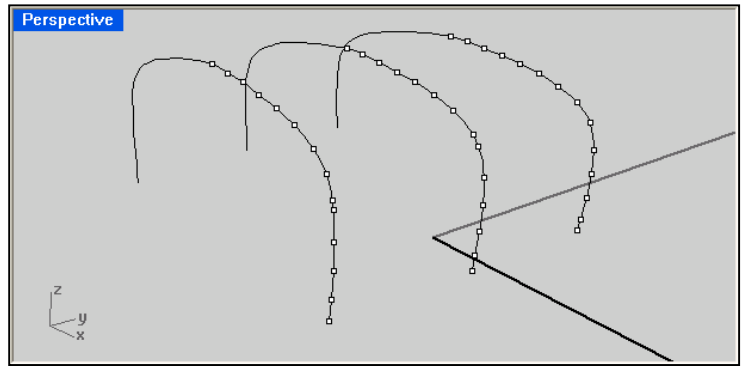
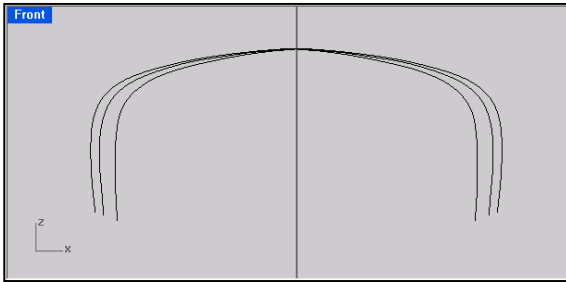


1: Modeling Stations 6, 7, & 8



Objective: Model 3 stations of the canoe in Rhino.

Open Rhino.

Before you can begin, you will need to make some changes to the document's properties.

Type "DocumentProperties" (Enter.)

On the left you will see a list of sub-windows such as **Rhino Render**, **Mesh**, **Units**, etc.

1. Click on **Units**.

Change the units from millimeters to inches.

2. Click on **Grid**.

Make the following changes:

Grid extends:	108.0 inches
Minor grid lines every:	2.0 inches
Major lines every:	6 minor grid lines


Imagine that the 3D canoe is made from 2D cross-sectional slices called, "stations." In this assignment you will enter points for stations 8, 7, and 6. Modeling from points is really quite easy, but you will need to take special care when typing.

Double click the FRONT view to maximize it.

Type "Point" enter.

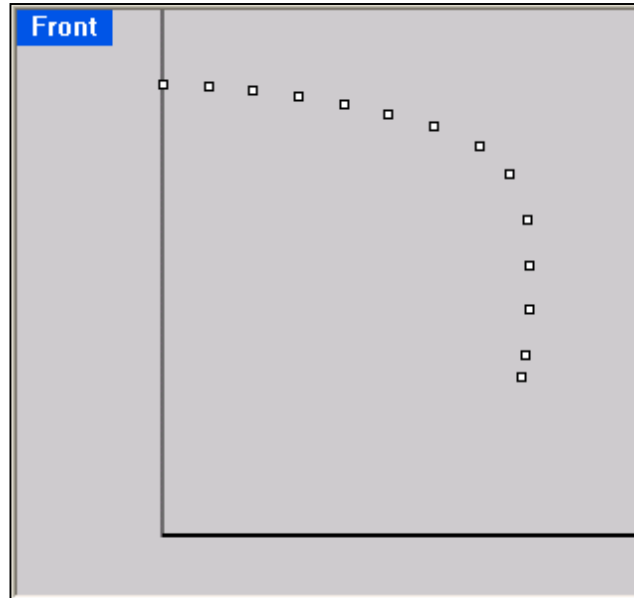
After "Location of point object:" Type 0,20 enter. Don't add a space.

