Tutorial Exercise #28
Column.Dwg (Wireframe Model)

3.50 DIA

2.50

2.00 DIA

3.50

5.00

R 1.50

2.50

1.50 DIA
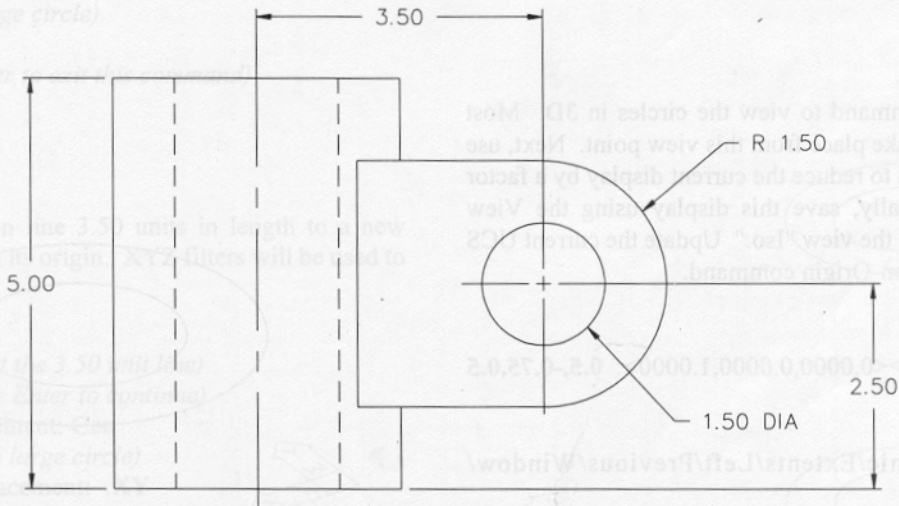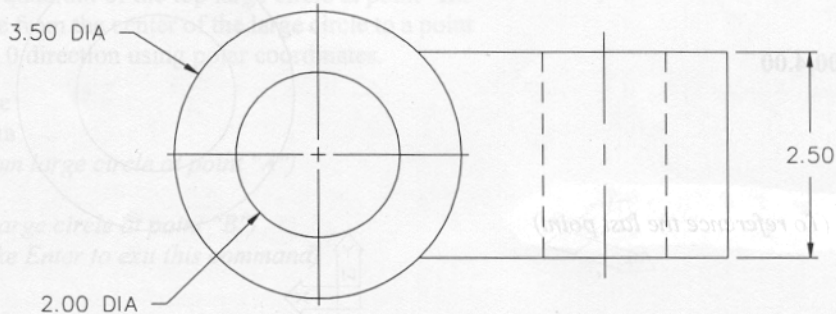
PURPOSE:
This tutorial is designed to use the UCS command to produce a 3D wireframe model of the Column. This model will be surfaced in the next tutorial segment.

SYSTEM SETTINGS:
Begin a new drawing called "Column." Use the Units command to change the number of decimal places past the zero from 4 to 2. Keep the remaining default unit values. Using the Limits command, keep 0,0 for the lower left corner and change the upper right corner from 12,9 to 10.50,8.00. Use the Grid command and change the grid spacing from 1.00 to 0.25 units. Do not turn the snap or ortho On.

LAYERS:
Create the following layers with the format:

Name-Color-Linetype
Wireframe - Yellow - Continuous
Surface - Magenta - Continuous

SUGGESTED COMMANDS:
Begin drawing the Column by laying out the plan view using the circle command. Use XYZ filters to copy the circles in the Z direction to form the column. Create new coordinate systems to lay out the flange that attaches to the Column. Use the Trim command to edit the Column before surfacing.

DIMENSIONING:
Dimensions do not have to be added to this problem.

PLOTTING:
This tutorial exercise may be plotted on "B"-size paper (11" x 17"). Use a plotting scale of 1=1 to produce a scaled plot.

Step #1

Begin this tutorial by drawing two circles in plan view using the Circle command. These Circles represent the main cylinder and hole going through it.

