Lesson 8.1: Graphing and Solving Exponents

$$y = a(\underline{b})^{x-h} + k$$

Growth	vs.	Decay
$b > 1$		$b < 1$
$y = e^x$		$y = e^{-x}$

$e \approx 2.718\ldots$

Miss Birthday

Determine if the model is a growth or decay and determine the growth or decay rate.

* $y = 23(1.03)^x$

Growth
rate: 1.03

* $y = 400(0.88)^x$

Decay
Rate: 0.88

* $y = 3e^{-0.56x}$

Decay
Rate: -0.56

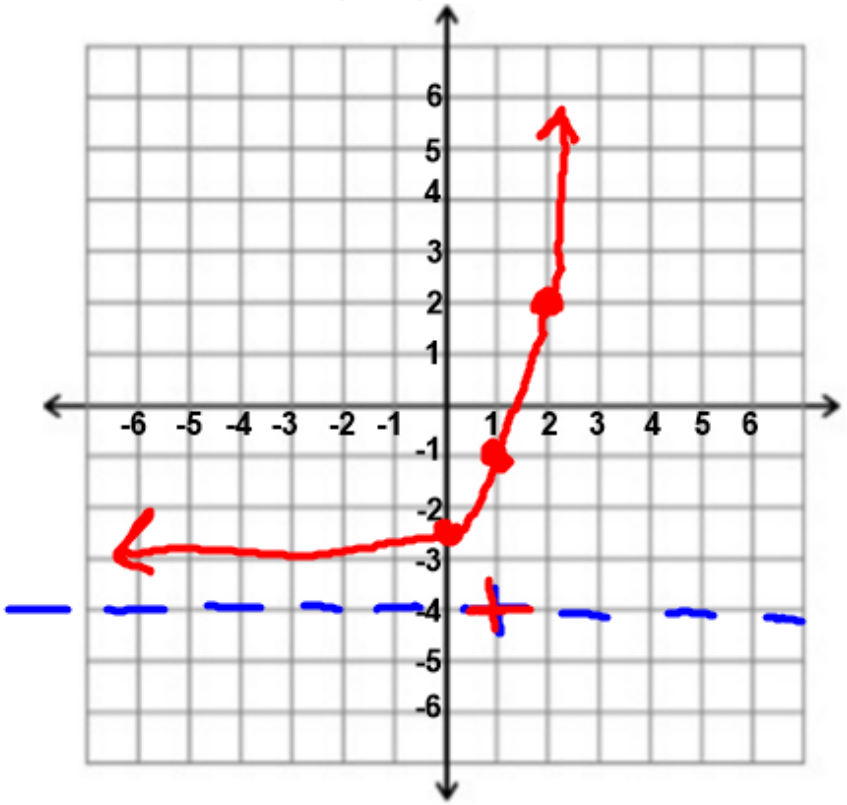
* $y = 492e^{0.77x}$

Growth
Rate: 0.77

Graph the following:

$$y = 3(2)^{x-1} - 4$$

R 1 ↓ 4



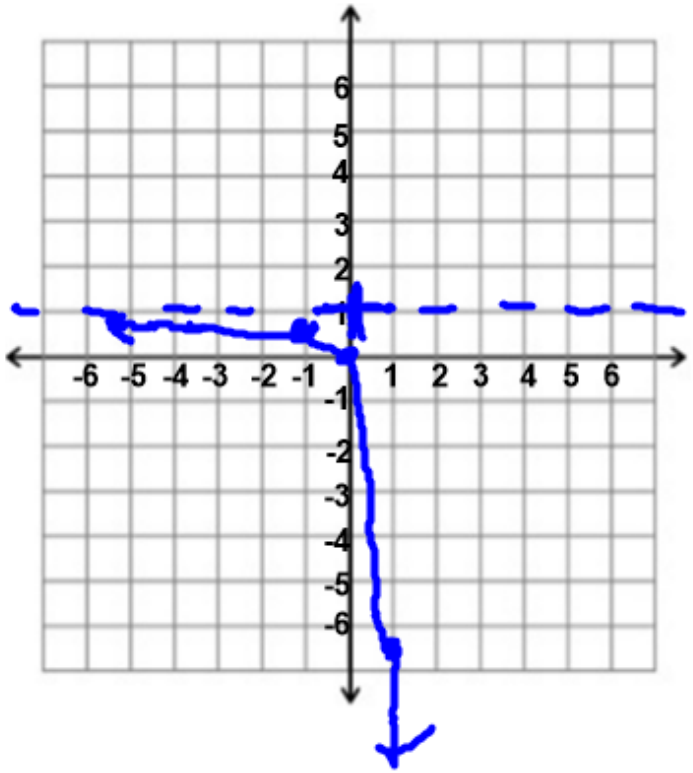
$$y = a(b)^{x-h} + k$$

horizontal Shift (Opposite)

