab and then click and drag to make a window around the perimeter that you just created (Figure 2.47). Also, if you push the **Escape** button on your keyboard, the **Select** tool is the default tool for Solid Edge. With the perimeter chosen, select the **Rotate** tool by clicking on the drop down arrow to the right of the **Move** tool on the **Draw** panel. The Rotate Window will



appear in the left of the screen. Then select the midpoint one of the center lines (Figure 2.49). Next, pick a point on the horizontal center line to indicate the point from where the shape will be rotated (Figure 2.50). After picking the point, type in “45” for the angle and then pick the direction of rotation to be to the upper right corner of the rectangle (Figure 2.51). The three boxes for Step, Angle and Position should read as in Figure 2.52. Click with your left mouse button to finish the **Rotate** command.

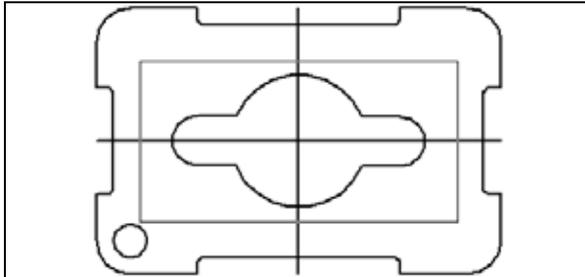


Figure 2.47 – Selecting the Perimeter

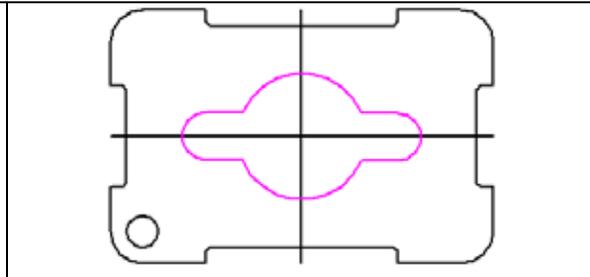


Figure 2.48 – The Perimeter Selected

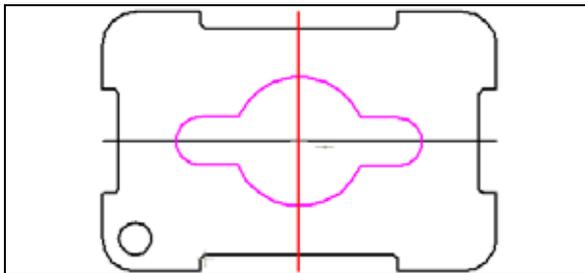


Figure 2.49 – Selecting Midpoint

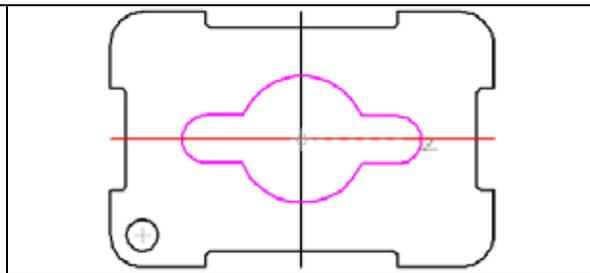


Figure 2.50 – Selecting Rotation Point

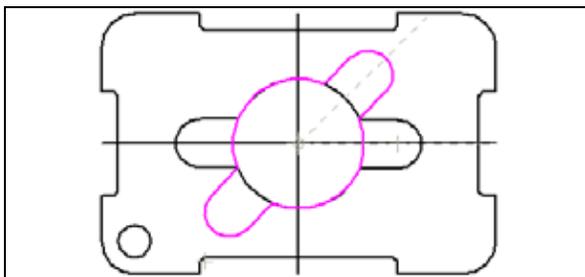


Figure 2.51 – Selecting Angle/Position

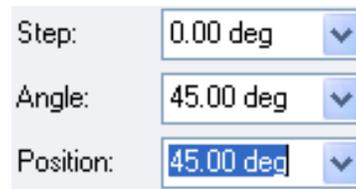


Figure 2.52 – Readouts for Rotation

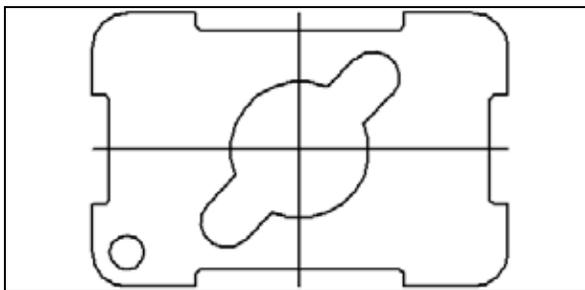


Figure 2.53 – Completed Rotation

*** World Class CAD Challenge 22-06 *
(See End of Chapter)**

Using the Rectangular Patterns Command

The **Rectangular Pattern** tool allows you to create patterns of entities from selected objects, in this case the 0.5 unit circle. First, select the 0.5 unit circle in the lower left corner of the rectangle (Figure 2.54). Next, click on the **Rectangular Pattern** command on the **Draw** panel. The Rectangular Patterns Window will appear on the left of the screen (Figure 2.55). In the box labeled **X-Count** type in the number “2”. Type “2” for the **Y-Count** box as well. In the **X-Offset** box type in “5” and type in “3” for the **Y-Offset**. Leave the **Angle** box at **0.00**. Before you hit **Finish**, make sure that the inputs for the counts and offsets are the same as in Figure 2.56. Also, make sure that the rectangular pattern being laid out on your matches the one in Figure 2.57. Once you have made sure that your inputs are correct and the pattern is in the right place, click the **Finish** button and the circle will appear in all four corners of the rectangle. Figure 2.58 is the completed drawing prior to dimensioning and notes. The typical CAD student needs 10 to 12 hours of practice to achieve World Class standards.