Command: **Circle**
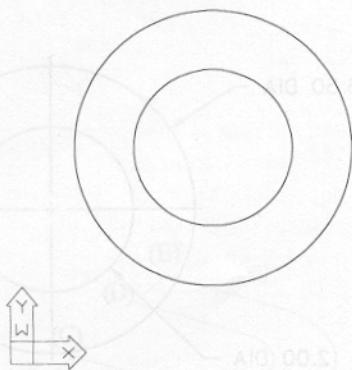3P/2P/TTR/<Center point>: **4.00,4.00**
Diameter/<Radius>: **D**
Diameter: **3.50**

Command: **Circle**
3P/2P/TTR/<Center point>: **@** *(To reference the last point)*
Diameter/<Radius>: **D**
Diameter: **2.00**

Step #2

Use the Vpoint command to view the circles in 3D. Most constructions will take place from this view point. Next, use the Zoom command to reduce the current display by a factor of 0.30 units. Finally, save this display using the View command and name the view "Iso." Update the current UCS icon with the Ucsicon-Origin command.

Command: **Vpoint**
Rotate/<View point><0.0000,0.0000,1.0000>: **0.5,-0.75,0.5**

Command: **Zoom**
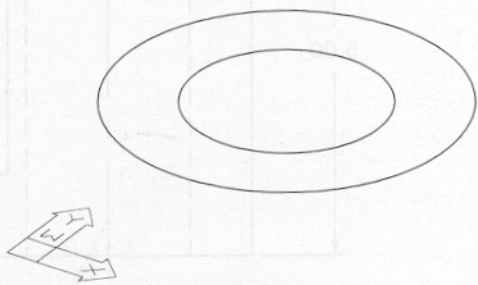All/Center/Dynamic/Extents/Left/Previous/Window/
<Scale(X)> **0.30X**

Command: **View**
?/Delete/Restore/Save/Window: **S**
View name to save: **Iso**

Command: **Ucsicon**
ON/OFF/All/Noorigin/ORigin<ON>: **Origin**

Step #3

Use the Copy command and XYZ point filters to copy the bottom circles 5.00 units in the Z direction.

Command: **Copy**
Select objects: *(Select the two circles)*
Select objects: *(Strike Enter to continue)*
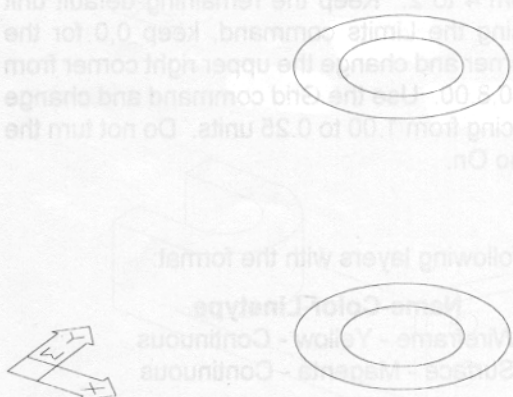<Base point or displacement>/Multiple: **Cen**
of *(Select the large circle)*
Second point of displacement: **.XY**
of **Cen**
of *(Select the large circle)*
(Need Z): **5.00**

Step #4

The next series of entities drawn are merely for construction purposes only. They will be deleted at later steps. First, draw a line from the quadrant of the bottom large circle at point "A" to the quadrant of the top large circle at point "B." Next, draw a line from the center of the large circle to a point 3.50 units in the 0 direction using polar coordinates.

Command: **Line**
From point: **Qua**
of *(Select bottom large circle at point "A")*
To point: **Qua**
of *(Select top large circle at point "B")*
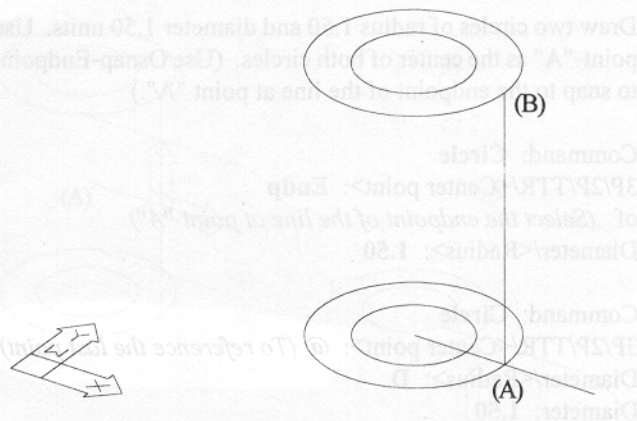To point: *(Strike Enter to exit this command)*

Command: **Line**
From point: **Cen**
of *(Select bottom large circle)*
To point: **@3.50<0**
To point: *(Strike Enter to exit this command)*

Step #5

Move the construction line 3.50 units in length to a new height 2.50 units from its origin. XYZ filters will be used to accomplish this.

