Warmup:

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

y = k

right 1

up 4

Graph the following exponential function:

(0, -3)

(1, -6)

y = 0

(0, a)

(1, ab)

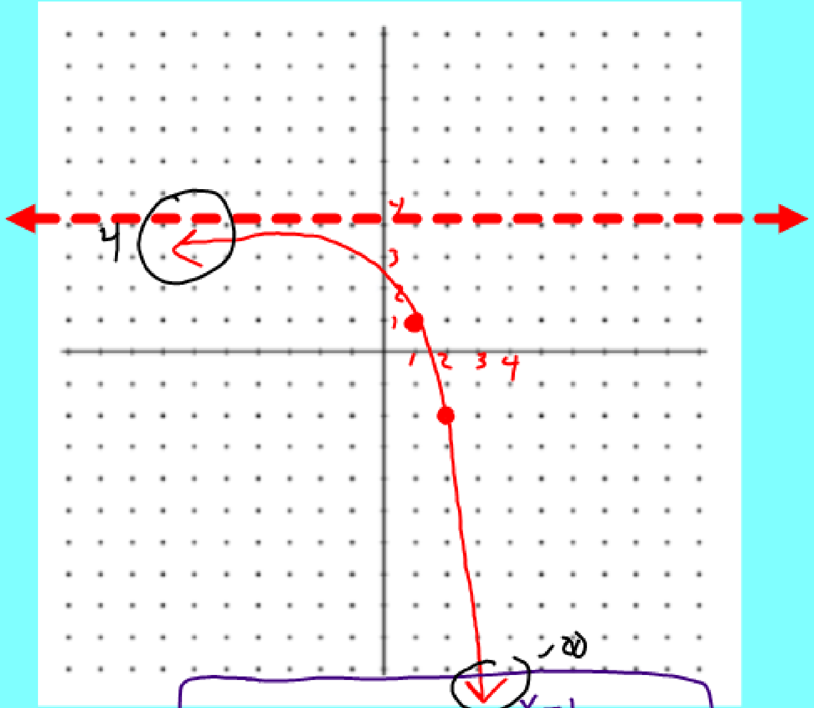
original

$y = -3(2)^x$

Right 1 (1 , 1).

Up 4 (2 , -2).

y = 4



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

Domain

$(-\infty, \infty)$ ✓

Range

$(-\infty, 4)$ ✓

y-int

(0, 2.5) ✓

$y = -3(2)^{0-1} + 4$

~~Inc~~/Dec

Dec. ✓

$(-\infty, \infty)$

Asymptote

y = 4 ✓

End Behavior ✓

as $x \to -\infty$ $y \to$ 4

as $x \to \infty$ $y \to -\infty$

What if your money doubled every 3 weeks.
Suppose that currently, you have $10 in the bank. How much money will you have in 6 months, assuming that there are four weeks each month? $2560
How long will it take for there to be $10,240 in your account?

# of doubles	0	1	2	3	4	5	6	7	8
weeks	0	3	6	9	12	15	18	21	24
$	10	20	40	80	160	320	640	1280	2560

y-int!