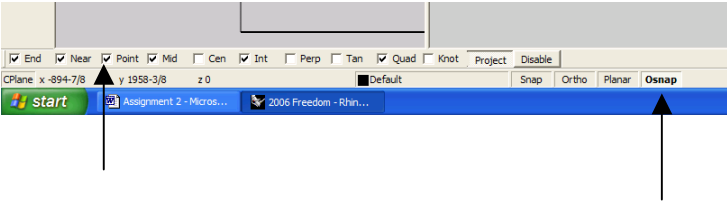
HEY! Nothing happened?!

Not true. Rhino did place a point at (0,20). You simply need to pan down slightly to see it. Use the hand tool , or shift-RMB drag. (RMB stands for Right-Mouse-Button.)

Now type “points” enter. NOTE that “points” is plural.
Enter the following points:

Station #8	
1.	0,20 (already entered)
2.	2,19-7/8
3.	4,19-11/16
4.	6,19-7/16
5.	8,19-1/8
6.	10,18-11/16
7.	12,18-1/8
8.	14,17-1/4
9.	15-3/8,16
10.	16-1/8,14
11.	16-1/4,12
12.	16-3/16,10
12.	16,8
14.	15-7/8,7
Hit enter twice after the last point.	

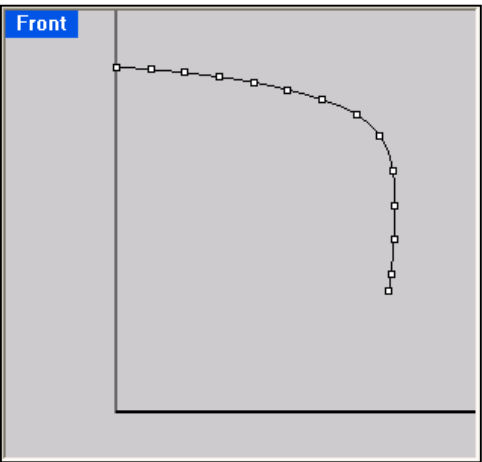




Verify that **Osnap** is selected and that Point is checked.

Type “InterpCrv” enter.

Start at the first point, (0,20) and select each of the 14 points in order to create the curve.



Vocabulary Builder

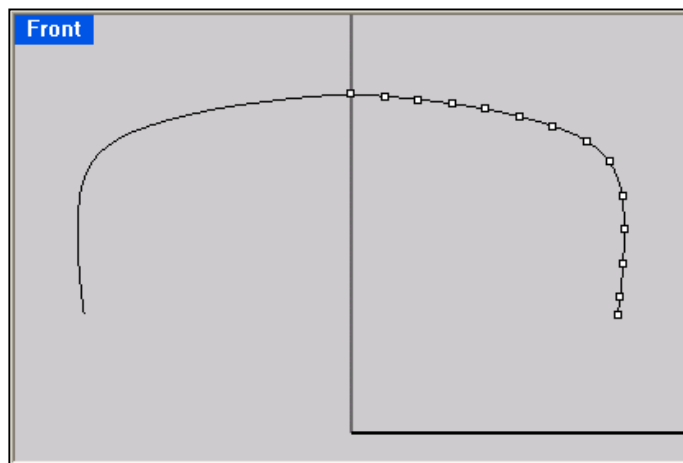
Osnap stands for “Object snap.” Osnap is a very useful tool that pulls the cursor to important parts of a model. Osnap-end, for example will pull the nearby cursor to the end of a line.

InterpCrv stands for “Interpolated curve.” A synonym for interpolate is insert. You are inserting a curve between points.

Ortho stands for “orthogonal.” You will use it in the next step. Orthogonal comes from the Greek *ortho* meaning right and *gonia* meaning angle. It means right angle.

Now, mirror the curve that you have created to the other side.

1. Type “mirror” enter.
2. Select the curve, enter.
3. To start the mirror plane, select the top point.
4. To end the mirror plane, move the cursor directly below the first point, hold Shift and click.



Note: Holding the shift key temporarily turns on Ortho mode. When in ortho mode, your cursor will be constrained to move in right angles.

Congratulations! You have now completed **Station #8**. This is the center of the canoe.

SAVE YOUR FILE to your student h-drive. Call the file “Perfect Freedom.”