Command: **Move**
Select objects: *(Select the 3.50 unit line)*
Select objects: *(Strike Enter to continue)*
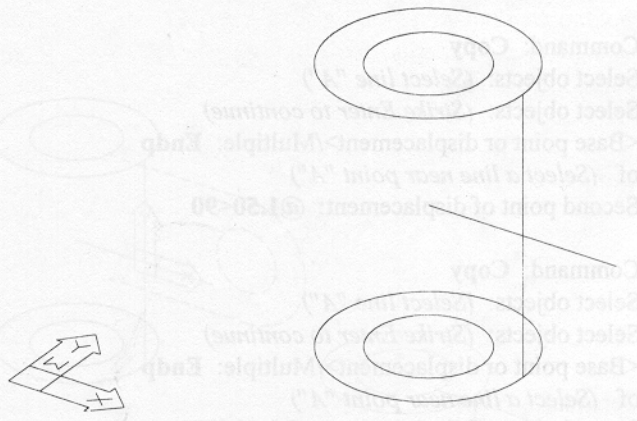Base point or displacement: **Cen**
of *(Select the bottom large circle)*
Second point of displacement: **.XY**
of **Cen**
of *(Select the bottom large circle again)*
(Need Z): **2.50**

Step #6

Create a new UCS using the UCS command and the 3 point option. (Be sure to use Osnap-Intersec and Osnap-Endpoint to snap onto intersections and endpoints of entities.) Use the prompts below and illustration at the right to guide you in this procedure. Use the UCS command again to save the position under the name "Front."

Command: **UCS**
Origin/ZAxis/3point/Entity/View/X/Y/Z/Prev/Restore/Save/Del/?/<World>: **3**
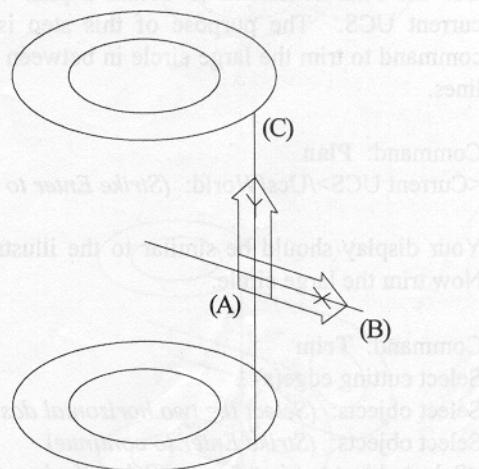Origin point <0,0,0>: *(Select the intersection of Point "A")*
Point on positive portion of the X axis<>: *(Select the end-point Point "B")*
Point on positive-Y portion of the UCS XY plane < >: *(Select the endpoint Point "C")*

Command: **UCS**
Origin/ZAxis/3point/Entity/View/X/Y/Z/Prev/Restore/Save/Del/?/<World>: **S**
Name to save: **Front**

Step #7

Draw two circles of radius 1.50 and diameter 1.50 units. Use point "A" as the center of both circles. (Use Osnap-Endpoint to snap to the endpoint of the line at point "A".)

Command: **Circle**
3P/2P/TTR/<Center point>: **Endp**
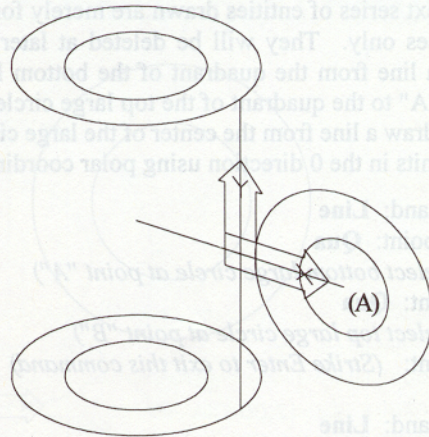of *(Select the endpoint of the line at point "A")*
Diameter/<Radius>: **1.50**

Command: **Circle**
3P/2P/TTR/<Center point>: **@** *(To reference the last point)*
Diameter/<Radius>: **D**
Diameter: **1.50**

Step #8

Copy line "A" 1.50 units above and below its current position using the Copy command.