27	30
5120	10,240

$y = 10(2)^{8} = 2560$

$$\boxed{y = 10(2)^{x}}$$

y = $ in acct.
x = # of doubles

x	y
0	1
1	2
2	4
3	8
4	16
5	32
6	64

$$\frac{10,240}{10} = \frac{\cancel{10}(2)^x}{\cancel{10}}$$

$$\boxed{(1024) = 2^x}$$

x	y
7	128
8	256
9	512
10	1024

$2^{10} = 2^x$

$2^0 = 1$

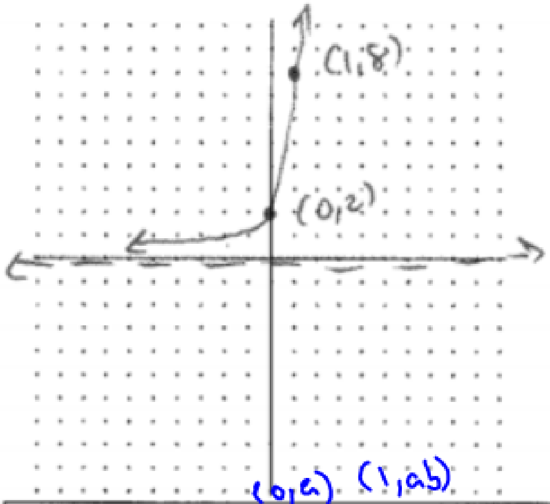
$1024 = 2^?$

$1024 = 2^{10}$

$x = 10$

$10 \cdot 3 = 30$ weeks

1. $y = 2(4)^x$



Critical Points: (0,2) (1,8)

Asymptote: y=0

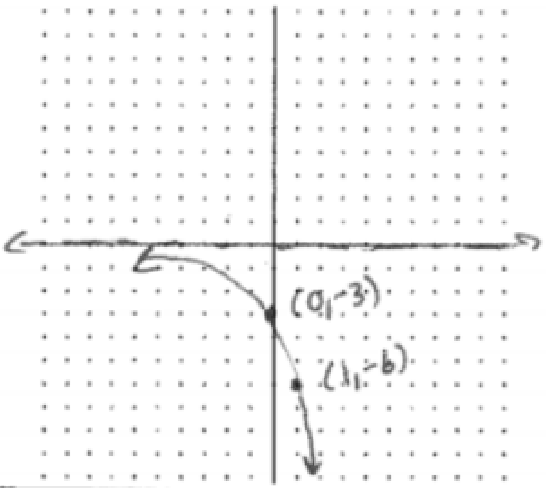
y – intercept: (0,2)

Domain: ($-\infty$, ∞) Range: (0, ∞)

End Behavior: $x \to \infty$, $y \to \infty$

$x \to -\infty$, $y \to 0$

2. $y = -3(2)^x$



Critical Points: (0,-3) (1,-6)

Asymptote: y=0

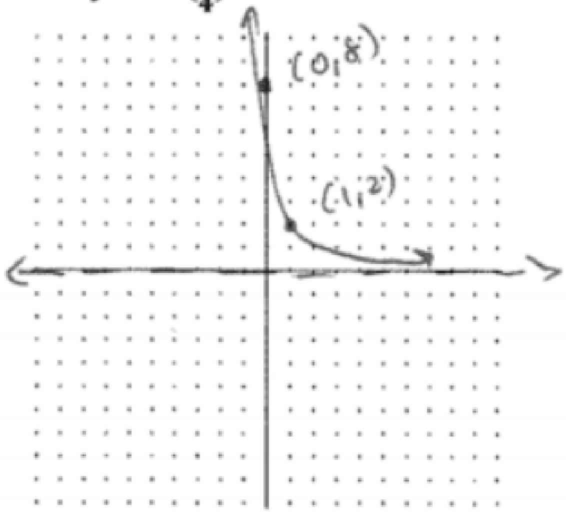
y – intercept: (0,-3)

Domain: ($-\infty$, ∞) Range: ($-\infty$, 0)

End Behavior: $x \to \infty$, $y \to -\infty$

$x \to -\infty$, $y \to 0$

3. $y = 8(\frac{1}{4})^x$



Critical Points: (0,8) (1,2)

Asymptote: y=0

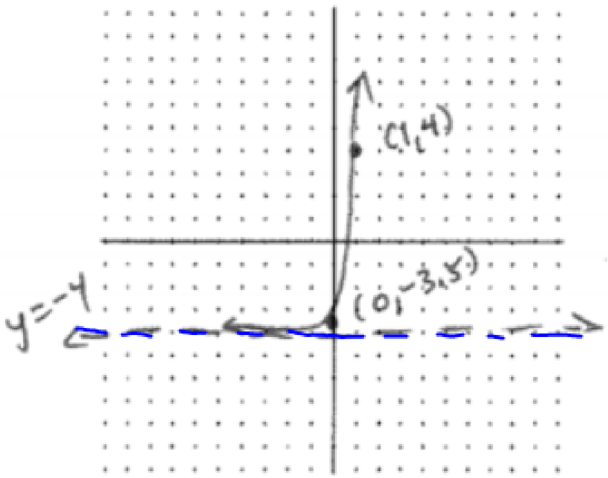
y – intercept: (0,8)