If you save to the c-drive, it will be erased when you log off and all your work will be lost.

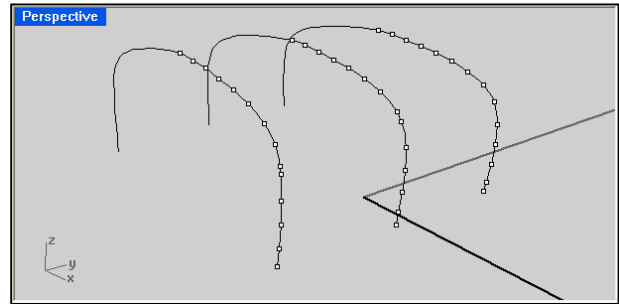
Now it is time to model stations 6 and 7.

When you entered points for station 8, you entered the points in simple (x, y) form. We are now entering the 3D environment. You will be entering points as (x, y, z) coordinates.

Type “4View” enter.

Moving around in 3D takes some practice.

Use the navigation buttons , to obtain favorable views in all 4 viewports.



To begin, type “points” enter. Then enter the following points.

The w that precedes each point is essential. Be sure to include it.

Station #7

1.	w0,-12,20
2.	w2,-12,19-13/16
3.	w4,-12,19-5/8
4.	w6,-12,19-5/16
5.	w8,-12,19
6.	w10,-12,18-1/2
7.	w12,-12,17-13/16
8.	w14,-12,16-5/8
9.	w14-9/16,-12,16
10.	w15-3/8,-12,14
11.	w15-9/16,-12,12
12.	w15-1/2,-12,10
12.	w15-5/16,-12,8
14.	w15-1/4,-12,6-3/4
Hit enter twice after the last point.	

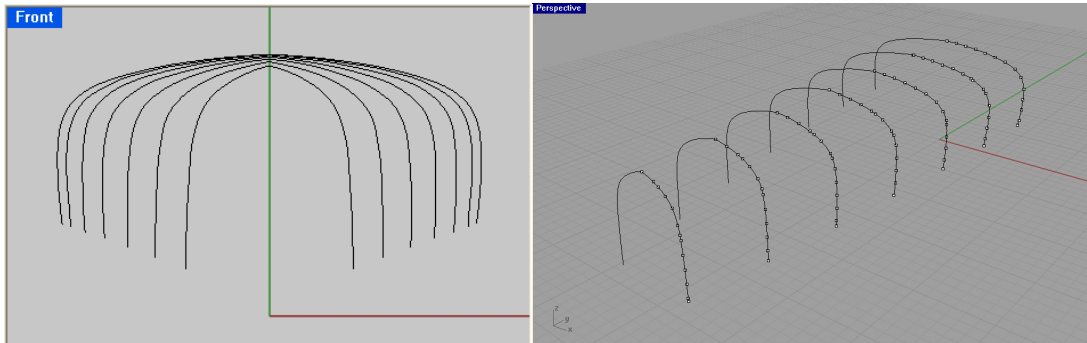
Station #6

1.	w0,-24,19-15/16
2.	w2,-24,19-11/16
3.	w4,-24,19-1/2
4.	w6,-24,19-1/8
5.	w8,-24,18-11/16
6.	w10,-24,18-1/8
7.	w12,-24,17-3/16
8.	w13-5/16,-24,16
9.	w14,-24,14-5/8
10.	w14-1/8,-24,14
11.	w14-5/16,-24,12
12.	w14-5/16,-24,10
12.	w14-1/4,-24,8
14.	w14-1/8,-24,6-3/8
Hit enter twice after the last point.	

Use the “InterpCrv” and “Mirror” commands like you did in station 8.
 Congratulations! Now, SAVE YOUR FILE.

2: Modeling Stations 2, 3, 4, & 5

Objective: Model the next 4 stations of the canoe.



Learning Rhino:

Before you begin modeling today, take a moment to familiarize yourself with three Rhino topics.