Vertical Shift

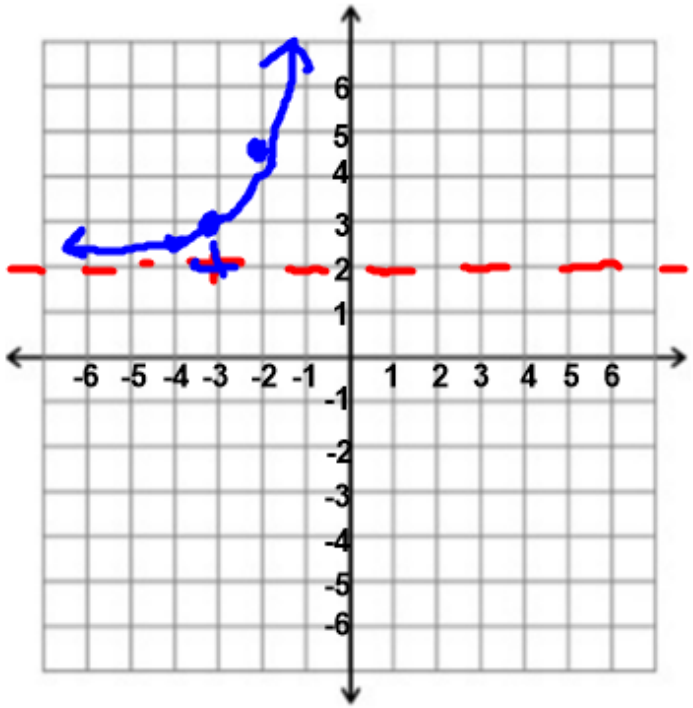
x	y
0	-2.5
1	-1
2	2

$y = 1 - e^{2x}$ $= -e^{2x} + 1$ (+1 ↑)



x	y
-1	0.9
0	0
1	-6.4

$y = 2 + e^{x+3}$ = $e^{x+3} + 2$



x	y
-4	2.4
-3	3
-2	4.7

Remember:

$b^0 = 1$

$b^{-x} = \frac{1}{b^x}$

$b^x \cdot b^y = b^{x+y}$

$\frac{b^x}{b^y} = b^{x-y}$

$(b^x)^y = b^{xy}$

Solve.

* $2^{2x-3} = 8^{-2 \cdot 2 \cdot 2}$

① Get same base on both sides

$$2^{2x-3} = 2^{3}$$

② Set exponents equal and solve.

$$2x - 3 = 3$$

$$+3 \quad +3$$

$$\frac{2x}{2} = \frac{6}{2}$$

$$\boxed{x = 3}$$

Solve.

* $9^{x+1} = \frac{1}{3}$

$\frac{3 \cdot 3}{3^2} = 9$

$9^{x+1} = 3^{-1}$

$(3^2)^{x+1} = 3^{-1}$

$3^{2x+2} = 3^{-1}$

$2x+2 = -1$

$-2 \quad -2$

$\frac{2x}{2} = \frac{-3}{2}$

$x = -3/2$

Solve.

* $2^{x^2} \cdot 4^{3x+1} = \frac{1}{8}$

$2 \cdot 2 \cdot 2 = 8$

2^3

$2^{x^2} \cdot 4^{3x+1} = 8^{-1}$

$2^{x^2} \cdot (2^2)^{3x+1} = (2^3)^{-1}$

$2^{x^2} \cdot 2^{6x+2} = 2^{-3}$

$2^{x^2+6x+2} = 2^{-3}$

$x^2 + 6x + 2 = -3$

$+3 \quad +3$

$x^2 + 6x + 5 = 0$

$(x+5)(x+1) = 0$

$x+5=0$ $\qquad$ $x+1=0$

$x = -5$ $\qquad$ $x = -1$

Solve.

* $e^{x^2} = e^{2x}$

$x^2 = 2x$

$x^2 - 2x = 0$

$x(x-2) = 0$

$x = 0$

$x - 2 = 0$

$x = 2$

Solve.

* $(e^x)^2 e^3 = \frac{1}{e^2}$

$e^{2x} \cdot e^3 = e^{-2}$

$e^{2x+3} = e^{-2}$

$2x+3 = -2$

$-3 \quad -3$

$\frac{2x}{2} = \frac{-5}{2}$

$x = -\frac{5}{2}$