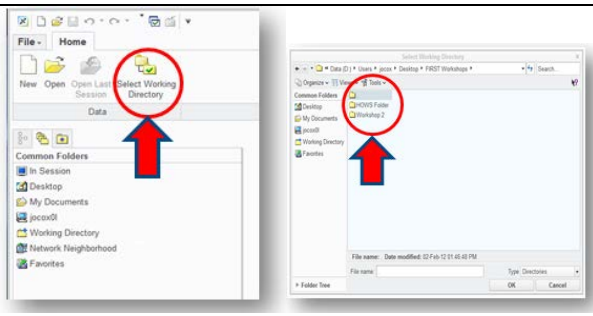
Instructions for creating the conceptual robot arm model parts

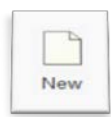
Task 1: Creating the gripper

1. Begin your conceptual model by opening **Creo Parametric** by Clicking its icon.

2. Now set your working directory to the workshop folder by selecting the **Select Working Directory** icon and then navigating to the **HOWS Folder 2012/MyParts** and clicking **OK**.

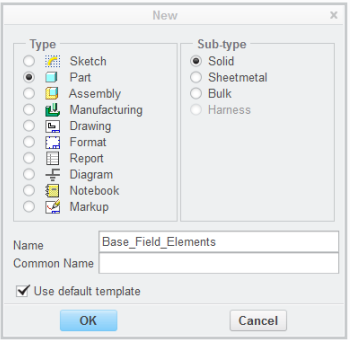


3. Now open a new part model by clicking the **New** icon.



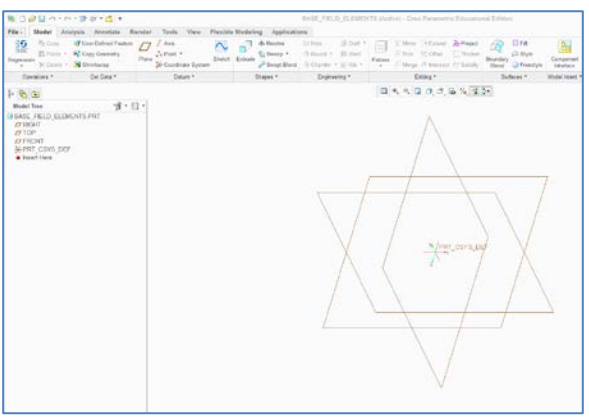
4. Type in the name of the new part as

"Robot_Gripper".



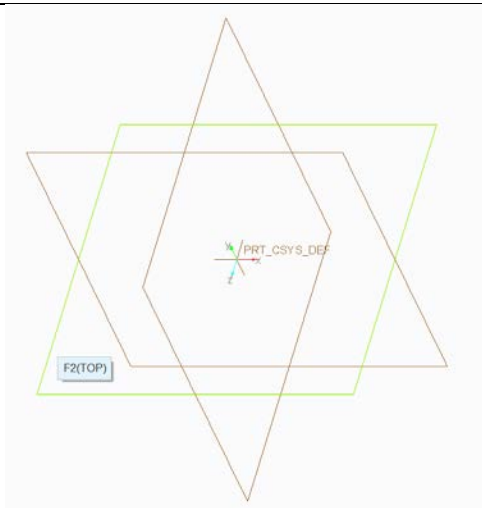
***Note**: You cannot have spaces in the file name but you can use an underscore.*

5. **Click OK**. Your **Model Display** will look as shown. There will be 3 orthogonal planes displayed.

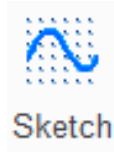


6. Enter the **2D Sketch** mode to create a sketch of the bottom of the rectangular base. To do this, begin by left clicking to select one of the datum planes in the

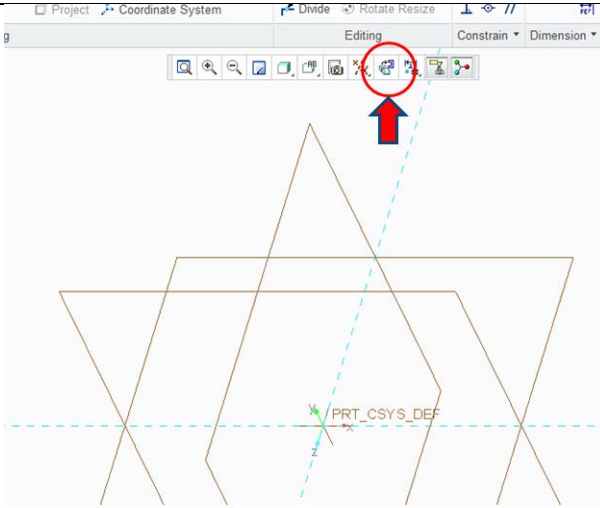
Model Display area.



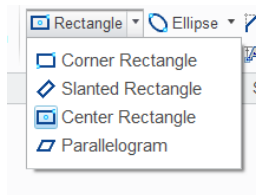
7. Then, Click the **Sketch** icon.