Domain: ($-\infty$, ∞) Range: (0, ∞)

End Behavior: $x \to \infty$, $y \to 0$

$x \to -\infty$, $y \to \infty$

4. $y = \frac{1}{2}(16)^x - 4$



Critical Points: (0,-3.5) (1,4)

Asymptote: y = -4

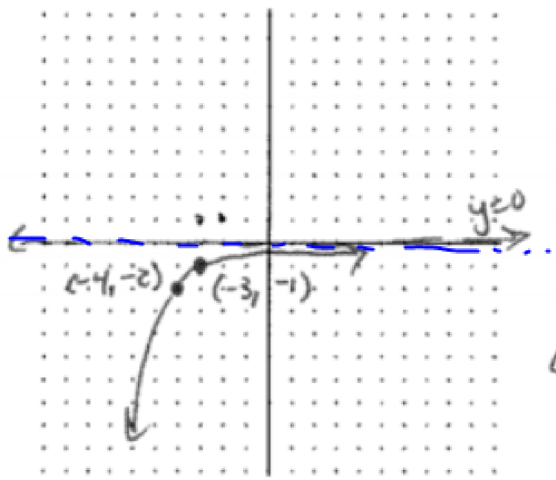
y – intercept: (0,-3.5)

Domain: (-∞,∞) Range: (-4,∞)

End Behavior: $x \to \infty$, $y \to \infty$

$x \to -\infty$, $y \to -4$

5. $y = -2(\frac{1}{2})^{x+4}$



Critical Points: (-4,-2) (-3,-1)

Asymptote: y=0

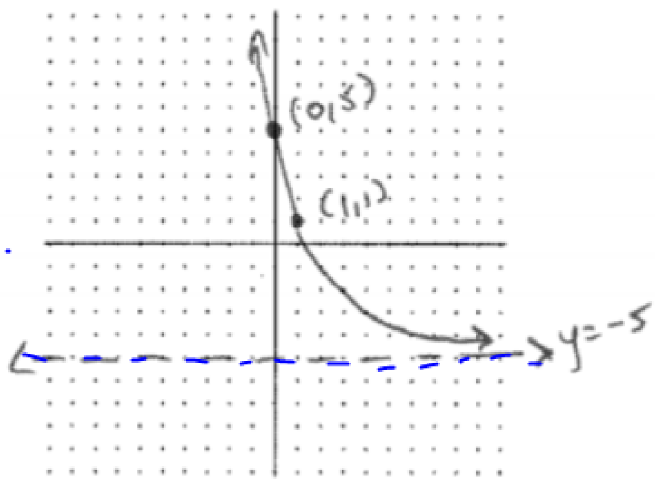
y – intercept: (0,-.125)

Domain: (-∞,∞) Range: (-∞,0)

End Behavior: $x \to \infty$, $y \to 0$

$x \to -\infty$, $y \to -\infty$

6. $y = 10(\frac{3}{5})^x - 5$



Critical Points: (0,5) (1,1)

Asymptote: y = -5

y – intercept: (0,5)

Domain: (-∞,∞) Range: (-5,∞)