Command: **Copy**
Select objects: *(Select line "A")*
Select objects: *(Strike Enter to continue)*
<Base point or displacement>/Multiple: **Endp**
of *(Select a line near point "A")*
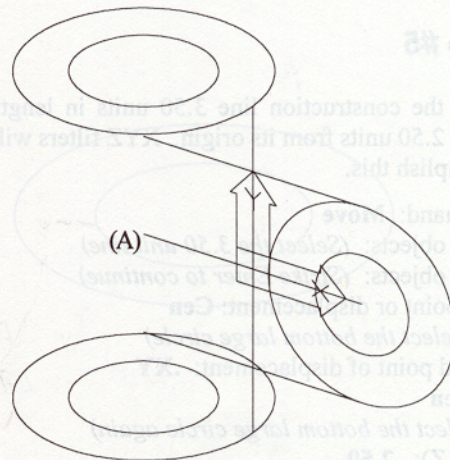Second point of displacement: **@1.50<90**

Command: **Copy**
Select objects: *(Select line "A")*
Select objects: *(Strike Enter to continue)*
<Base point or displacement>/Multiple: **Endp**
of *(Select a line near point "A")*
Second point of displacement: **@1.50<270**

Step #9

Use the Plan command to obtain a plan view based on the current UCS. The purpose of this step is to use the Trim command to trim the large circle in between the two horizontal lines.

Command: **Plan**
<Current UCS>/Ucs/World: *(Strike Enter to continue)*

Your display should be similar to the illustration at the right. Now trim the large circle.
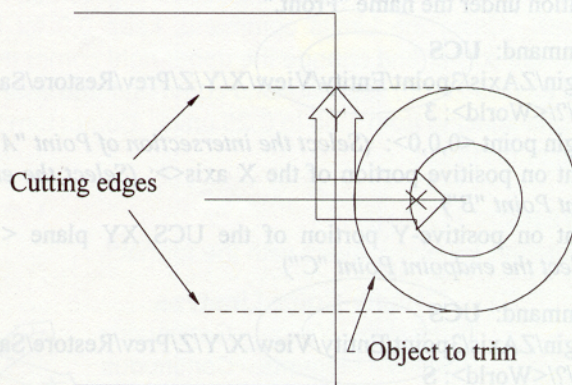
Command: **Trim**
Select cutting edge(s)...
Select objects: *(Select the two horizontal dashed lines)*
Select objects: *(Strike Enter to continue)*
<Select object to trim>/Undo:*(Select the large circle at the right)*
<Select object to trim>/Undo:*(Select Enter to exit this command)*

Step #10

Restore the view called "Iso." Then select the dashed entities at the right and move the entities -1.25 units in the Z direction. Use .XYZ filters and the Osnap-Endpoint option to accomplish this.

Command: **View**
?/Delete/Restore/Save/Window: **R**
View name to restore: **Iso**

Command: **Move**
Select objects: *(Select the four dashed entities)*
Select objects: *(Strike Enter to continue)*
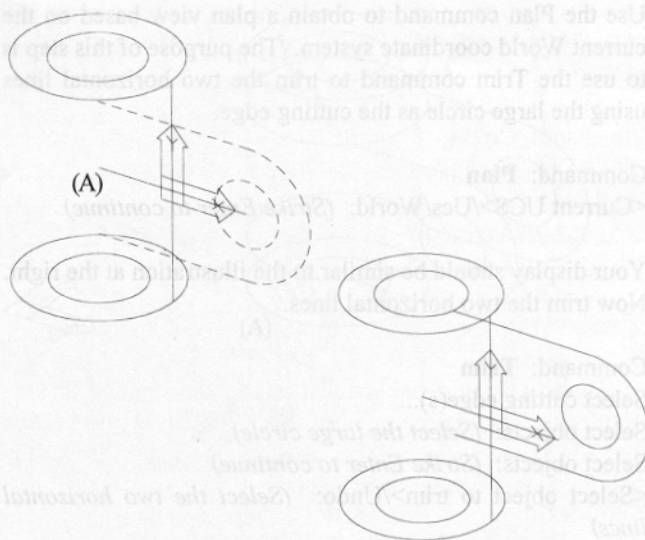Base point or displacement: **Endp**
of *(Select the endpoint of the line at "A")*
Second point of displacement: **.XY**
of **Endp**
of *(Select the endpoint of line "A" at point "A")*
(Need Z): **-1.25**

Step #11

Select the dashed entities at the right and copy the entities 1.25 units in the Z direction. Use XYZ filters and the Osnap-Endpoint option to accomplish this.