8. Now click on the **Sketch View** icon to orient the plane so that you are looking straight on it.

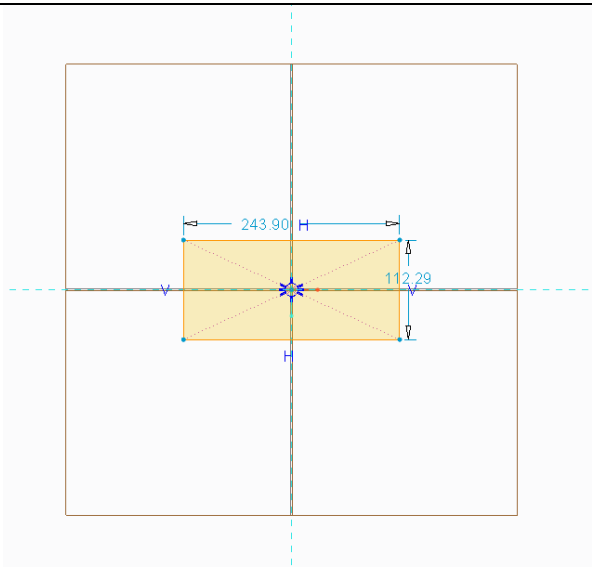


9. Click the **Rectangle** tool in the **Sketching** region of the Ribbon to access the list of rectangle types. Click to select the **Center Rectangle**.



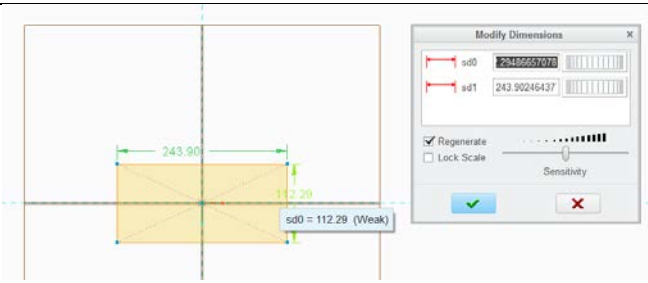
10. Use the **Center Rectangle** tool to create a rectangle centered at the intersection of the light blue reference lines.
    - Click once at the intersection point to center the rectangle, drag the mouse outward to expand the dimensions of the rectangle from the center.
    - Click once to form the rectangle.
    - Click the **Middle Mouse Button** to

deselect the **Rectangle** tool.

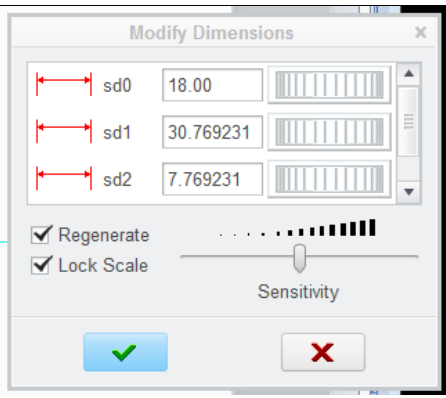


11. Now **Drag Select** the entire rectangle: Click and Hold the left mouse button and drag a selection box around the rectangle. The dimensions will turn green as shown. Then, click the **Modify** (Dimensions) icon 

in the **Editing** region of the Ribbon. Make sure that the **Lock Scale** box is checked.



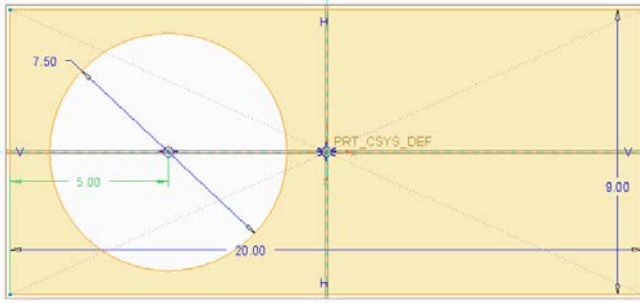
12. Set the width dimension (sd0) to 9 units and then click the green checkmark.



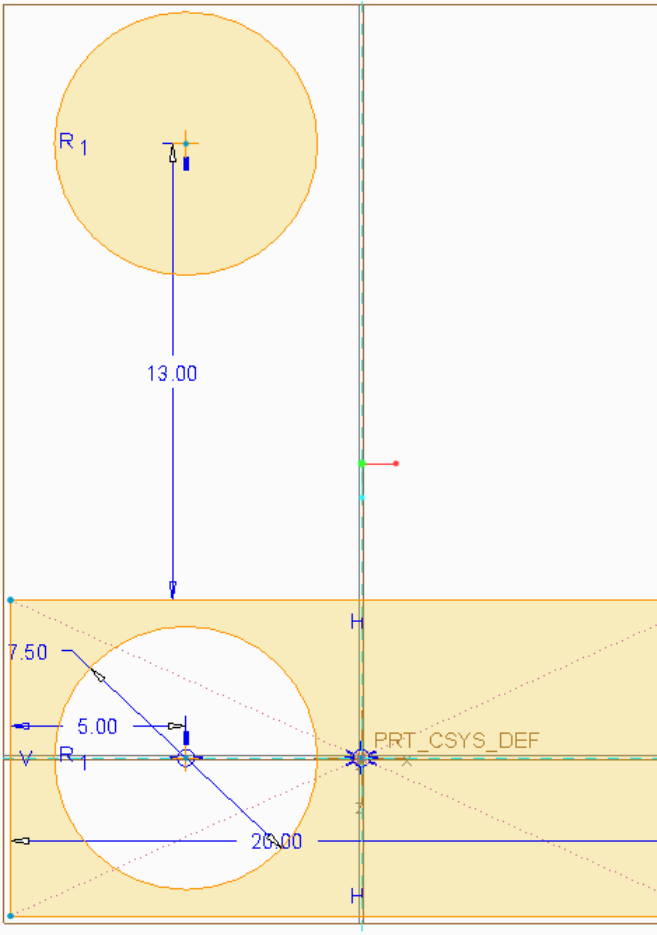
13. Double click on the length dimension (sd1) and set it to 20 units.