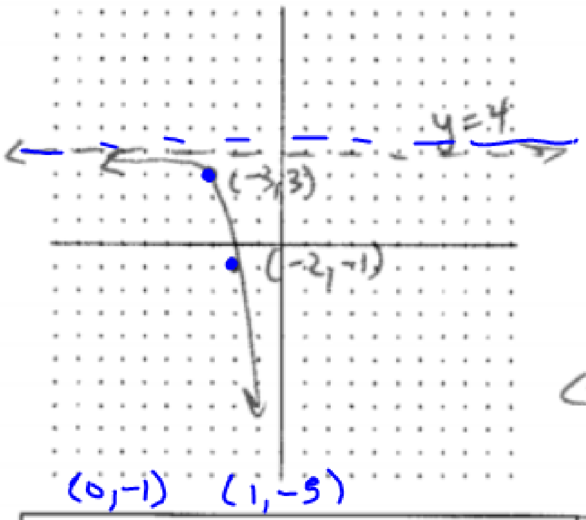
End Behavior: $x \to \infty$, $y \to -5$

$x \to -\infty$, $y \to \infty$

(0,a) (1,ab)

translations.

7. $y = -(5)^{x+3} + 4$



(0,-1) (1,-5)

Critical Points: (-3,3) (-2,-1)

Asymptote: y = 4

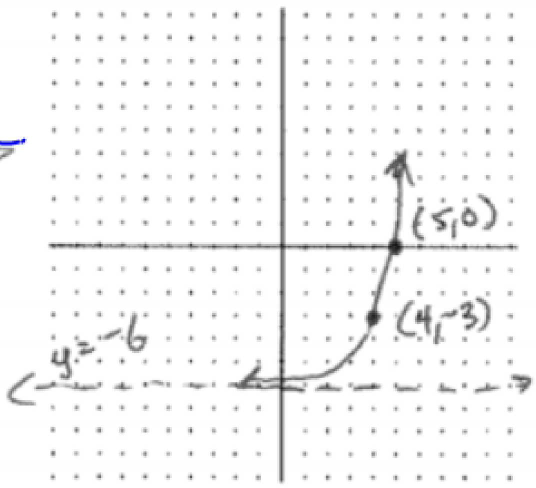
y – intercept: (0, -121)

Domain: (-∞, ∞) Range: (-∞, 4)

End Behavior: $x \to \infty$, $y \to -\infty$

$x \to -\infty$, $y \to 4$

8. $y = 3(2)^{x-4} - 6$



Critical Points: (4,-3) (5,0)

Asymptote: y = -6

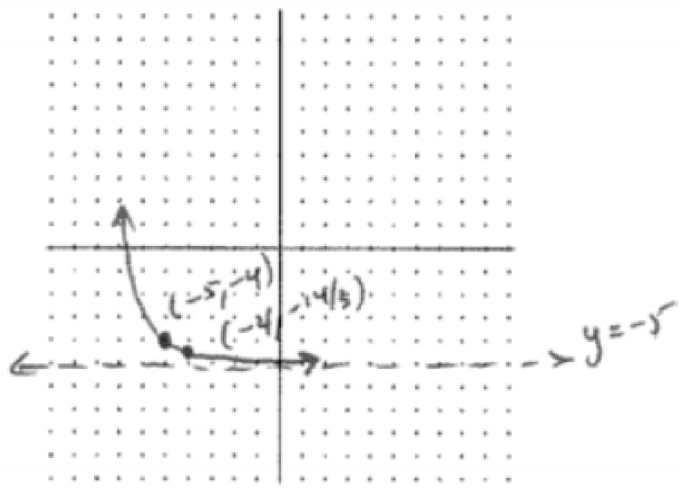
y – intercept: (0, -5.81)

Domain: (-∞, ∞) Range: (-6, ∞)

End Behavior: $x \to \infty$, $y \to \infty$

$x \to -\infty$, $y \to -6$

9. $y = (\frac{1}{3})^{x+5} - 5$



Critical Points: (-5,-4) (-4,-14/3)

Asymptote: y = -5

y – intercept: (0, -4.99)

Domain: (-∞, ∞) Range: (-5, ∞)

End Behavior: $x \to \infty$, $y \to -5$

$x \to -\infty$, $y \to \infty$

(0,a)
(1,ab)
y=0

translations.

E.Q.:

How do we solve exponential equations?

