

Chapter 10

The Bracket Problem

This chapter will cover the following:

- **Create a Top Orthographic View**
- **The Copy Command**
- **Placing an Arc between Circles Using the Fillet Command**
- **Using the IntelliTrim Tool to Turn Circles into Arcs**
- **Using the Mirror Tool to Copy Entities across the Centerline**
- **Creating a Front Orthographic View with Construction Lines**
- **Finishing the Top View by Projecting from the New Front View**
- **Creating an Arc from a Line to a Circle**
- **Using the Extend Tool**
- **Moving Entities from One Level to Another**

The bracket problem is the final problem in basic CAD training. Much like the other problems, the bracket problem will cover tools and concepts learned in previous chapters as well as introduce you to new strategies and procedures. The bracket problem is different than what you have drawn before because it features a multi-view layout. You will be using construction lines to add details from one view to another.

Starting a New Drawing

In the Bracket problem, you will begin the drawing by selecting the template you created in the previous assignment. In Figure 10.1, the window “Select template” is loaded by selecting the New tool on the Standard Toolbar. Select the browse and find the seed file you just made in chapter 8, “Metric seed”. Click Open to open the seed file.

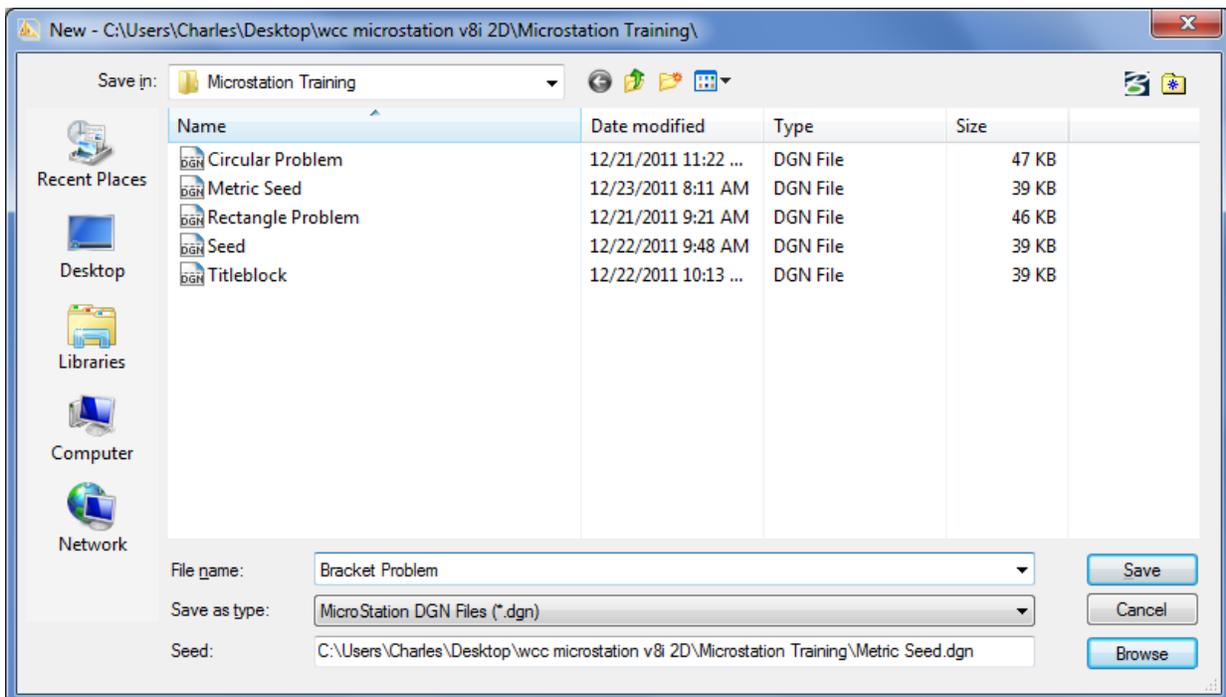


Figure 10.1 - Starting the Drawing

Use the Copy Command using Relative Coordinates

To begin drawing the Bracket problem, draw a 1 inch radius circle in the lower left hand corner of the display screen. Next, draw a 0.25 radius circle in the center of the first circle as shown in Figure 10.2.



Next, you need to copy both circles 2.3 inches to the right and 0.75 inches up. First, use the Element Selection tool to select both circles. Then select the Copy command from the Manipulate toolbox. Select the first point as the center of both circles and the AccuDraw compass will appear. Move the cursor to the right and type 2.3, and then up and type 0.75. Left-click to place the new circles, as shown in Figure 10.3.

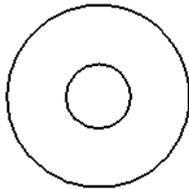


Figure 10.2 – Draw Two Circles

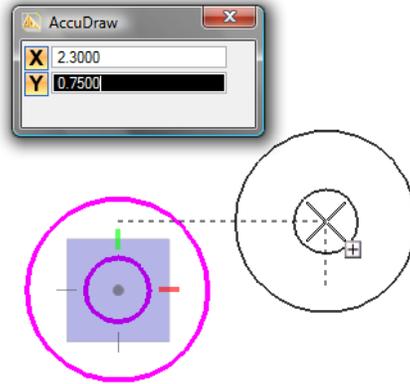


Figure 10.3 – Copy First Two Circles

Placing an Arc between Circles by Constructing a Circular Fillet

You need to place a 1.2” radius curve connecting both outer circles. Select the Construct Circular Fillet tool from the Fillets toolbox and the Construct Circular Fillet window will appear.