14. Now select the circle tool and left click on the axis in the center of the rectangle box and to the left side as shown. Then stretch the circle out and left click again. Now middle click to end the circle tool. Double click on the circle dimension and set it to 7.5. Also double click on the dimension aligning the circle center form the left side

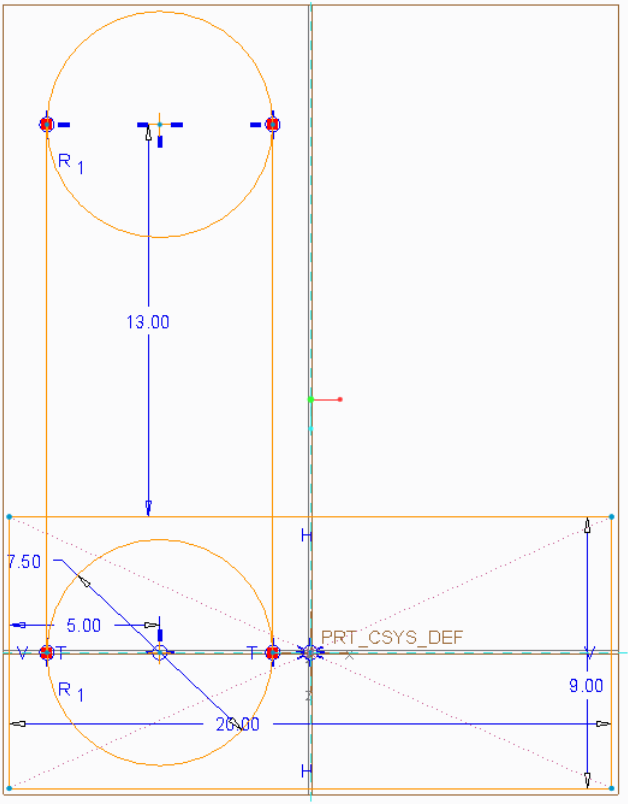
of the rectangle and set it to 5.



15. Create a second circle using the circle tool again and let Creo snap the center of the circle as well as the radius of the circle so that the two sircles are the same as shown. Left click to finish placing the second circle and then middle click twice to finish. Set the dimension between the rectangle and the circle to 13.

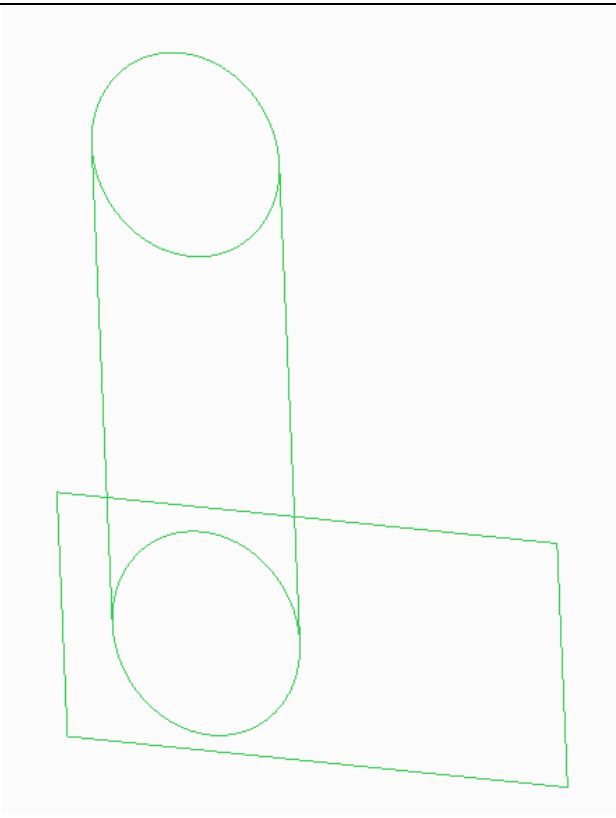


16. Finish the construction of the gripper by drawing two lines on either side of the circles that connect them and close the cross-section of the inner-tube as shown.