1. Navigating

Hey, it's easy to get lost.



or RMB drag, will pan.



or Zoom extents, will re-center the entire canoe in a viewport.




or Ctrl-RMB drag, will zoom in and out.

2. Hide

HIDE

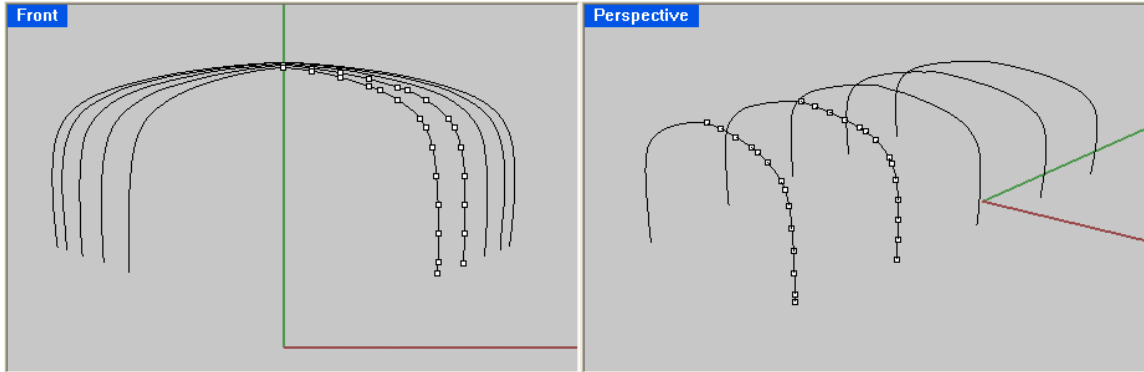
, Ctrl-H, or simply typing “hide,” will hide selected objects. It is **very useful** to hide stations that you are not working on. For example, you can select and hide stations 8, 7, and 6 before typing the points for station 5. If you want to see your model again, hit Ctrl-Alt-H, or type, “show.”

Feeling fancy?

You could make each station a separate layer. Use  and the typed command, “ChangeLayer.” If you go this route, you can turn individual layers on and off with light bulbs. You can also play with colors. Yep, pretty cool.

3. World Coordinates

There are many ways to enter points in Rhino. Typing a w before the x , y , z points ensures that your points go where you intend them to go. If you don't use the w, then Rhino will interpret the point as a C-plane coordinate. “C-plane” stands for, “construction plane.” The C-plane is different for the different viewports. To reduce confusion, use the w until you gain more experience with C-planes.



Here are the station coordinates. Be careful when entering.

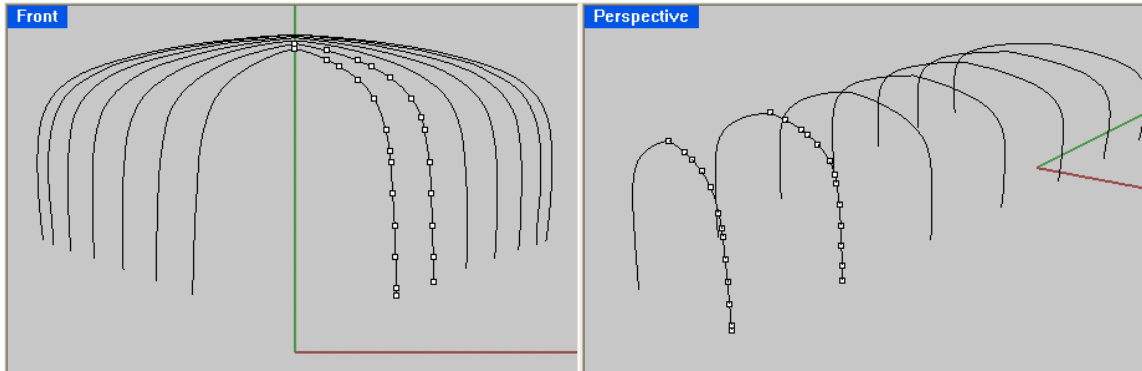
Station 5

Type "Points" enter.	
1.	w0,-36,19-13/16
2.	w2,-36,19-9/16
3.	w4,-36,19-1/4
4.	w6,-36,18-13/16
5.	w8,-36,18-1/4
6.	w8-3/4,-36,18
7.	w10,-36,17-3/8
8.	w11-5/8,-36,16
9.	w12,-36,15-7/16
10.	w12-1/2,-36,14
11.	w12-3/4,-36,12
12.	w12-3/4,-36,10
13.	w12-3/4,-36,8
14.	w12-5/8,-36,5-7/8

