Sail Away

Name_____

When sailing a boat creates waves. A bow wave builds up under the front of the boat. Under normal conditions, it is not possible for the boat to have enough power to break through this bow wave and "surf" on the front of it. So, the boat has a kind of speed limit called "hull speed". However, the boat can exceed hull speed if there is a great amount of wind power or power from other sources.

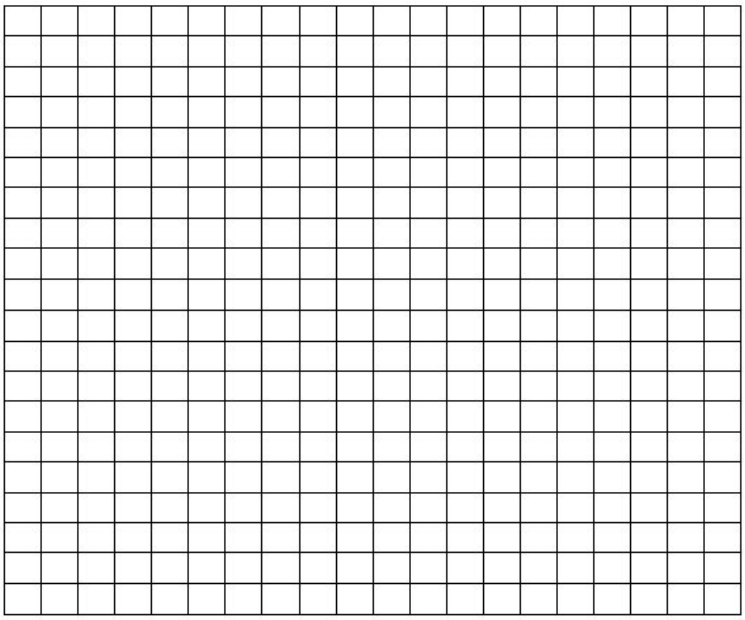
The hull speed of a sailboat depends on the waterline length of the boat which is the length of the boat at the point in which it sits in the water.

The formula is given by $h = 1.34\sqrt{l}$. h is the hull speed in knots and l is the waterline length of the boat in feet.

1. Which variable is your input?_____

Use this formula to fill out the following table and create a graph: (Label the axes!)

l (feet)	h (knots) (round to nearest tenth)
10	
20	
30	
40	
50	
60	
70	



2. Should you connect the points on your graph? Explain.

3. The world's longest sailing yacht has a waterline length of 233 feet. What is the hull speed for this vessel? Show work:

4. If the world's shortest sailboat is 10 feet long, give the domain and range for this function.

D:_____ R:_____

5. A vessel has hull speed 10 knots. Estimate the waterline length of this sailboat from your graph. _____ ft Show how where you found this answer on your graph.

6. Find the answer to #5 by using the formula; show work.

7. Which quantity gets bigger faster, waterline length or hull speed? _____ Use the formula to support your answer:

8. a. What is the hull speed for a 10 foot vessel? (3 decimal places) _____

b. What is the hull speed for a 40 foot vessel? (3 decimal places) _____

c. What is the hull speed for a 90 foot vessel? (3 decimal places)_____

d. Divide your answer for b by your answer for a. What do you get?_____ Why?

e. Divide your answer for c by your answer for a. What do you get?_____ Why?

9. If you want a boat that has twice the hull speed, how many times longer does the boat need to be? _____ Use the formula to support your answer.

10. What is the parent function for $h = 1.34\sqrt{l}$? _____ How has it been transformed from the parent function?

11. Fill out the table at the right for the parent function. Graph this in a different color and label it as the parent function.

12. Find the inverse function for $h = 1.34\sqrt{l}$. (You do not need to switch the variables; just solve for l.) Show work.

13. What is the parent function for the inverse? _____ How has it been transformed from the parent function?

x	y
0	
9	
16	
25	
36	
49	
64	

14. Give the domain and range for the inverse, according to the information from questions #3 and #4.

D:_____ R:_____
How do these compare to the domain and range for the original function?

15. Put your hull speed formula $h = 1.34\sqrt{l}$ into Y= in your calculator. Use an intersection on your graph to find the length of a sailboat that has hull speed 7.5 knots. Give your answer to three decimal places:_____
Give the steps to answering this question: