8-7 Exponential Functions

Definition **Exponential Function**

An **exponential function** is a function in the form $y = a \cdot b^x$, where a is a nonzero constant, b is greater than 0 and not equal to 1, and x is a real number.

Examples $y = 0.5 \cdot 2^x$ $f(x) = -2 \cdot 0.5^x$

domain of a function - are the values that you substitute in for x (represents the width of your graph)

range of a function - are the values that you get for y or what the function equals (represents the height of your graph)

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1 EXAMPLE **Evaluating an Exponential Function**

Evaluate each exponential function. (use your calculator)

a. $y = 5^x$ for $x = 2, 3, 4$

x	5^x	y
2	$5^2 = 25$	25
3	$5^3 = 125$	125
4	$5^4 = 625$	625

b. $t(n) = 4 \cdot 3^n$ for the domain $\{-3, 6\}$

n	$4 \cdot 3^n$	$t(n)$
-3	$4 \cdot 3^{-3} = 4 \cdot \frac{1}{27} = \frac{4}{27}$	$\frac{4}{27}$
6	$4 \cdot 3^6 = 4 \cdot 729 = 2916$	2916

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1 Evaluate each exponential function for the domain $\{-2, 0, 3\}$.

a. $y = 4^x$ **b.** $f(x) = 10 \cdot 5^x$ **c.** $g(x) = -2 \cdot 3^x$

x	y
-2	
0	
3	

x	y
-2	
0	
3	

x	y
-2	
0	
3	

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Real World Problems: $y = a \cdot b^x$

Ex2a) Suppose 10 animals are taken to an island, and then the population of these animals quadruples every year. Use the function $f(x) = 10 \cdot 4^x$. How many animals would there be after 6 years.

looking at the formula what is a, b, and x?

Suppose 20 rabbits are taken to an island. The rabbit population then triples every half year. The function $f(x) = 20 \cdot 3^x$, where x is the number of half-year periods, models this situation. How many rabbits would there be after 2 years?

$f(x) = 20 \cdot 3^x$ looking at the formula what is a, b, and x?

$= 20 \cdot 3^4$ **In 2 years, there are 4 half years. Evaluate the function for $x = 4$.**

$= 20 \cdot 81$ **Simplify powers.**

$= 1620$ **Simplify.**

After two years, there would be 1620 rabbits.

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In exponential functions $y = a \cdot b^x$

What represents a?
What represents b?
What represents x?

Try: Suppose 2 mice live in a barn. If the number of mice quadruples every 3 months, how many mice will be in the barn after 2 years?

What is the exponential function?

How many mice are there after 2 years?

Try: A bacteria culture doubles in every 8 hours. The culture starts with 150 cells. How many will ther ebe after 24 hrs? After 72 hours?

What is the exponential function?

How many after 8 hrs?

How many after 72 hours?

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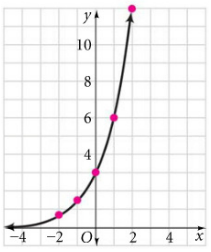
3 EXAMPLE **Graphs of Exponential Functions**

Graph $y = 3 \cdot 2^x$.

x	$3 \cdot 2^x$	(x, y)
-2	$3 \cdot 2^{-2} = \frac{3}{2^2} = \frac{3}{4}$	$\left(-2, \frac{3}{4}\right)$
-1	$3 \cdot 2^{-1} = \frac{3}{2^1} = 1\frac{1}{2}$	$\left(-1, 1\frac{1}{2}\right)$
0	$3 \cdot 2^0 = 3 \cdot 1 = 3$	(0, 3)
1	$3 \cdot 2^1 = 3 \cdot 2 = 6$	(1, 6)
2	$3 \cdot 2^2 = 3 \cdot 4 = 12$	(2, 12)



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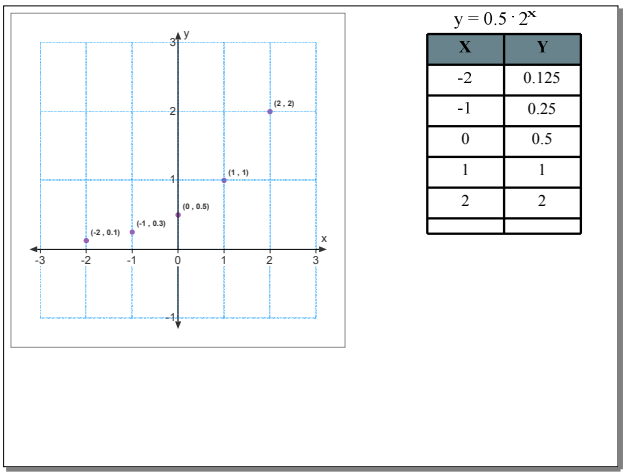

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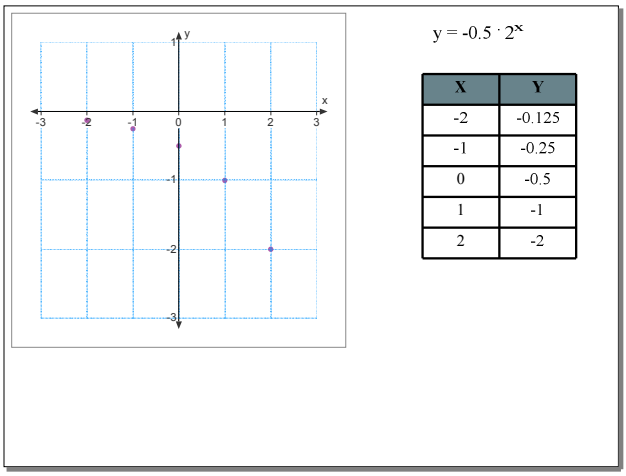

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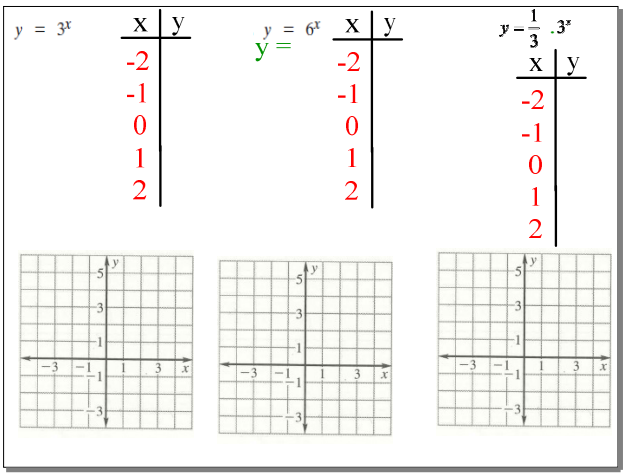

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