17. Now exit the sketcher by clicking the green check mark in the upper menu.

18. Save your part.



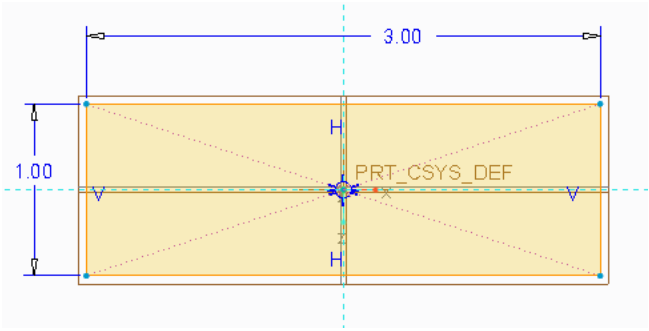
Congratulations! You have completed the gripper component.

Task 2: Creating the arm

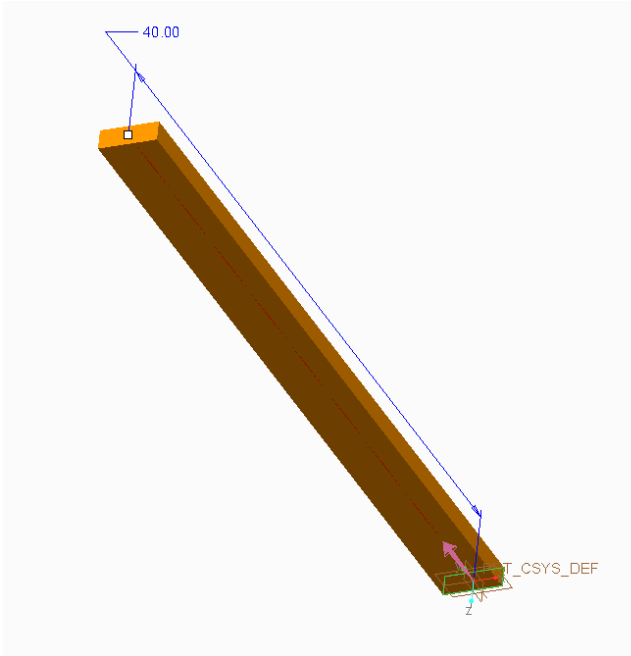
Objective: In this task you will open a new part and create the robot arm that will be used to construct the assembly.

1. Close the Robot_Gripper part and open a

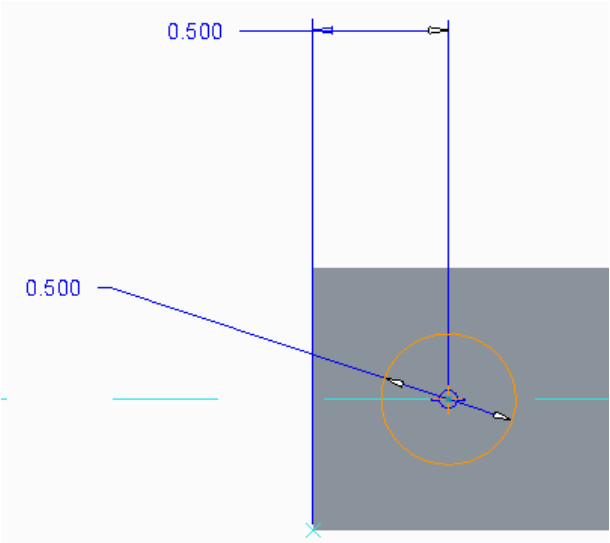
new part and name it “**Robot_Arm**”. Then select the top plane and go into **Sketch** mode. Then using the **Centered Rectangle** tool create the following rectangle.



2. Now exit the **Sketch** mode and **Extrude** this rectangle sketch 40 units by using the extrude tool.



3. Select one of the thin sides of the rectangle and go back into the **Sketch** mode and sketch a circle at one end as shown below.



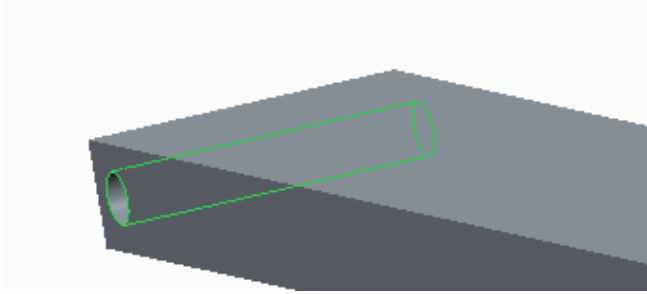
4. Exit sketcher and extrude this circle using the **Extrude** tool in the extrude dashboard.

5. Now change the extrude to cutting away material using the **Cut** tool.

Also you can change the direction of the hole to make sure it goes through the arm using the direction tool

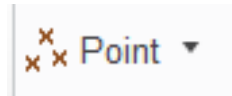
And finally, you can limit the hole so that it just goes through the solid

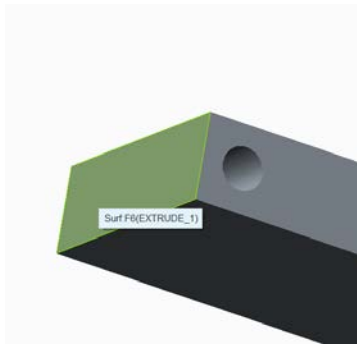
material of the arm
however big the arm is
using the through all tool
.