Station 4

Type "Points" enter.	
1.	w0,-48,19-5/8
2.	w2,-48,19-3/8
3.	w4,-48,18-15/16
4.	w6,-48,18-5/16
5.	w6-13/16,-48,18
6.	w8,-48,17-3/8
7.	w9-5/8,-48,16
8.	w10,-48,15-3/8
9.	w10-1/2,-48,14
10.	w10-3/4,-48,12
11.	w10-7/8,-48,10
12.	w10-7/8,-48,8
13.	w10-14/16,-48,6
14.	w10-13/16,-48,5-3/16

Hit enter twice after the last point. Then connect the points with the **InterpCrv** command. Finally, use the **Mirror** command to reflect each curve.



Station 3

Type “Points” enter.	
1.	w0,-60,19-7/16
2.	w2,-60,19
3.	w4,-60,18-3/8
4.	w4-13/16,-60,18
5.	w6,-60,17-5/16
6.	w7-3/8,-60,16
7.	w8,-60,14-13/16
8.	w8-3/16,-60,14
9.	w8-4/8,-60,12
10.	w8-5/8,-60,10
11.	w8-11/16,-60,8
12.	w8-3/4,-60,6
13.	w8-3/4,-60,4-7/16

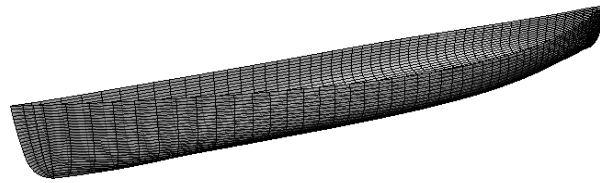
Station 2

Type “Points” enter.	
1.	w0,-72,19-1/8
2.	w2,-72,18-7/16
3.	w2-13/16,-72,18
4.	w4,-72,17-3/16
5.	w5,-72,16
6.	w5-3/4,-72,14
7.	w6,-72,12-11/16
8.	w6-1/16,-72,12
9.	w6-3/16,-72,10
10.	w6-5/16,-72,8
11.	w6-3/8,-72,6
12.	w6-7/16,-72,4
13.	w6-7/16,-72,3-9/16

Hit enter twice after the last point. Then connect the points with the **InterpCrv** command. Finally, use the **Mirror** command to reflect each curve.

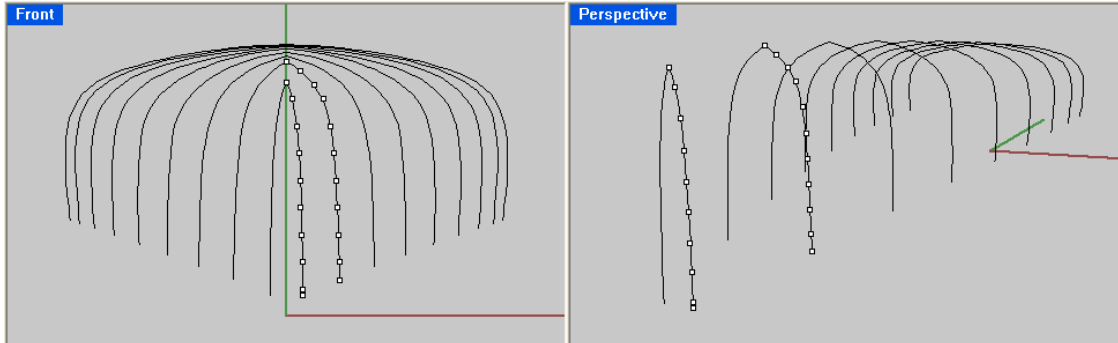
Congratulations, now save your file.