Command: **Copy**
Select objects: **P** *(To select the previous selection set)*
Select objects: *(Strike Enter to continue)*
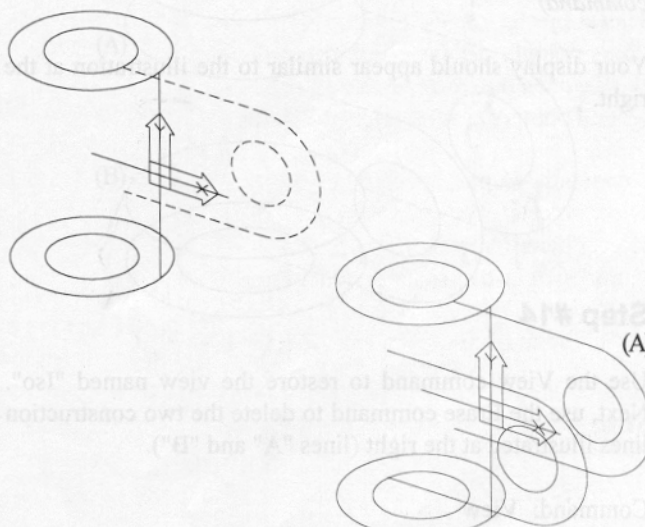<Base point or displacement>/Multiple: **Endp**
of *(Select the endpoint of the line at "A")*
Second point of displacement: **.XY**
of **Endp**
of *(Select the endpoint of the line at "A")*
(Need Z): **1.25**

Step #12

Change from the UCS to the World coordinate system by issuing the UCS command and striking the Enter key at the prompt (the World coordinate system is the default).

Command: **UCS**
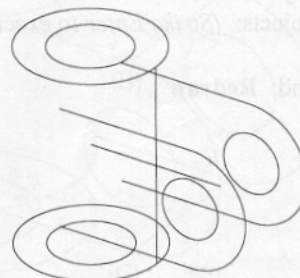Origin/ZAxis/3point/Entity/View/X/Y/Z/Prev/Restore/Save/
Del/?/<World>: *(Strike Enter to accept the default value)*

Step #13

Use the Plan command to obtain a plan view based on the current World coordinate system. The purpose of this step is to use the Trim command to trim the two horizontal lines using the large circle as the cutting edge.

Command: **Plan**
<Current UCS>/Ucs/World: *(Strike Enter to continue)*

Your display should be similar to the illustration at the right. Now trim the two horizontal lines.

Command: **Trim**
Select cutting edge(s)...
Select objects: *(Select the large circle)*
Select objects: *(Strike Enter to continue)*
<Select object to trim>/Undo: *(Select the two horizontal lines)*
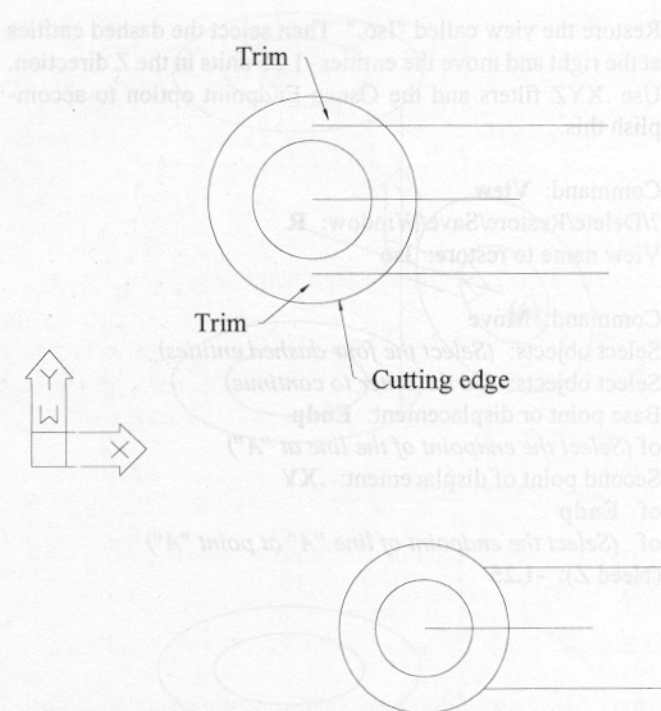<Select object to trim>/Undo: **'Redraw** *(Transparent redraw)*
Resuming TRIM command.
<Select object to trim>/Undo: *(Select the two horizontal lines again)*
<Select object to trim>/Undo: *(Strike Enter to exit this command)*

