SC Algebra 1
9.3 Writing Exponential Expressions (Day 1)

Warm Up:

Calculate the slope between the following points.

1. $(1, -3), (3, -1)$ $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-1+3}{3-1} = \frac{2}{2} = 1$ $\frac{2}{2} = 1$
2. $(0, 4), (4, 2)$ $\frac{-2}{4} = -\frac{1}{2}$
3. $(-3, 2), (-5, 4)$ $\frac{2}{-2} = -1$
4. $(4, 10), (6, -2)$ $\frac{-12}{2} = -6$

How can I meet today's standards?

*I can **write equations for exponential functions**, given two points, a graph, or a table of values.*

Speak Like A Mathematician:

* **compound interest:** interest calculated on the principal, which is the original amount, and on the accumulated interest from previous periods.

KEY CONCEPT: Constructing Exponential Functions

If you are given two points, a graph, or a description of an exponential behavior, you can write an exponential function to model the data.

Given Two Points:

1) Substitute the values of each x and y into the equation, $y = a(b)^x$.
2) This will result in a system of equations in two variables each with a and b as unknowns.
3) You can then solve the system using substitution.

Given a Graph:

1) Use ANY two points from the graph to write equations in the form $y = a(b)^x$.
2) Substitute the values of x and y into the equations.
3) Solve for a and b using substitution.

Given a Description:

1) Use the information to create a table or a graph.
2) Look for a patterns between the input and output values.
3) Use key features to write an equation in the form $y = a(b)^x$.

Reminder:

$y = a(b)^x$

a: y int, x = 0

b: rate of change

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Example 1: Write an Exponential Function Given Two Points

A) Write an exponential function for the graph that passes through $(1,6)$ and $(3,24)$.

$y = a(b)^x$

$6 = ab^1$

$24 = ab^3$

$ab = 6$

$a = \frac{6}{b}$

$24 = \frac{6b^3}{b^1} = 6b^2$

$\frac{24}{6} = \frac{6b^2}{6}$

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

$b = 2$

$a = \frac{6}{2} = 3$

$a = 3 \quad b = 2$

$y = 3(2)^x$ ★

$6 = 3(2)^1$ ✓

$24 = 3(2)^3$

$24 = 3(8)$ ✓

B) Write an exponential function for the graph that passes through $(-3,1)$ and $(0,8)$.

$y = ab^x$

$1 = ab^{-3}$

$8 = ab^0 = 1$

$8 = a$

$y = 8(2)^x$

$1 = 8(2)^{-3}$ ✓

$8 = 8(2)^0$ ✓

$1 = ab^{-3}$

$\frac{1}{8} = \frac{ab^{-3}}{8}$

$\frac{1}{8} = b^{-3}$

$8 = b^3$

$2^3 = b^3$

$2 = b$

C) Write an exponential function for the graph that passes through $(-1,20)$ and $(1,5)$.

$y = a(b)^x$

$20 = a(b)^{-1}$

$5 = a(b)^1$

$\frac{5}{b^1} = \frac{a(b)^1}{b^1}$

$a = \frac{5}{b}$

$20 = \frac{5b^{-1}}{b^1}$

$\frac{20}{5} = \frac{5b^{-2}}{5}$

$4 = b^{-2}$

$\sqrt{b^2} = \sqrt{\frac{1}{4}}$

$b = \frac{1}{2}$

$a = \frac{5}{\frac{1}{2}} = 10$

$y = 10\left(\frac{1}{2}\right)^x$

Systems by Substitution

Evaluate $2x - 5$ if $x = -2$

$2(-2) - 5 = -9$

* - exponents FLIP

$b^3 = 8$

$b^{-3} = \frac{1}{8}$

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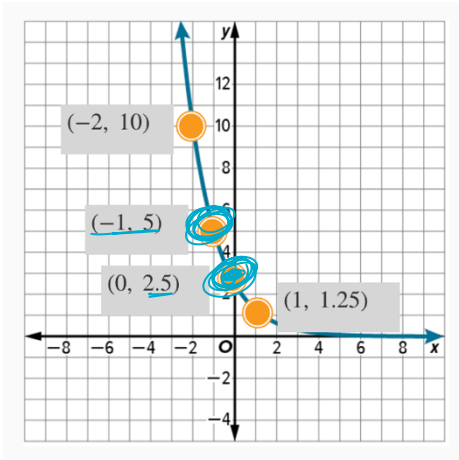
Example 2: Writing an Exponential Function Given a Graph

A) Write an exponential function for the graph.



$y = a(b)^x$

$2.5 = a(b)^0$

$2.5 = a$

$5 = ab^{-1}$

$\frac{5}{2.5} = \frac{2.5b^{-1}}{2.5}$

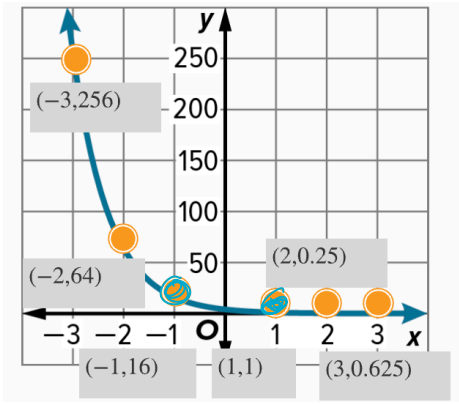
$2 = b^{-1}$

$y = 2.5(0.5)^x$

y int Decay

$b = \frac{1}{2} = 0.5$

B) Write an exponential function for the graph.



(1,1) (−1,16)

$y = a(b)^x$

$\frac{1}{b} = \frac{a(b)^1}{b}$

$\frac{1}{b} = a$

$16 = a(b)^{-1}$

$16 = \frac{1}{b^1}$

$16 = b^{-2}$

$\sqrt{\frac{1}{16}} = \sqrt{b^2}$

$b = \frac{1}{4}$

$a = \frac{1}{\frac{1}{4}} = 4$

$y = 4\left(\frac{1}{4}\right)^x$

Example 3: Writing an Exponential Function Given a Description.

A radio station is giving away $1000 to the first listener who answers a question correctly. If the question goes unanswered for one hour, the prize increases by 10% until it is answered correctly. Write a function to describe this situation.

y int = a

10% as a decimal

1.10

$y = 1000(1.1)^x$