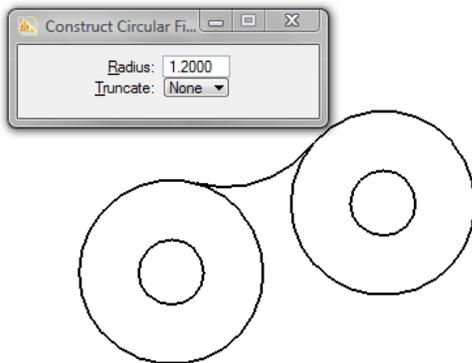


Figure 10.4 – Fillet Arc between Circles

In the Construct Circular Fillet window, change the Radius to 1.2 and set Truncate to None. Then you can select one of the outer circles near the top, and then the other also near the top. A 1.2 inch curve will appear between the two circles, as shown in Figure 10.4.

Next, draw a line off the left quadrant of the left circle, 0.8 inches downward, and another line of any length all the way to the right using the SmartLine command. The first line you drew there will be part of the bracket, and the horizontal line will be the centerline of the bracket. Next, you need to copy the centerline up 0.4 inches to begin creating the loop. Choose the Copy command, select the line, and use AccuDraw to copy the new line 0.4 inches up.

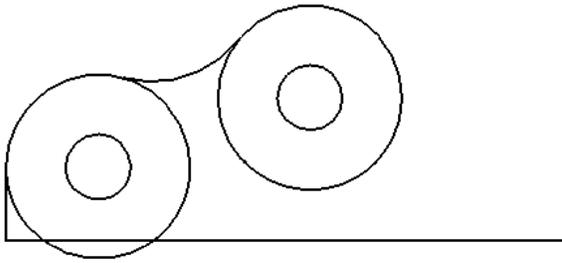


Figure 10.5 –Line and Centerline

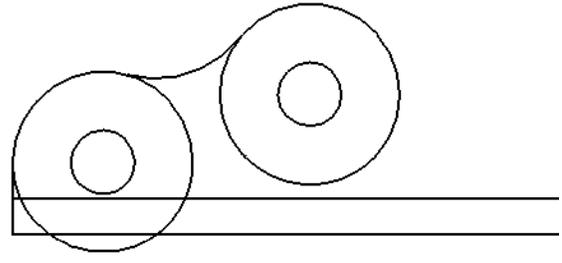


Figure 10.6 – The Centerline Copied

Now draw another line of any length from the east quadrant of the right circle downward but not intersecting the horizontal line. To create a curve that connects the two lines you just drew, select the Construct Circular Fillet tool from the Fillets toolbox. When the Construct Circular Fillet window appears this time, set the Radius to 0.4 and set Truncate to Both. Select either line first and then the other to place the curve. Notice that the extra parts of the lines disappear: this is due to the Truncate setting.

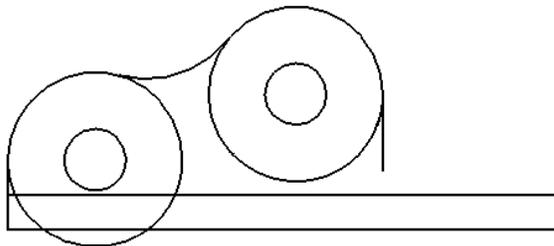


Figure 10.7 – Placing the Vertical Line

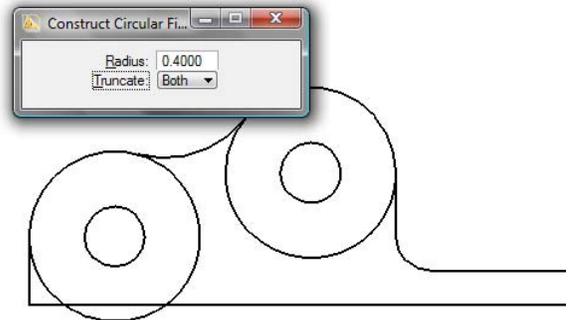


Figure 10.8 – The Circular Fillet

Using the IntelliTrim Tool to Turn Circles into Arcs

Next, select the IntelliTrim tool from the Modify toolbox and the IntelliTrim window will appear. Change the Mode to Advanced and the Operation to Trim, and also make sure the Select Cutting Elements radio button is highlighted. To execute the trim, first select the cutting elements, which are the two horizontal lines as well as the 1.2-inch radius curve. Right-click to continue. Next, select both 1-inch radius circles as the elements you wish to trim, and right click again. Finally, place two dots near the top edge of each circle to show the areas you wish to keep. Right click to finalize the trim.