6. Now we need to create a datum point on the end face of the arm that we will use later on in the assembly.

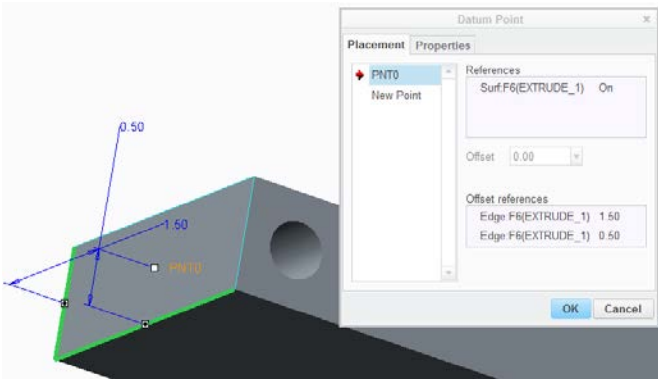
7. Use the datum point tool and then select the end face nearest the hole.





8. Drag the green handles of the datum point to the two edges so that you can place the point in the middle of the face. Then

change the values in the dialog box by right clicking on them so that the point is in the middle of the face.



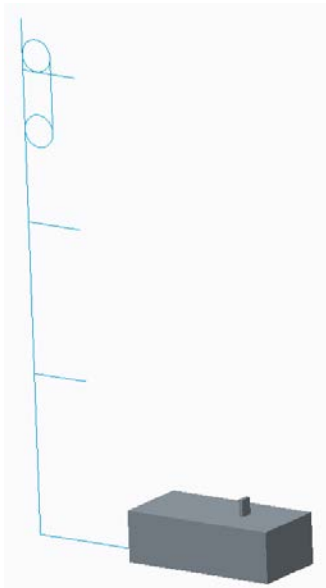
9. Click **OK** to finish creating the datum point.

10. Make sure that you save your part!

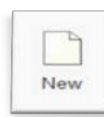
Congratulations! You have completed the robot arm component.

Task 3: Creating the base

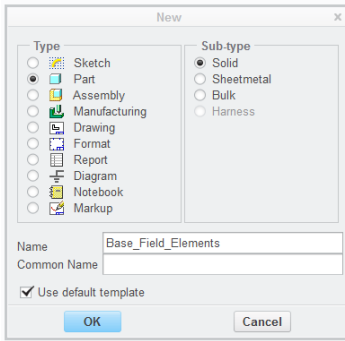
Objective: In this task you will create the base of the conceptual model.



1. Now open a new part model by clicking the **New** icon.

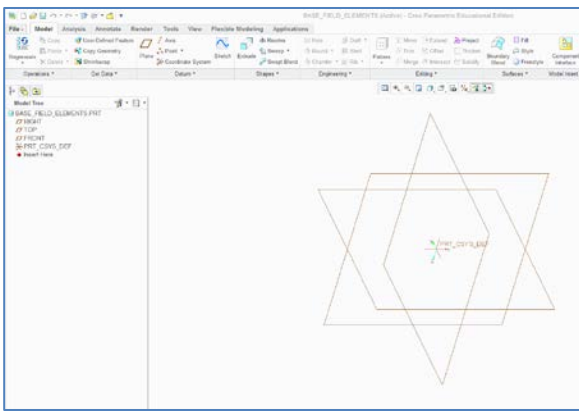


2. Type in the name of the new part as **“Base_Field_Elements”**.

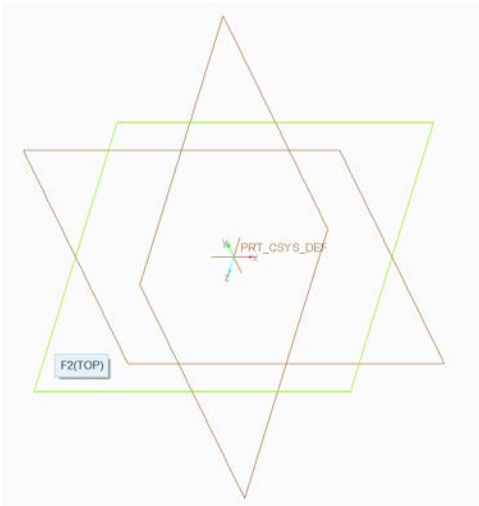


***Note**: You cannot have spaces in the file name but you can use an underscore.*

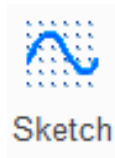
3. Click OK. Your **Model Display** will look as shown. There will be 3 orthogonal planes displayed.