6: Modeling Stations 0, 1 & 9-16



Well, it's time to get serious. By the end of this session, you will have all of the points entered for the entire canoe.

Here are the station coordinates. Be careful when entering.



Station #1

Type "Points" enter.	
1.	w0,-84,18-11/16
2.	w1-1/16,-84,18
3.	w2,-84,17
4.	w2-11/16,-84,16
5.	w3-1/4,-84,14
6.	w3-1/2,-84,12
7.	w3-5/8,-84,10
8.	w3-3/4,-84,8
9.	w3-13/16,-84,6
10.	w3-7/8,-84,4
11.	w3-15/16,-84,2-5/8

Station #0

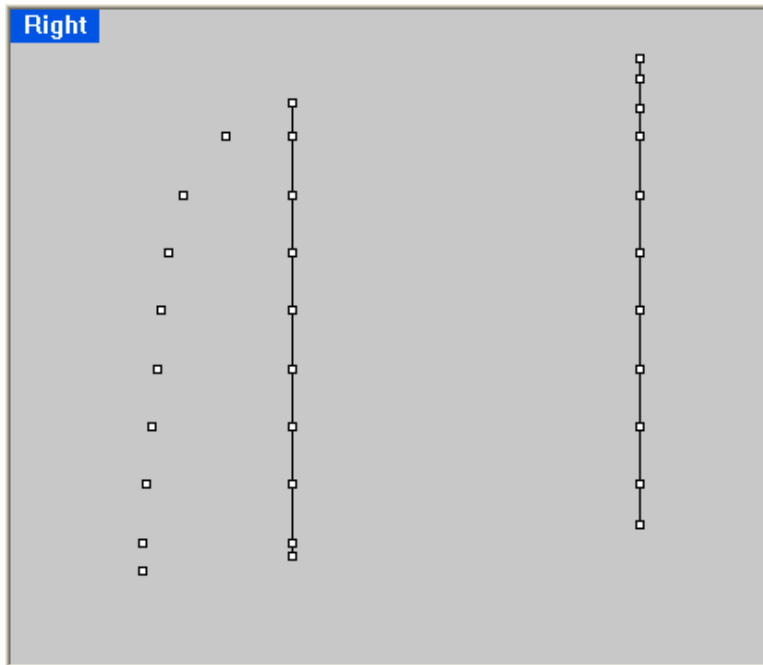
Type "Points" enter.	
1.	w0,-96,17-3/16
2.	w0-7/16,-96,16
3.	w0-3/4,-96,14
4.	w0-15/16,-96,12
5.	w1,-96,10
6.	w1-1/16,-96,8
7.	w1-1/8,-96,6
8.	w1-3/16,-96,4
9.	w1-3/16,-96,2
10.	w1-3/16,-96,1-9/16

Hit enter twice after the last point. Then connect the points with the **InterpCrv** command. Finally, use the **Mirror** command to reflect each curve.

Good news! These are the last nine points that you will need to enter.

Bow

Type “ Points ” enter.	
1.	w0,-98-5/16,16
2.	w0,-99-3/4,14
3.	w0,-100-1/4,12
4.	w0,-100-1/2,10
5.	w0,-100-11/16,8
6.	w0,-100-7/8,6
7.	w0,-101-1/16,4
8.	w0,-101-3/16,2
9.	w0,-101-3/16,1