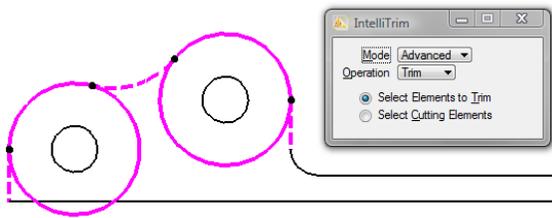


Figure 10.9 – Selecting Elements to Trim

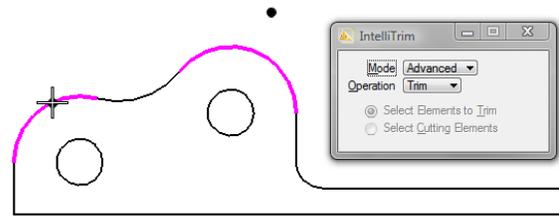


Figure 10.10 – Selecting Elements to Keep

*** World Class CAD Challenge 22-19 * - Create a New file and draw the 10 entities shown in Figure 10.10 in 50 seconds. Continue this drill four times, each time completing the drawing under 50 seconds to maintain your World Class ranking.**

Using the Mirror Tool to Copy Entities across the Centerline

Because the Bracket is symmetrical, you only have to detail one side of the part. You will use the Mirror tool from the Manipulate toolbox to create the other half of the part.



First, select all of the elements in the part except for the bottom horizontal line. Next, select the Mirror tool from the Manipulate toolbox and the Mirror Window will appear. Change Mirror About to Line and also select the Make Copy box.

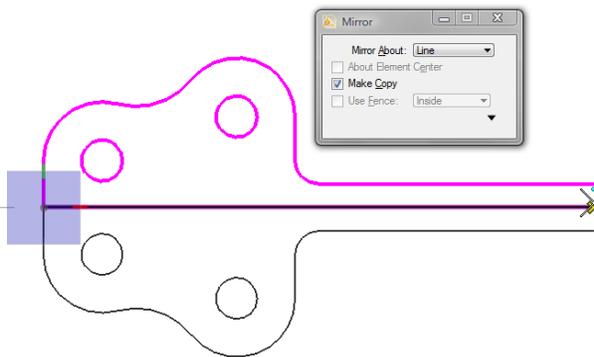


Figure 10.11 – Selecting the Entities for Mirroring

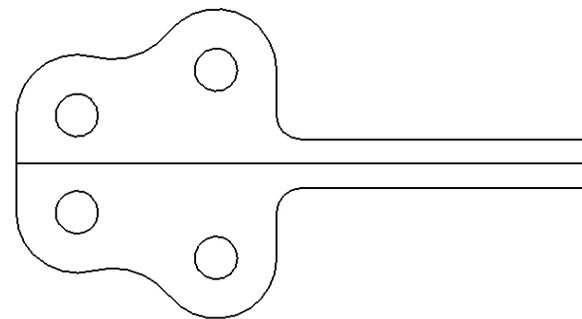


Figure 10.12 – Finishing the Mirror Process

Creating a Front Orthographic View Using Construction Lines

Zoom out of the drawing by selecting the Zoom Out tool from the 2D View Control toolbox. Also, scroll down so that the bracket moves to the top of the workspace.



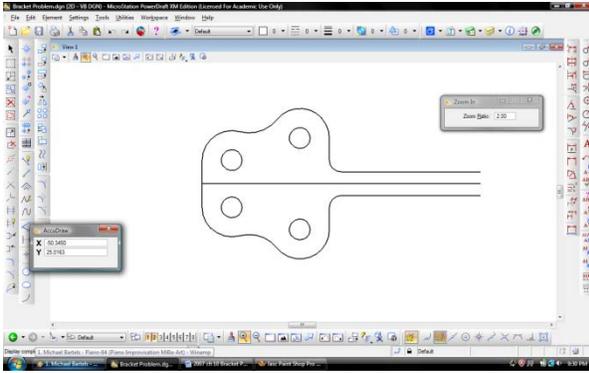


Figure 10.13 – Zooming Out One Time

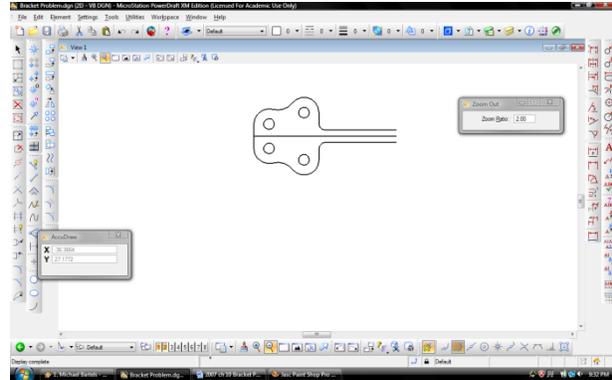


Figure 10.14 – Panning the Top Orthographic View into Position

Your next few construction lines will not be drawn with exact measurements. Just make sure you give yourself enough space to create the details that have to be accurate, which will come later.

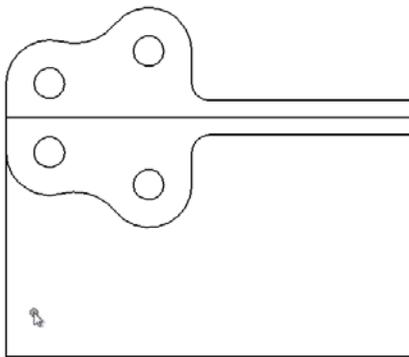


Figure 10.15 – Drawing the Left Boundary and Bottom Lines of the Front View

Select the SmartLine command from the Linear Elements toolbox and the SmartLine window will appear. Make sure that the Join Elements box is unchecked. Next, draw a line from the left side of the bracket straight down, and then another line from the bottom of the first all the way to the right.