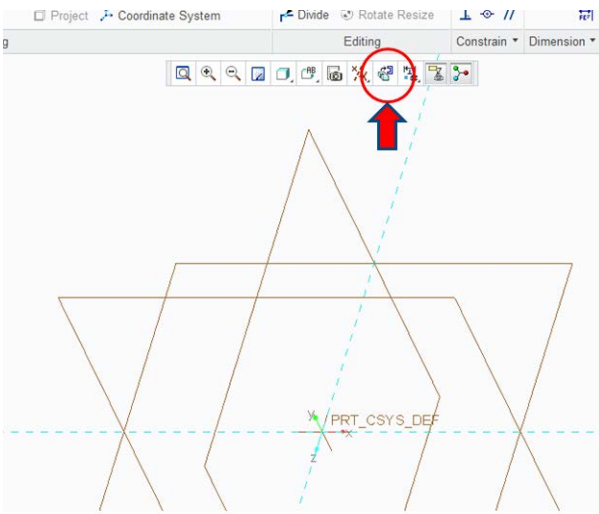
4. Enter the **2D Sketch** mode to create a sketch of the bottom of the rectangular base. To do this, begin by left clicking to select one of the datum planes in the **Model Display** area.



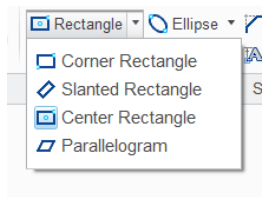
5. Then, Click the **Sketch** icon.



6. Now click on the **Sketch View** icon to orient the plane so that you are looking straight on it.



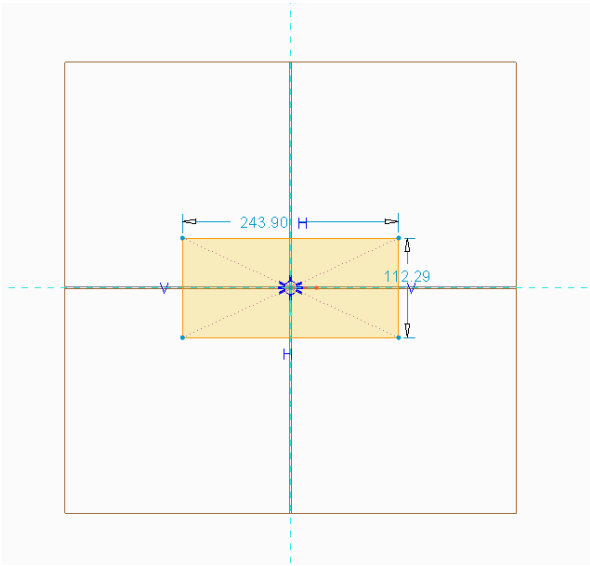
7. Click the **Rectangle** tool in the **Sketching** region of the Ribbon to access the list of rectangle types. Click to select the **Center Rectangle**.

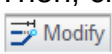


8. Use the **Center Rectangle** tool to create a rectangle centered at the intersection of the light blue reference lines.

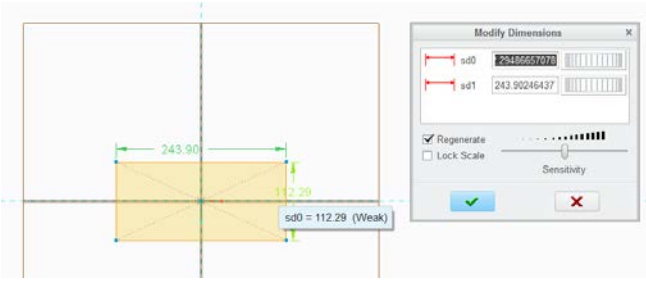
- Click once at the intersection point to center the rectangle, drag the mouse outward to expand the dimensions of the rectangle from the center.
- Click once to form the rectangle.
- Click the **Middle Mouse Button** to

deselect the **Rectangle** tool.

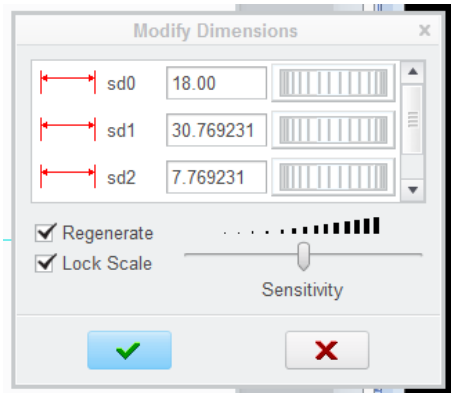


9. Now **Drag Select** the entire rectangle: Click and Hold the left mouse button and drag a selection box around the rectangle. The dimensions will turn green as shown. Then, click the **Modify** (Dimensions) icon 

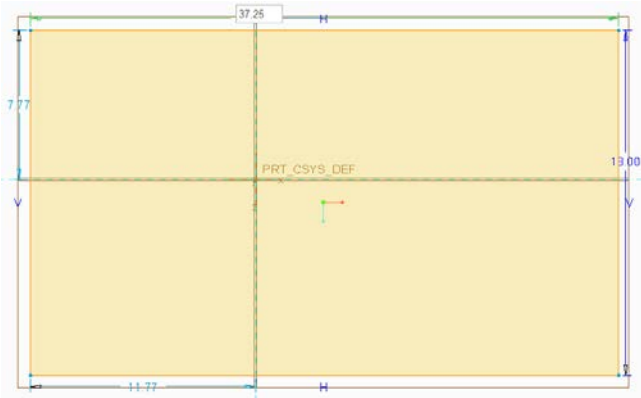
in the **Editing** region of the Ribbon. Make sure that the **Lock Scale** box is checked.