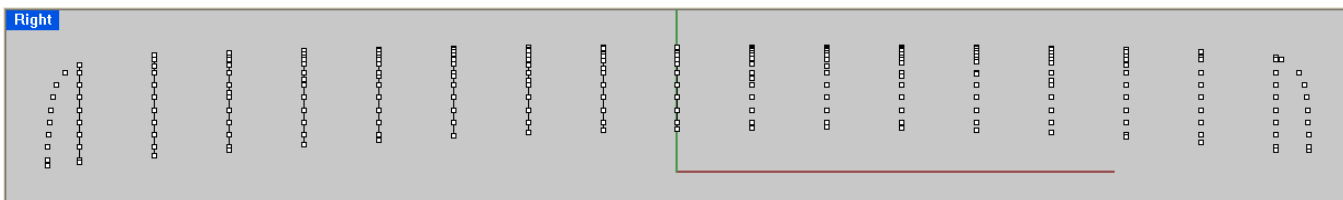


Hit enter twice after the last point, but **do not** connect the bow points with InterpCrv.

Ready for a fancy trick?

Open Excel.

Open “s:Curriculum Folder\Swets\Stations 9 through 16.xls” and follow the instructions on the screen.



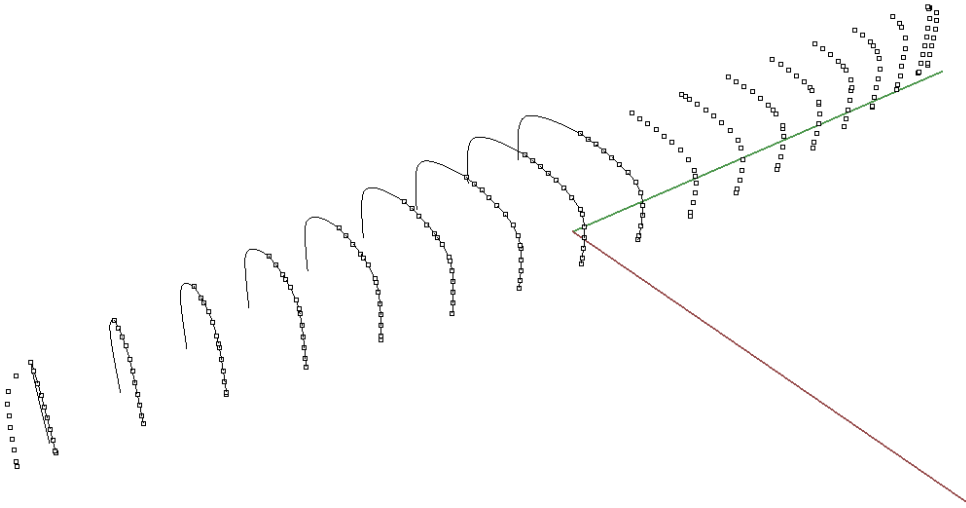
Impressive, eh?

Well, pretty soon it will dawn on you that your teacher could have saved you a bunch of time by giving you all 17 stations in Excel.... but that wouldn't have been any fun now, would it? would it? I can't hear you?

Don't think about it too much.

Congratulations, now save your file.

8: Model

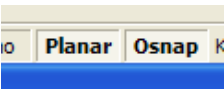


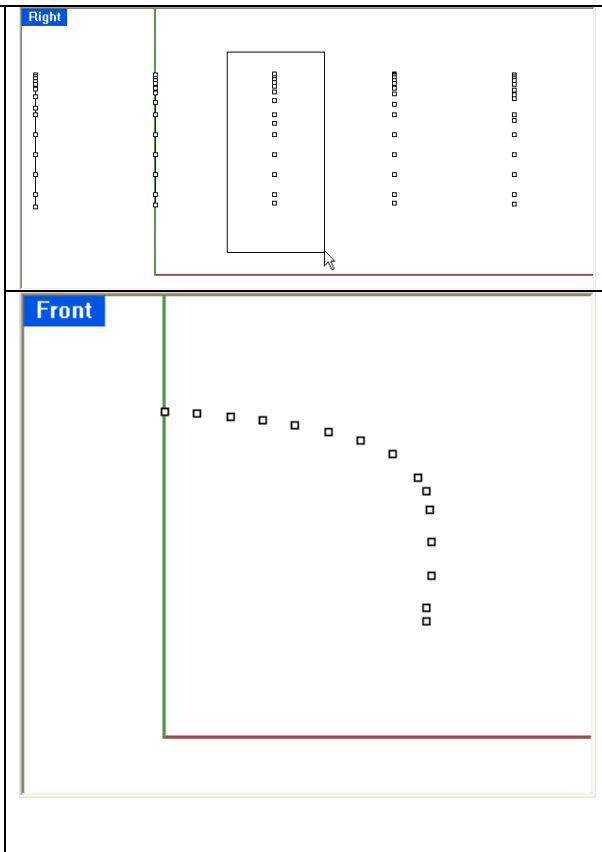
Today you will put a surface on the canoe.