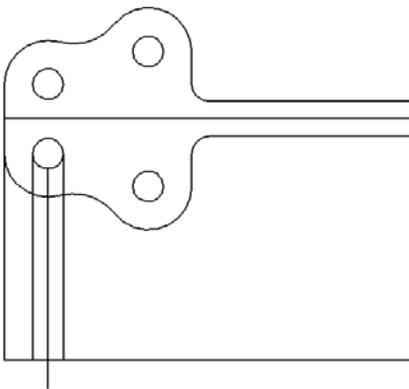
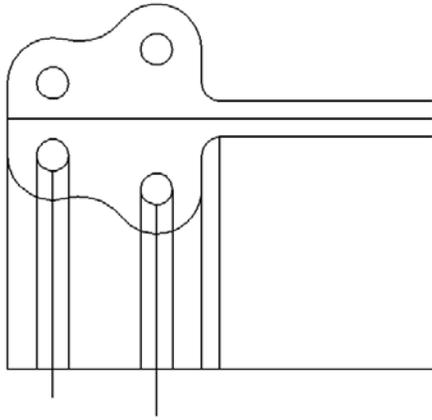


Figure 10.16 – Lines from the Left Circle

Now you need to draw construction lines that will show the detail of the holes. First, select the Perpendicular AccuSnap setting from the AccuSnap toolbox. To draw the lines, first select the bottom horizontal line and then the quadrant of the circle. This will ensure that the line is perpendicular. Do this for both the west and east quadrants of the bottom hole. Finally, draw a line starting at the south quadrant of the hole but this time pass through the horizontal line.





Draw the same construction lines for the bottom right circle. Also, bring a construction line up to the left side of the 0.4 arc and another up to the side of the bottom right curve.

Figure 10.17 – More Construction Lines

Using the Copy Tool on the Front Orthographic View

Select the Copy tool from the Manipulate toolbox. Select the bottom horizontal line and copy it upward 0.6 inches. Also, copy the vertical line coming off of the south quadrant of the left hole 5.9” to the left.

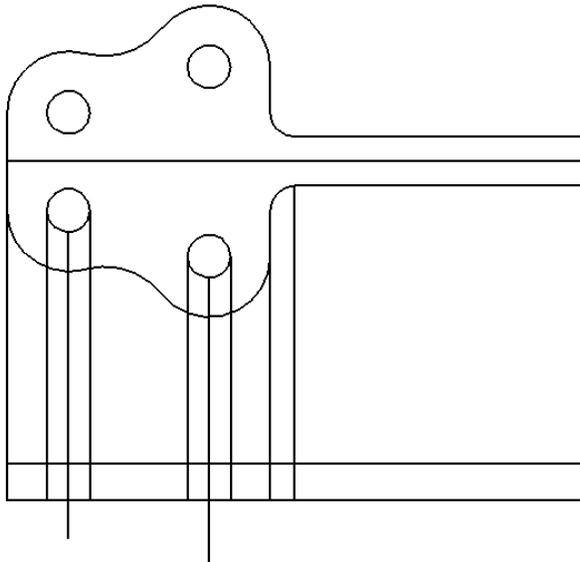


Figure 10.18 – Offset a Line 15 mm

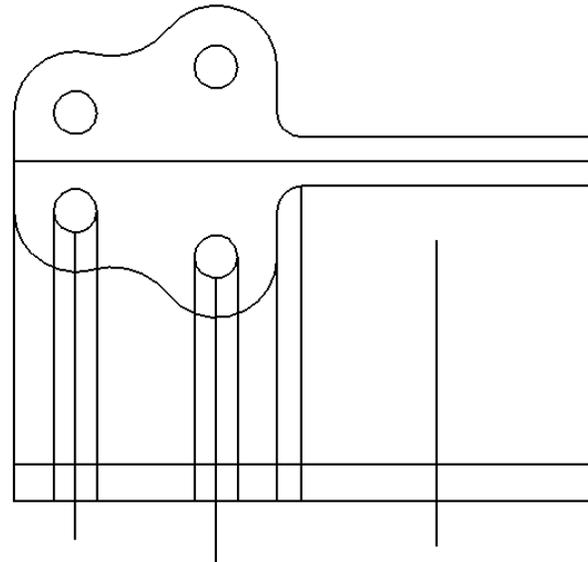


Figure 10.19 – Offset a Line 150 mm

*** World Class CAD Challenge 10-20 * - Create a New file and draw the 31 entities shown in Figure 10.18 in 2 minutes 35 seconds. Continue this drill four times, each time completing the drawing under 2 minutes 35 seconds to maintain your World Class ranking.**

Creating a Front Orthographic View Using Circles

Select the Place Circle tool from the Ellipses toolbox and the Place Circle window will appear. Draw two circles, both with their center on the intersection of the new bottom horizontal line and the newly copied vertical line. Draw one circle with a 1" radius and the other with a 0.6" radius. Then move both circles using the Move command. First, select both circles by using the Element Selection tool. Then select the Move tool from the Manipulate toolbar. Select the south quadrant of the larger circle as the base point for the move, and move the circles up to the intersection of the vertical copied line and the bottom horizontal line.