Your display should appear similar to the illustration at the right.

Step #14

Use the View command to restore the view named "Iso". Next, use the Erase command to delete the two construction lines illustrated at the right (lines "A" and "B").

Command: **View**
?/Delete/Restore/Save/Window: **R**
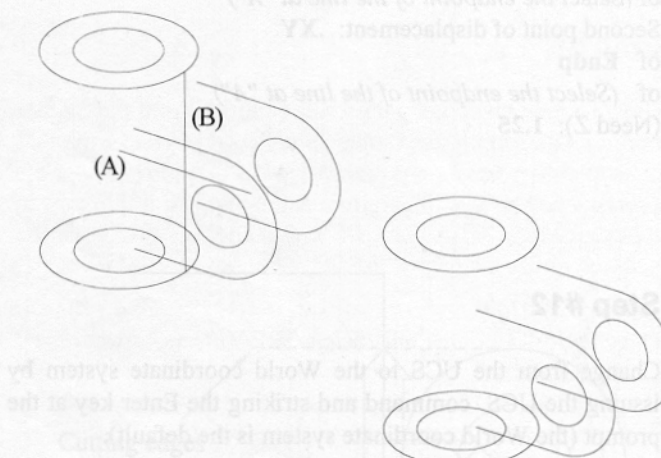View name to restore: **Iso**

Command: **Erase**
Select objects: *(Select line "A")*
Select objects: *(Select line "B")*
Select objects: *(Strike Enter to execute this command)*

Command: **Redraw**

Step #15

Use the Copy command to place two additional circles 1 and 4 units above circle "A". Use the Osnap-Center option in combination with XYZ filters.

Command: **Copy**
Select objects: *(Select circle "A")*
Select objects: *(Strike Enter to continue)*
<Base point or displacement>/Multiple: **Cen**
of *(Select circle "A" using the Osnap-Center option)*
Second point of displacement: **.XY**
of **Cen**
of *(Select Circle "A" again using Osnap-Center)*
(Need Z): **1**

Repeat the above procedure exactly as before; however, type in a value of **4** instead of **1** for the new Z value.

(A)

Step #16

The two large circles will be trimmed to form arcs that match the curvature of the cylinder. Use the Trim command, select the four dashed lines as cutting edges, and select one circle at "A" and the other circle at "B" to trim the circles and form arcs.

Command: **Trim**
Select cutting edge(s)...
Select objects: *(Select the four dashed lines)*
Select objects: *(Strike Enter to continue)*
<Select object to trim>/Undo: *(Select the circle at "A")*
<Select object to trim>/Undo: *(Select the circle at "B")*
<Select object to trim>/Undo: *(Strike Enter to exit this command)*

(A)

(B)

Step #17

This step is meant for construction purposes only and will be used at a later step where surfacing is required. One line is drawn from point "A" to point "B." The line is then copied from point "B" to point "C" using Osnap-Endpoint.

Command: **Line**
From point: **Endp**
of *(Select the endpoint of the line or arc at "A")*
To point: **Endp**
of *(Select the endpoint of the line or arc at "B")*
To point: *(Strike Enter to exit this command)*