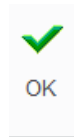
Set the width dimension (sd0) to 18 units and then click the green checkmark.



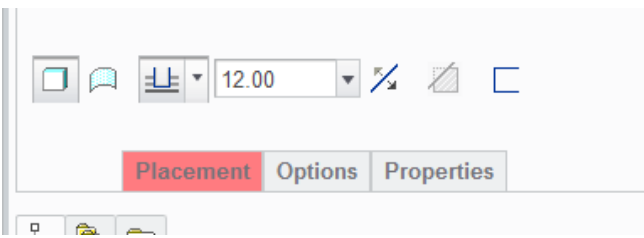
Double click on the length dimension (sd1) and set it to 37.25 units.



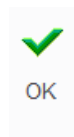
10. Finish your sketch by clicking the green check mark



11. Select the **Extrude** icon and set the value to 12 units.

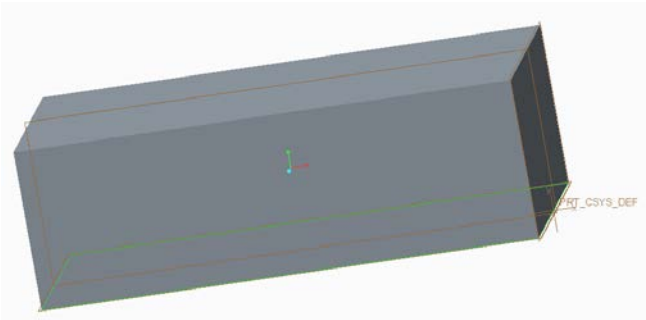


12. Now click the green check mark

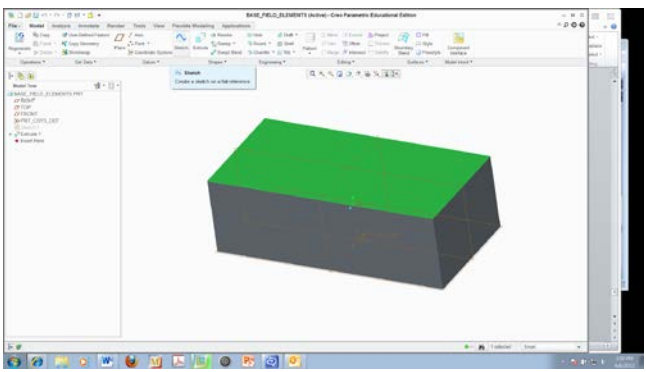


13. You can rotate the rectangle to see the

base by holding the middle mouse button down and moving your mouse.

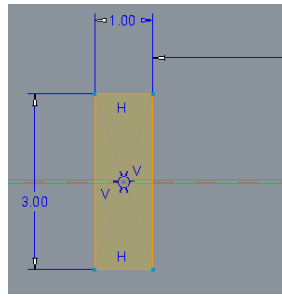


14. Now select the top of the base by left mouse clicking the top surface and then select the **Sketch** icon. This will put you in sketch mode again where you will be able to sketch on the top surface.



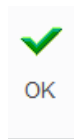
15. Orient your view using the **Sketch View i**con .

16. Now sketch another rectangle oriented at 11.25 units from the right side of the base that will be the connecting point for the robotic arm. Use the dimensions shown in the image at right.

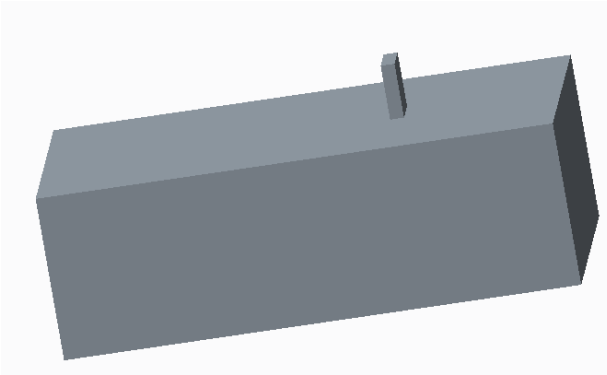


*Note: You can use the **Normal** dimension tool to set the dimension from the right hand side of the base. Click on the **Normal** dimension tool, then left mouse button click on the line representing the right edge of the base and left mouse button click to select the right edge of the new sketched rectangle, then middle click to place the dimension. You can now set the dimension to 11.25.*

17. Finish your sketch using the green check mark.



18. Once again select the **Extrude** tool and set the height of the new rectangle at 4 units. Your finished base should look like this.