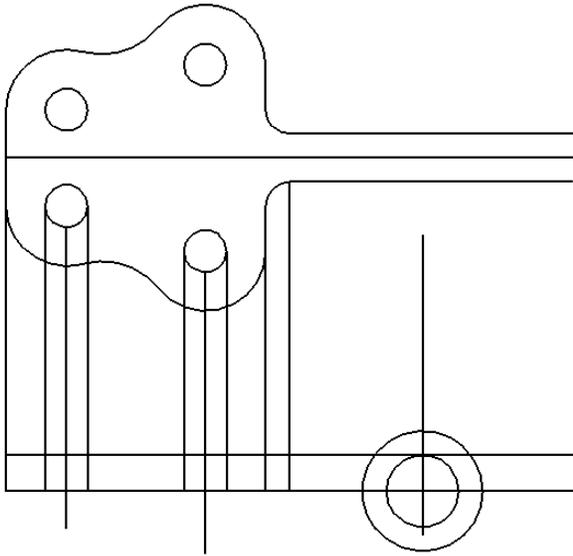


Figure 10.20 – Adding Two Circles

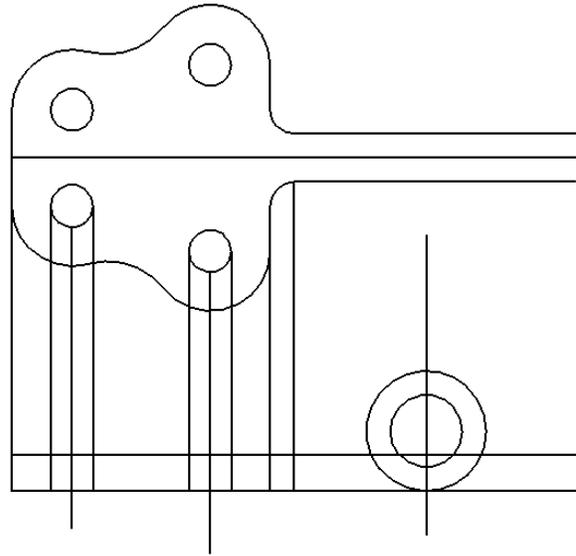


Figure 10.21 – Moving the Circles to the Baseline

Finishing the Top View by Projecting Off the New Front View

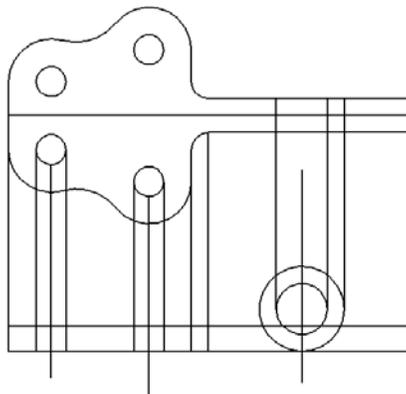


Figure 10.22 – Projecting Lines to the Top View

Using the SmartLine command, draw three construction lines. Draw one from each of the east quadrants of the circles to the uppermost horizontal line. You might want to use the Perpendicular AccuSnap setting when you drew construction lines before.

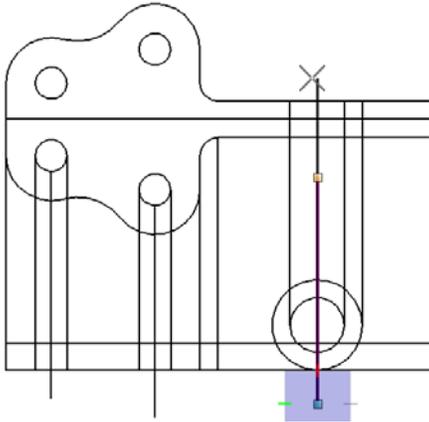


Figure 10.23 – Projecting the Centerline

You will need to show a centerline on the top view, so borrow the centerline of the two circles that make the loop of the bracket. Select the line with the Element Selection tool and then use the handles to extend it up through the top view of the bracket.

Creating an Arc from a Line to a Circle

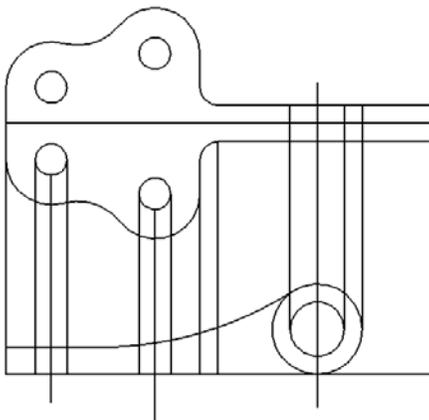


Figure 10.24 – Making a 200 Radius Arc

Select the Create Circular Fillet tool from the Fillets toolbox. Change the Radius to 8 and set Truncate to Both. Select the top of larger circle on the bottom view as the first point and then the top horizontal line of the bottom view as the second point.

Using the Extend Command

To transfer the arc you just drew on the bottom view to the top view, you need to first draw another construction line. Using the SmartLine command, draw a line from the left endpoint of the arc up past the horizontal line of the top view.

Next, select the Extend tool from the Modify toolbox. Extend both horizontal edges from the top view to the right so that they end at the new vertical construction line.