Powers of Numbers:

- In order to solve exponential equations, it is beneficial to be familiar with the different powers of some common numbers. $2^0, 2^1, 2^2, 2^3, 2^4, 2^5, 2^6, 2^7, 2^8, 2^9, 2^{10}$

Powers of 2: 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024

Powers of 3: 1, 3, 9, 27, 81, 243, 729,

Powers of 4: 1, 4, 16, 64, 256, 1024,

Powers of 5: 1, 5, 25, 125, 625,

Powers of 6: 1, 6, 36, 216,

Powers of 7: 1, 7, 49, 343,

Property of Equality of Exponential Functions:
If b is a positive number other than 1, then $b^x = b^y$ if and only if $x = y$. In other words, if the bases are the same, then the exponents must be equal.

$$b^{x} = b^{y}$$

x has to $= y$

$$3^x = 27$$

$$3^{x} = 3^{3}$$

$$x = 3$$

$$2^x = 4$$

$$2^{x} = 2^{2}$$

$$x = 2$$

Example 1: Solve for x

$$12^{1} = 12^{x}$$

$X = 1$

$1 = x$

$8^4 = 8^4$ ✓

Example 2: Solve for x

$8^{(7-3)}$

$$8^{(x-3)} = 8^{(4)}$$

$$x - 3 = 4$$
$$+3 \quad +3$$

$$x = 7$$

You try:
Solve each of the following equations

$100^6 = 100^x$

$x = 6$

$5^{(2x)} = 5^3$

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

$x = 1.5$
or
$\frac{3}{2}$

$2^{y-1} = 2^{-10}$

$y - 1 = -10$
$+1 \quad\quad +1$

$y = -9$

$y = -9$

Example 3: Solve for x

$$5^x = 25$$

$$\underline{5}^{x} = \underline{5}^{2}$$

$$x = 2$$

$$x = 2$$

-In order to solve exponential equations:

1) Get the same bases for the exponential equation.

2) Set the exponents = to each other.

3) Solve for the variable.

Example 4: Solve for x

$$3^{4x} = 27$$

$$\cancel{3}^{4x} = \cancel{3}^{3}$$

$$\frac{\cancel{4}x}{\cancel{4}} = \frac{3}{4}$$

$$\boxed{x = 3/4 \text{ or } .75}$$

You try:

Solve each of the following equations

$$2^x = 8$$

$$2^x = 2^3$$

$$x = 3$$

$$4^{x+1} = \underline{64}$$

$$4^{x+1} = 4^3$$

$$x+1 = 3$$

$$x = 2$$

$$8^{2x} = 64$$

$$8^{2x} = 8^2$$

$$2x = 2$$

$$x = 1$$

Example 5: Solve for y

$$9^{3y} = 27$$

$$(9)^{3y} = 3^3$$

$$(3^2)^{3y} = 3^3$$

$$3^{6y} = 3^3$$

$$\frac{6y}{6} = \frac{3}{6}$$

$$\boxed{y = \frac{1}{2} \text{ or } .5}$$

Example 6: Solve for x

$$32 = (4)^{x-3}$$

$$2(x-3)$$

$$2^5 = (2^2)^{x-3}$$

$$2^5 = 2^{2x-6}$$

$$5 = 2x - 6$$
$$+6 \qquad +6$$

$$11 = 2x$$

$$\boxed{x = 5.5 \text{ or } \frac{11}{2}}$$

You try:
Solve each of the following equations

$$8 = 16^x$$

$$2^3 = (2^4)^x$$

$$2^3 = 2^{4x}$$

$$3 = 4x$$

$$x = 3/4$$

$$125 = 25^{6y}$$

$$5^3 = (5^2)^{6y}$$

$$5^3 = 5^{12y}$$

$$3 = 12y$$

$$y = 3/12$$

$$\boxed{y = 1/4}$$

$$9^{x-1} = 27$$

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

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

$$2x - 2 = 3$$

$$2x = 5$$

$$\boxed{x = 5/2}$$

HW #4

Solving Exponential Equations