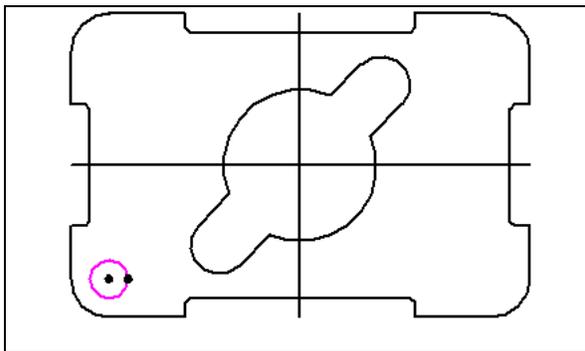


Figure 2.54 – Selecting the .5 Circle

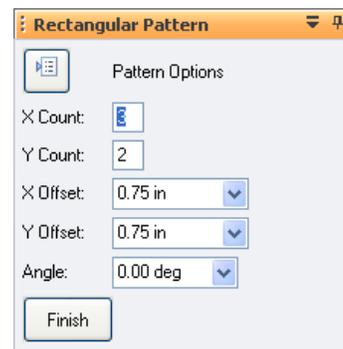


Figure 2.55 – Rectangular Pattern Window

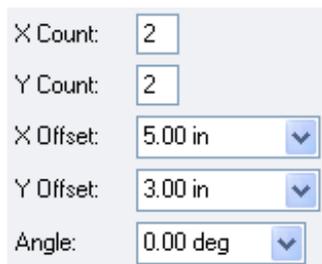


Figure 2.56 – Selecting Pattern Inputs

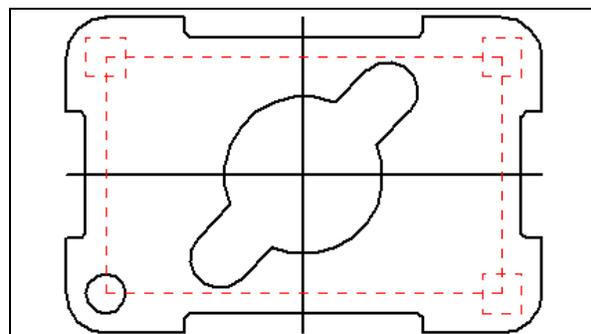


Figure 2.57 – Rectangular Pattern

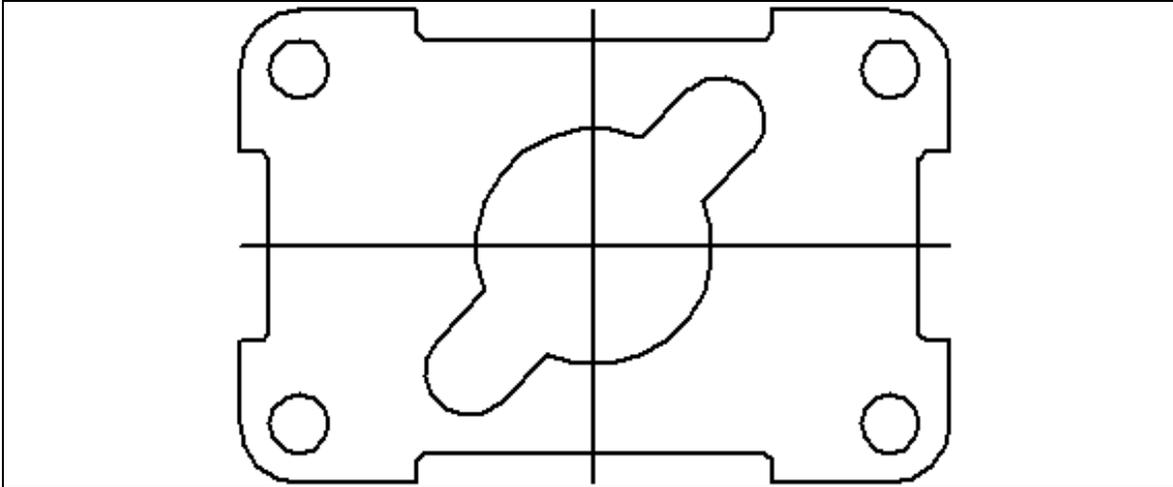


Figure 2.58 – The Finished 2D Drawing Prior to Dimensioning

*** World Class CAD Challenge 22-07 * (See End of Chapter)**

World Class CAD Challenges for Chapter 2

Before starting each challenge, you need to open a new drawing so that you can begin working from scratch. Working from the beginning of the drawing to the more complicated parts at the end will help make sure you have a strong understanding of the basic Solid Edge functions. Working repeatedly through each challenge will allow you to increase your level of efficiency when making drawings and help you to achieve and maintain a World Class ranking.

***(22-01)* Draw the 6x4 rectangle in less than 20 seconds.**

***(22-02)* Draw the 6x4 rectangle and the two center lines in less than 30 seconds. Continue this drill four times, each time completing the drawing in less than 30 seconds to maintain your World Class ranking.**

***(22-03)* Draw the 6x4 rectangle, the two center lines and the eight offset lines in less than 70 seconds. Continue this drill four times, each time completing the drawing in less than 70 seconds to maintain your World Class ranking.