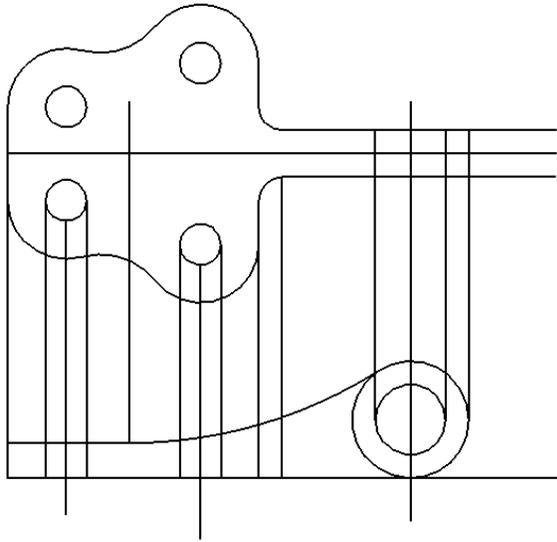


Figure 10.25 – Drawing an Extension Line

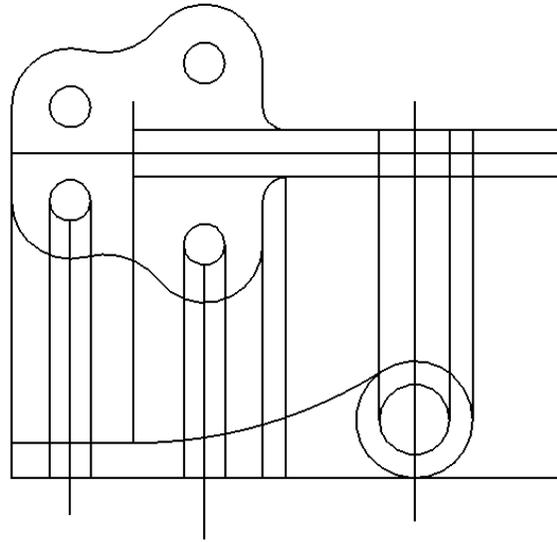


Figure 10.26 – Extending Two Lines

Also, extend the top horizontal line on the bottom view to the construction line that corresponds with the face of the bracket. Now you can erase that construction line along with the one you drew to extend the two lines above. Finally, draw one more construction line from the west quadrant of the larger circle on the bottom view to the top horizontal line on the top view.

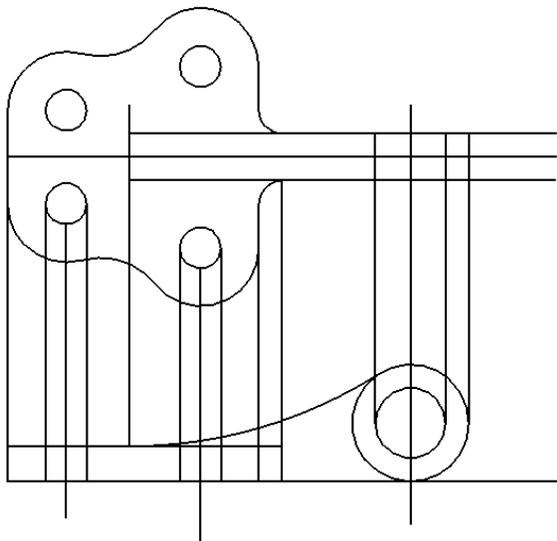


Figure 10.27 – Extending One Line

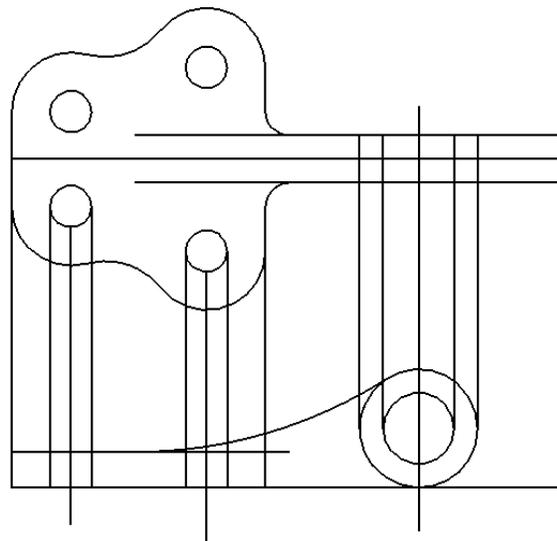


Figure 10.28 – Erasing the Boundary Lines

Using the IntelliTrim Tool

Select the IntelliTrim tool from the Modify toolbox and the IntelliTrim window will appear. Set the Mode to Quick and the Operation to Trim. First select the line



highlighted in Figure 10.29 as the element to trim to, and then draw lines over the four construction lines to trim them. Next, restart the IntelliTrim command and select the line highlighted in Figure 10.30. Trim toolbar and pick the bottom line (shown in red) in figure 10.29 representing the loop in the top view. After selecting the cutting line, press Enter and trim the four lines that were drawn from the circles that make up the loop in the front view.

Press the Enter key twice to stay in the command and select top line on the front view (shown in red) as the new cutting edge (See Figure 10.30). After selecting the cutting line, press Enter and trim the six lines that were drawn from the circles showing the loop in the front view, but not the centerlines. Finally, you need to trim the very bottom horizontal line, the vertical line all the way to the left, and the edge of the 1" circle that is on the inside of the 8" fillet. Select the bottom line of the bracket as the trimming line and then draw a line over the inside of the circle.

