**Exploring an Exponential Function**

In this activity we will explore the exponential function $y=16^{x}$.

**Instructions: In the Y = menu on your calculator, enter Y1 = 16^X**

 **In the Window menu set the following values:**

 Xmin = –2.35 Xmax = 2.35 Xscl = .5

 Ymin = –20 Ymax = 130 Yscl = 10

1. Describe what you see in the first quadrant.
2. Describe what you see in the second quadrant.
3. Press TRACE. Use the right arrow to move your cursor along the curve. Record function values (values of *y*)in the table. Stop when you obtain the *y* value for *x*  = 1.75.

|  |  |
| --- | --- |
| ***x*** | ***y*** |
| 0 |  |
| 0.25 |  |
| 0.5 |  |
| 0.75 |  |
| 1 |  |
| 1.25 |  |
| 1.5 |  |
| 1.75 |  |

1. Use the rules of exponents discovered in Activities 7.2.2 and 7.2.3 to find the missing exponent in each equation.

a. $16^{0.5}∙16^{0.75}=16^{\\_\\_\\_}$ b. $\left(16^{0.25}\right)^{3}=16^{\\_\\_\\_}$

c. $16^{0.25}∙16^{1.25}=16^{\\_\\_\\_}$ d. $\left(16^{0.5}\right)^{2}=16^{\\_\\_\\_}$

e. $\frac{16^{1.5}}{16^{1}}=16^{\\_\\_\\_}$

1. Now check each of the equations in question 4 by substituting values from the table above. The first one is done for you. The table above shows that $16^{0.5}=4$, $16^{0.75}=8$, and $16^{1.25}=32$.

a. Example: $16^{0.5}∙16^{0.75}=16^{1.25}$ ? d. $\left(16^{0.25}\right)^{3}=16^{\\_\\_\\_}$

 $4∙8=32$ ?

 $32=32$ (true)

b. $16^{0.25}∙16^{1.25}=16^{\\_\\_\\_}$ e. $\left(16^{0.5}\right)^{2}=16^{\\_\\_\\_}$

c. $\frac{16^{1.5}}{16^{1}}=16^{\\_\\_\\_}$

1. Continue to trace, pressing the right arrow until *x* = 2. What do you notice?

**Change the window so you can see on the graph where *x* = 2. (Let Xmax = 600)**

1. Predict the value of $16^{2.25}$. Use the rules of exponents to justify your prediction. Check your prediction by pressing the right arrow until *x* = 2.25.
2. Use the rules of exponents to explain why $16^{\frac{1}{2}}=4$ and $16^{\frac{1}{4}}=2$.
3. Now move the cursor back to the *y­*-axis (where *x* = 0). Continue moving the cursor to the left and fill in this table.

|  |  |
| --- | --- |
| ***x*** | ***y*** |
| 0 |  |
| –0.25 |  |
| –0.5 |  |
| –0.75 |  |
| –1 |  |
| –1.25 |  |
| –1.5 |  |
| –1.75 |  |

1. The graph of the function $y=16^{x}$ does not appear in the second quadrant, yet the domain of the function includes negative numbers. Explain.

**Change the window so we can get a better view of what’s happening in the second quadrant, by letting Ymin = –0.1 and Ymax = 1. Trace again to see all the values in the table.**

1. At least one of the ordered pairs in the table still appears to lie on the *x*-axis. Which ordered pair? What could you do to make it “visible” in the graph?
2. According to the rule for negative exponents, what is the value of $16^{–1}$? Does that agree with the table and the graph? Explain.