Graphing Square Roots (GeoGebra)

Graphing $y = \sqrt{x}$

Launch GeoGebra, click on the **Algebra** perspective (in the pop-up menu that comes out of the triangle on the right of the window.) Right-click on the graphics area, and select Grid to show the grid.

In the Input Bar, enter **y=sqrt(x)**

1. The graph is entirely within the first quadrant.
   a. Why is x never negative?
   b. Why is y never negative?

2. Using the Point tool, make a point *on the curve*. GeoGebra will label it **A**. Drag it to find the approximate value of y when x=4; x=3; x=2; x=1; x=0; x=-1. Explain the answers.

A Closer Look

Let us get a closer look by changing the window. Right-click the graphics area, and choose **Graphics....** Set

x Min = 0, x Max = 10
y Min = 0, y Max = 8

Important: This is the window for #3-11.

Drag A to answer the following questions:

3. What is x when y=0? y=1? y=2? y=3? Explain. (Careful, this is not the same question as #2.)

4. For what values of x do we have:
   a. $x = \sqrt{x}$? b. $x > \sqrt{x}$? c. $x < \sqrt{x}$?

More Complicated Functions

Use the same window as above.
Double-click the function, and change it to $y = \sqrt{x^2}$, like this: y = sqrt(x^2)

5. Describe the graph. Sketch it on paper.

6. Drag A to find a simpler equation for the graph. To check whether you're right, enter it as a new function in the Input Bar. If you were right, there should be no difference between the two graphs.

For each function below:

a. Predict what the graph will look like
b. Enter the function in the input bar. *(Be sure to put parentheses around the quantity that is under the radical.)*
c. Sketch the graph.
d. If possible, write a simpler equation for the graph. You may get an idea for it by putting a point on it and dragging. Check your answer by entering your function in the Input Bar.

7. $y = \sqrt{4x^2}$

8. $y = \sqrt{x^2 + 4}$

9. $y = \sqrt{\dfrac{x^2}{4}}$

10. One of these graphs was not a line. Which one? Why?

Delete all the functions.

Note that all this work has been done in the first quadrant, *where x is positive.*

11. **When x is positive:**

a. $\sqrt{x^2}$ =

b. $\sqrt{4x^2}$ =

c. $\sqrt{\dfrac{x^2}{4}}$ =

d. ___________ cannot be simplified

Negative Values of x

To see what happens with negative values of x, we will change the window. Use

x Min=-10, x Max=0
y Min=0, y Max=8

Important: This is the window for #12-17.

For each function below:

a. Predict what the graph will look like
b. Enter the function in the input bar. *(Be sure to put parentheses around the quantity that is under the radical.)*
c. Sketch the graph.
d. If possible, write a simpler equation for the graph. You may get an idea for it by putting a point on it and dragging. Check your answer by entering your function in the Input Bar.

After each problem, delete the functions.

12. $y = \sqrt{x^2}$

13. $y = \sqrt{4x^2}$

14. $y = \sqrt{x^2 + 4}$

15. $y = \sqrt{\dfrac{x^2}{4}}$

Note that this was all done in the second quadrant, *where x is negative.*

16. **When x is negative:**

a. $\sqrt{x^2}$ =

b. $\sqrt{4x^2}$ =

c. $\sqrt{\frac{x^2}{4}}$ =

d. ___________ cannot be simplified

17. Compare the formulas you found in #11 and #16.

Looking at All Four Quadrants

Use

x Min=-10, x Max=10

y Min=-8, y Max=8

18. a. What do you think the graph of $y = \sqrt{x^2}$ will look like if you can see all four quadrants? Find out, and sketch the graph on paper.

b. Write a simpler equation for the graph. To check whether you're right, enter it in the Input Bar. Compare with your sketch. If you were right, there should be no difference between the two graphs.

Repeat #18 for the following functions:

19. $y = \sqrt{4x^2}$

20. $y = \sqrt{x^2 + 4}$

21. $y = \sqrt{\frac{x^2}{4}}$

Simplifying Radical Expressions

22. Simplify the following expressions. Make sure your method works for both positive and negative values of x. You may check your answers by graphing.

a. $\sqrt{x^2}$ =

b. $\sqrt{9x^2}$ =

c. $\sqrt{\frac{x^2}{9}}$ =

23. My former student Hank believes that $\sqrt{x^2 + 9} = x + 3$. Explain why he is wrong.

24. **Summary:** Summarize what you learned about the absolute value and square root functions. What is the definition of absolute value? (Hint: it is a piecewise function.) When can you simplify radical expressions? How is this related to absolute value?