Command: **Copy**
Select objects: **L**
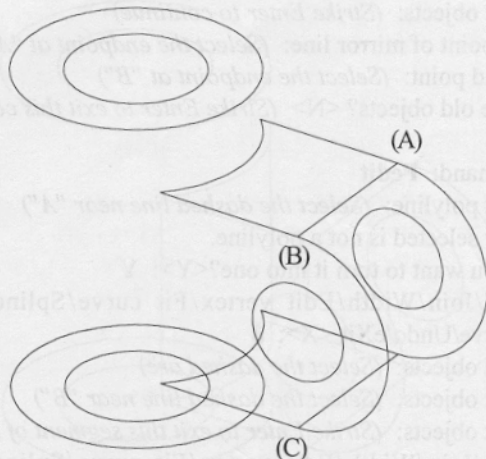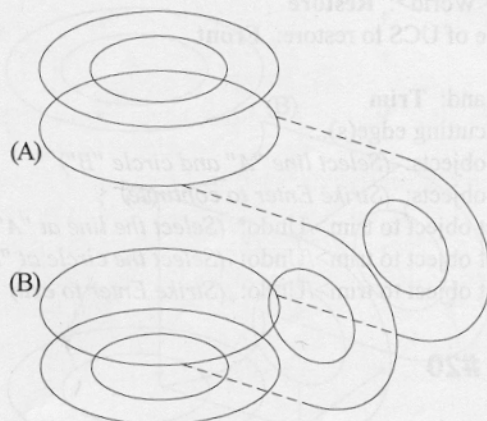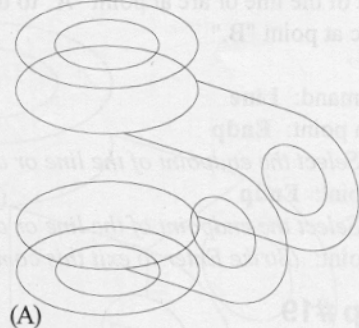Select objects: *(Strike Enter to continue)*
<Base point or displacement>/Multiple: **Endp**
of *(Select the endpoint of the line at "B")*
Second point of displacement: **Endp**
of *(Select the endpoint of the line or arc at "C")*

(A)

(B)

(C)

Step #18

Draw another line using the Line command from the endpoint of the line or arc at point "A" to the endpoint of the line or arc at point "B."

Command: **Line**
From point: **Endp**
of *(Select the endpoint of the line or arc at "A")*
To point: **Endp**
of *(Select the endpoint of the line or arc at "B")*
To point: *(Strike Enter to exit this command)*

Step #19

Use the UCS command and restore the view named "Front." Next, use the Trim command, select the circle and vertical line illustrated at the right as cutting edges, and trim half of the circle and the middle of the line.

Command: **UCS**
Origin/ZAxis/3point/Entity/View/X/Y/Z/Prev/Restore/Save/
Del/?/<World>: **Restore**
?/Name of UCS to restore: **Front**

Command: **Trim**
Select cutting edge(s)...
Select objects: *(Select line "A" and circle "B")*
Select objects: *(Strike Enter to continue)*
<Select object to trim>/Undo: *(Select the line at "A")*
<Select object to trim>/Undo: *(Select the circle at "B")*
<Select object to trim>/Undo: *(Strike Enter to exit)*

Step #20

Use the Mirror command to copy and flip the dashed arc at the right. Then use the Pedit command to convert all dashed entities at the right to a polyline. This polyline will be used later for adding surfaces to the model.

Command: **Mirror**
Select objects: *(Select the dashed arc at the right)*
Select objects: *(Strike Enter to continue)*
First point of mirror line: *(Select the endpoint at "A")*
Second point: *(Select the endpoint at "B")*
Delete old objects? <N> *(Strike Enter to exit this command)*