**

***(22-04)* Draw the 6x4 rectangle, two centerlines, eight offset line, trim the drawing and fillet the 12 corners in less than 2 minutes and 50 seconds. Continue this drill four times, each time completing the drawing in less than 2 minutes and 50 seconds to maintain your World Class ranking.**

***(22-05)* Draw the 6x4 rectangle, two centerlines, eight offset lines, trim the drawing, fillet the 12 corners, draw the three circles and move and copy the 0.75 circle in less than 3 minutes and 10 seconds. Continue this drill four times, each time completing the drawing in less than 3 minutes and 10 seconds to maintain your World Class ranking.**

***(22-06)* Draw the 6x4 rectangle, two centerlines, eight offset lines, trim the drawing, fillet the 12 corners, draw the 3 circles, move and copy the 0.75 circle, draw the lines connecting the quadrants, trim the detail and rotate it 45 degrees in less than 3 minutes and 30 seconds. Continue this drill four times, each time completing the drawing in less than 3 minutes and 30 seconds to maintain your World Class ranking.**

***(22-07)* Draw the 6x4 rectangle, two centerlines, eight offset lines, trim the drawing, fillet the 12 corners, draw the 3 circles, move and copy the 0.75 circle, draw the lines connecting the quadrants, trim the detail, rotate it 45 degrees and create the rectangular pattern with the 0.5 circle in less than 3 minutes and 50 seconds. Continue this drill four times, each time completing the drawing in less than 3 minutes and 50 seconds to maintain your World Class ranking.**