Your canoe should look very similar to the one above.

Creating the surface is a 4-part process. You need to follow the process carefully to get a successful result.

Part 1: Draw curves through the points of stations 9 through 16.

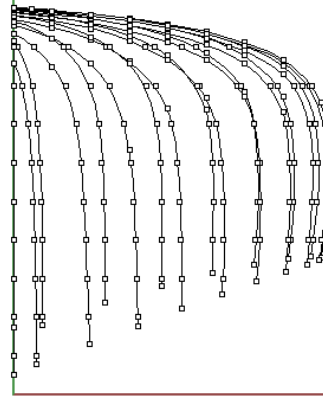
- I suggest highlighting the points of station 9 in RIGHT view.
- Then type, “Invert” enter. Now everything else is selected.
- Now type, “Hide” enter.
- Make sure that **Planar** is highlighted.

- Now it is easy to connect the points with InterpCrv.
- Finally, type “Show” enter, and repeat the process with stations 10 through 16.



Part 2: Hide the left-hand side of the stations

This command is pretty easy.
Select the left of the hull in FRONT view
and hide it.

Front

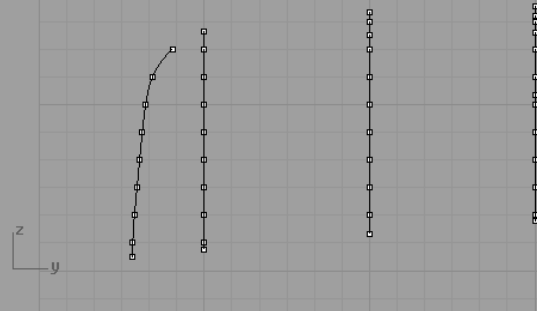


Part 3: Connect the bow and stern points.

Connect the bow and stern points with the
InterpCrv command.

LEAVE A SPACE AT THE TOP.

Right



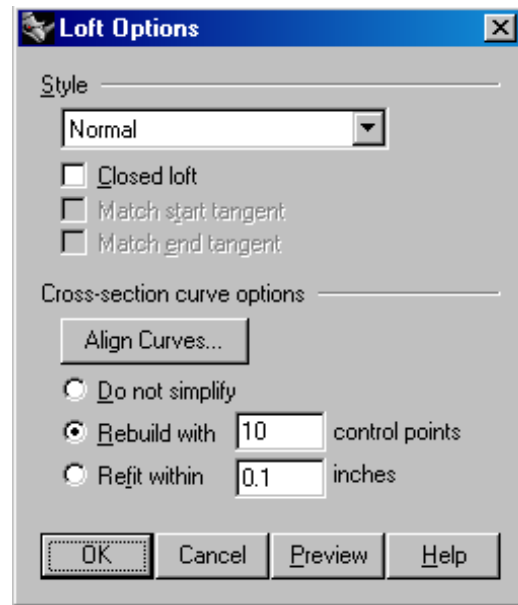
Right



Part 4: Loft the hull

Finally!

- Type, “SelPt” enter, to select all of the points. Now Hide them.
- Type, “Loft” enter. Hit Ctrl-A to select all of the curves, Enter.
- Select the loft options shown at the right and hit OK.
- Mirror the surface to create a complete hull.
- Finally, select both halves and type, “Join” enter. If Rhino was able to join both halves of your boat, then you were successful.



Congratulations!

Save your file.