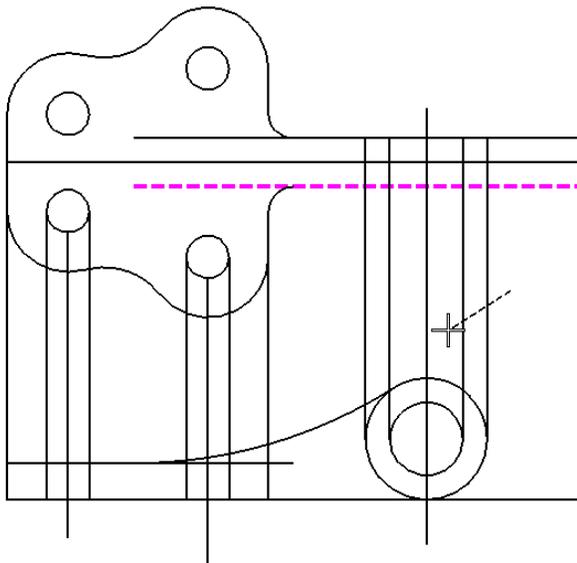


Figure 10.29 – Trim Four Lines

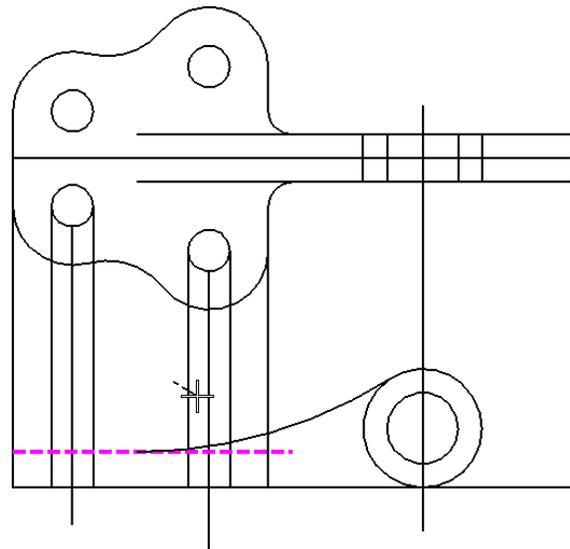


Figure 10.30 – Trimming Six Lines

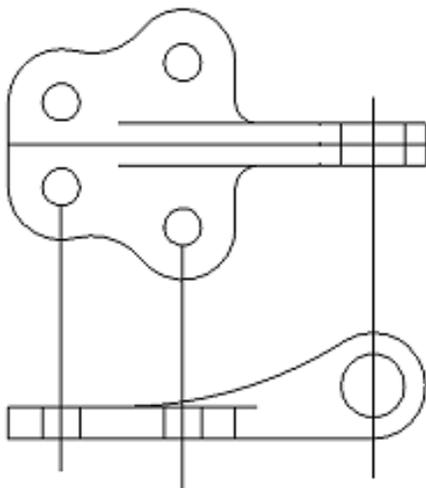


Figure 10.31 – Trimming Two Objects

Moving Entities from One Layer to Another

The last thing you need to do is move the construction lines and turn them into centerlines on both views. All of your necessary levels should already be set under the seed file. To change the level of an element, just select it with the Element Selection tool, and then select the preferred level from the level drop menu.

Before you change the level of the construction lines, you need to resize them. Using the Element Selection tool and the element handles, shorten all of the vertical construction lines and lengthen the horizontal construction line as shown in Figure 10.32. Then select the four lines shown in Figure 10.32 and then select the Center level from the Level drop menu.