Command: **Pedit**
Select polyline: *(Select the dashed line near "A")*
Entity selected is not a polyline.
Do you want to turn it into one?<Y>: **Y**
Close/Join/Width/Edit vertex/Fit curve/Spline curve/
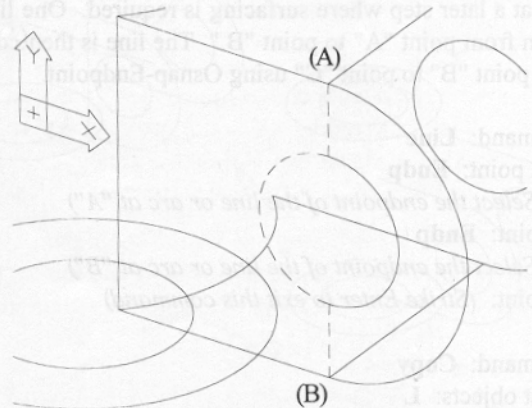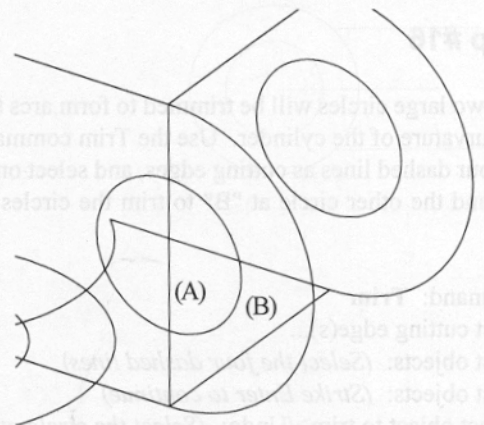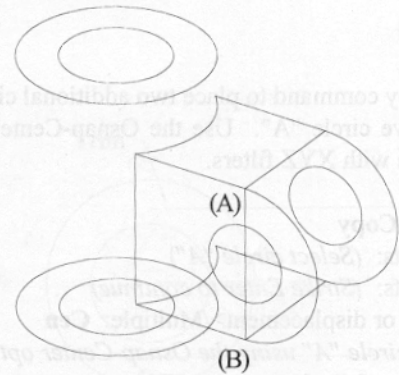Decurve/Undo/eXit <X>: **J**
Select objects: *(Select the dashed arc)*
Select objects: *(Select the dashed line near "B")*
Select objects: *(Strike Enter to exit this segment of Pedit)*
Close/Join/Width/Edit vertex/Fit curve/Spline curve/
Decurve/Undo/eXit <X>: **X**

Step #21

Change back to the World coordinate system using the UCS command. Draw a line using the line command from the endpoint of the arc at point "A" to the endpoint of the arc at point "B."

Command: **UCS**
Origin/ZAxis/3point/Entity/View/X/Y/Z/Prev/Restore/Save/Del/?/<World>: *(Strike Enter to accept the default value)*
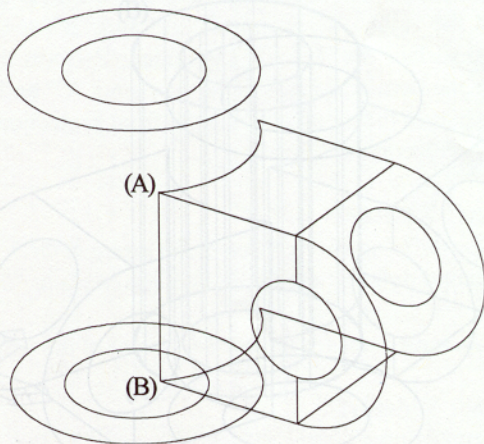
Command: **Line**
From point: **Endp**
of *(Select the endpoint of the arc at "A")*
To point: **Endp**
of *(Select the endpoint of the arc at "B")*
To point: *(Strike Enter to exit this command)*

Step #22

Use the copy command to duplicate the last line drawn. Copy this entity from "A" to "B," as illustrated at the right.
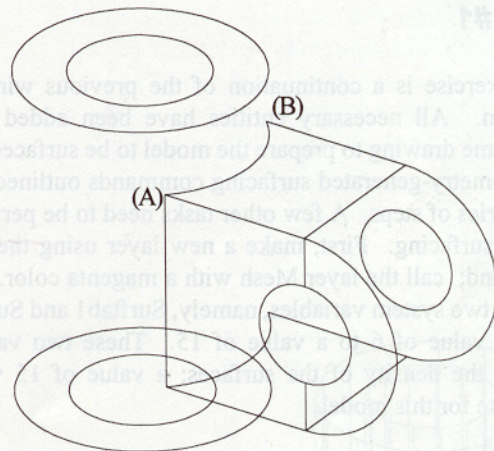
Command: **Copy**
Select objects: **L**
Select objects: *(Strike Enter to continue)*
<Base point or displacement>/Multiple: **Endp**
of *(Select the endpoint of the line at "A")*
Second point of displacement: **Endp**
of *(Select the endpoint of the line at "B")*

The Wireframe model becomes the basis if the need to surface the model is required. Existing geometry is used for creating the following surfaces: Ruled, Tabulated, Revolved, and Edge surfaces. Follow the next series of steps for surfacing the Column.