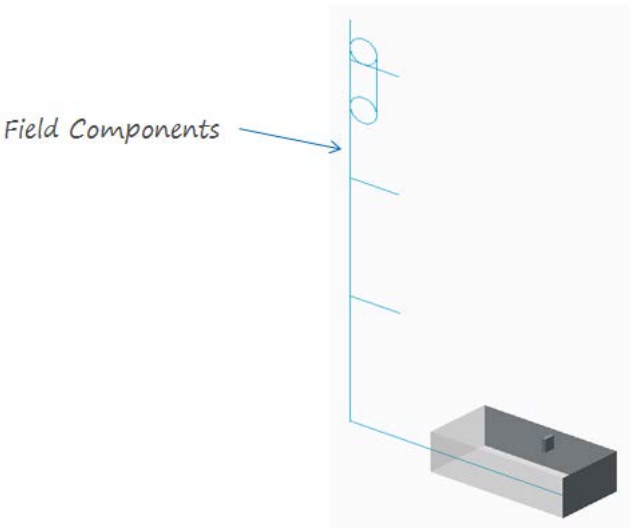


19. Make sure that you save your part!

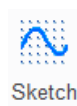
Congratulations! You have completed the base geometry.

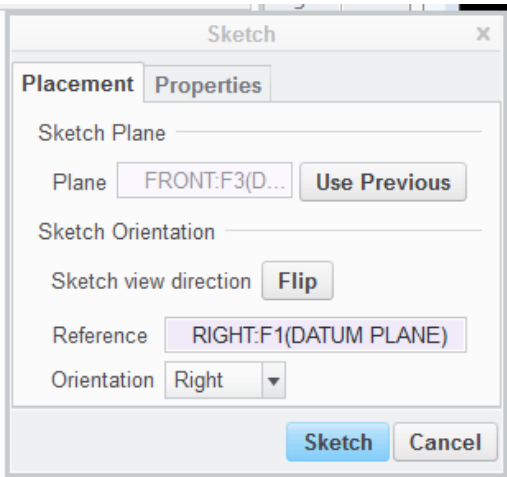
Task 4: Creating the field components

Objective: In this task you will add to the base the field components of the conceptual model. These will be in the form of a 2D sketch.

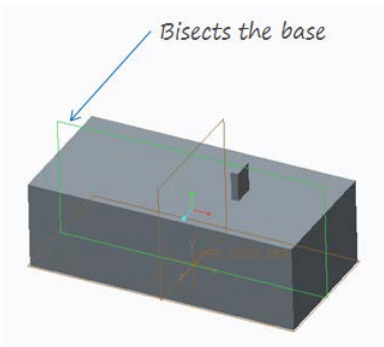


1. Create a new sketch in your model by clicking the **Sketch** icon.

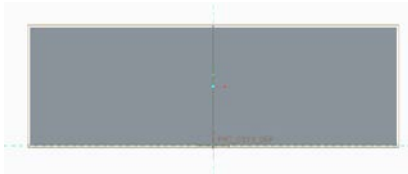




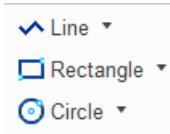
2. Now select the plane that bisects the base. And click the **Sketch** button.



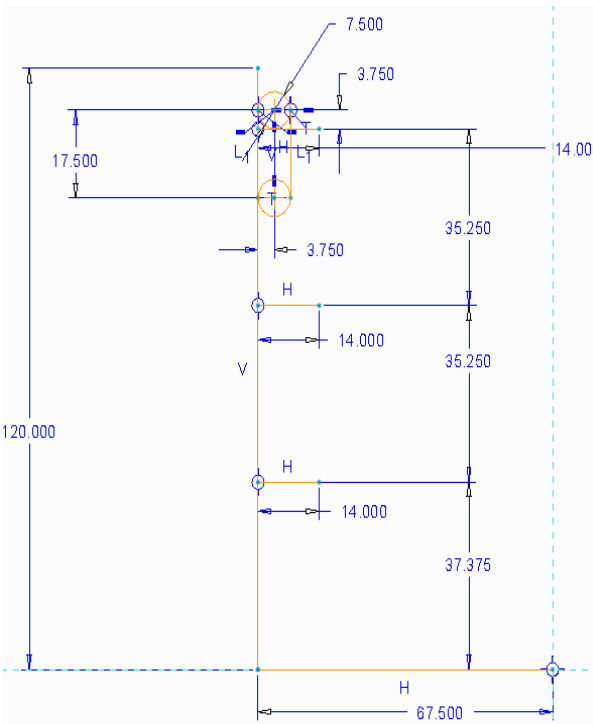
3. Orient the view again using the Orient View icon.

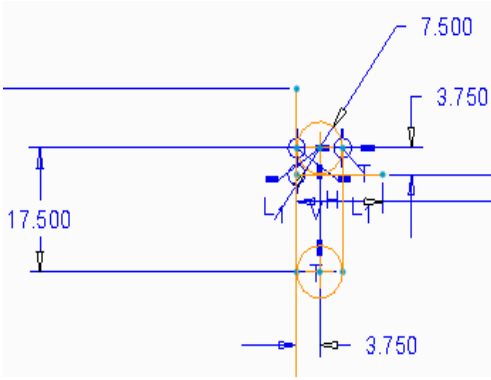


4. Now use the **Line** and **Circle** tools



to create a 2D sketch of the field floor and poles used in the game, as shown below. The orange lines are the lines you will construct.





5. Remember clicking the middle mouse button once, exits the line and circle tools. Once you have constructed all the field elements, click the green check mark to exit the sketcher.
6. Make sure that you save your part.

Congratulations! You have completed the base and field components.

You have now completed all of the parts!