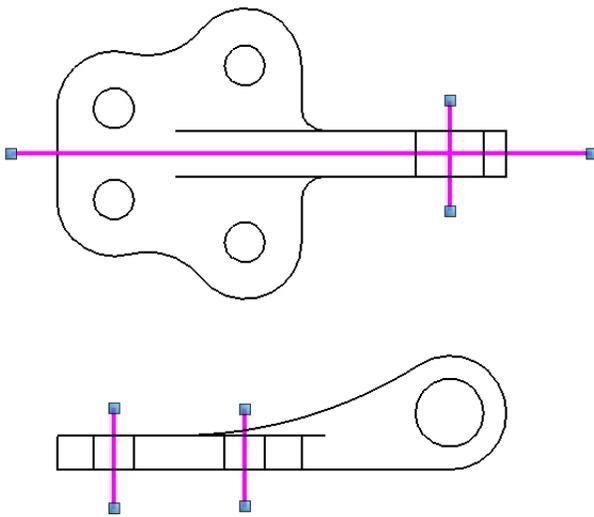


Figure 10.32– Selecting Centerlines

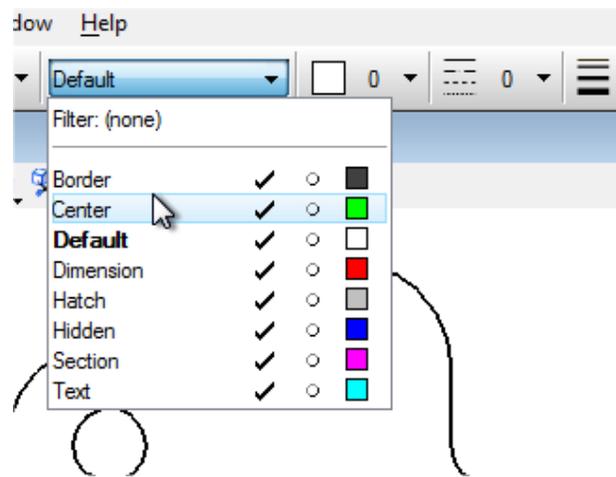


Figure 10.33 – Changing to Center Level

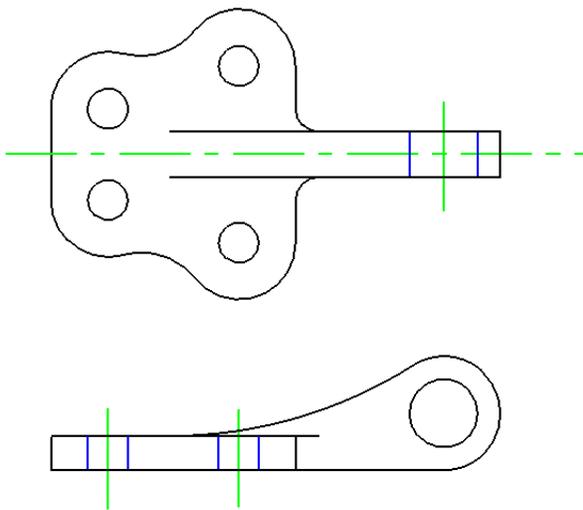


Figure 10.34 – Changing to Hidden Layer

Now select the six lines that show the hole from the other view in each drawing. Change these lines to the Hidden level. Make sure that the symbology is set to ByLevel under the color and linetype drop boxes.

Figure 10.35 shows the complete display of a properly drawn Bracket problem for your preview.

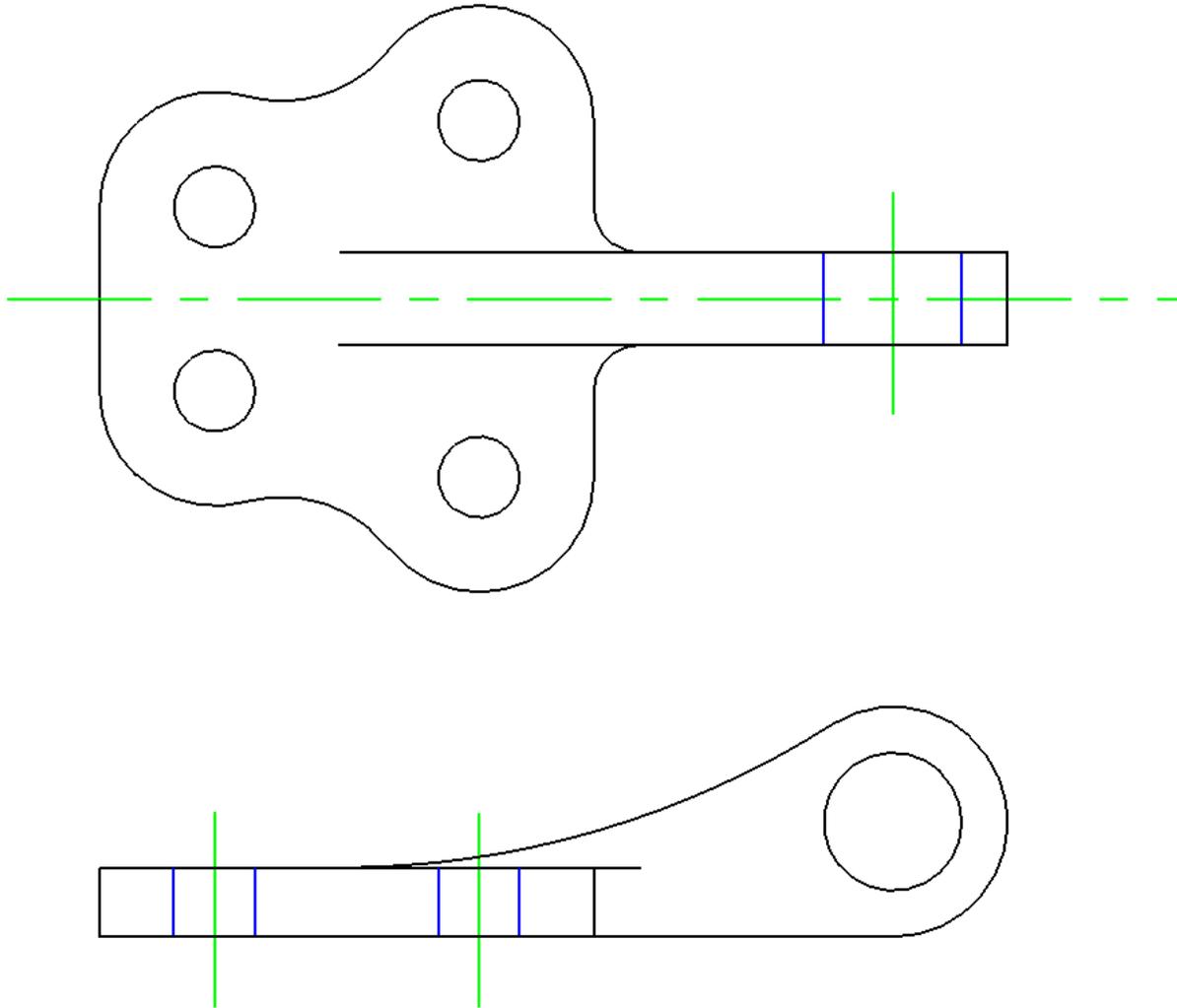


Figure 10.35 – The Bracket Problem

*** World Class CAD Challenge 22-21* - Create a New file using the Metric template, and draw the 39 entities shown in Figure 10.35 in 3 minutes 15 seconds. Continue this drill four times, each time completing the drawing under 3 minutes 15 seconds to maintain your World Class ranking.**