GRAPHING EXPONENTIAL FUNCTIONS – NOTES

OBJECTIVES:

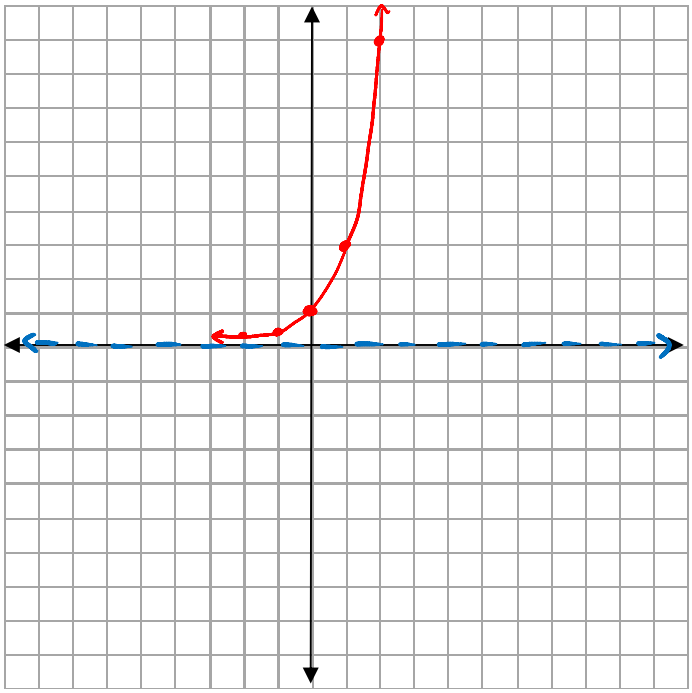
1) Graph an exponential function using a table. Identify the x and y intercepts and domain/range.
2) Identify and write an exponential growth or decay model from a real world scenario.

For the following examples, create a table of values and plot the points on the provided coordinate plane.

1. Sketch the graph of $f(x) = 3^x$.

x	y
-2	1/9
-1	1/3
0	1
1	3
2	9

x int. Algebraically:
$0 = 3^x$
No solution



x-int: DNE y-int: (0, 1)

Domain: $\mathbb{R}$ Range: $y > 0$

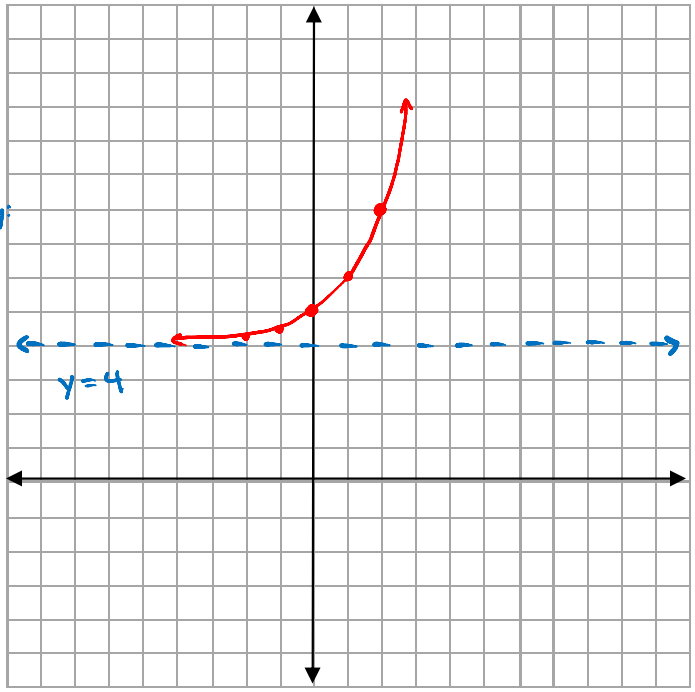
Asymptote: $y = 0$

ASYMPTOTE: An asymptote is a line in which a graph gets arbitrarily close to, but never touches, as the independent or dependent variable gets very large (in the positive or the negative direction).

2. Sketch the graph of $f(x) = 2^x + 4$.

x	Y
-2	$2^{-2}+4 = \frac{1}{4}+4 = 4.25$
-1	$2^{-1}+4 = \frac{1}{2}+4 = 4.5$
0	$2^0+4 = 1+4 = 5$
1	$2^1+4 = 2+4 = 6$
2	$2^2+4 = 4+4 = 8$

Algebraically:
x int:
$2^x + 4 = 0$
$2^x = -4$
No solution



x-int: D.N.E. y-int: (0, 5)

Domain: $\mathbb{R}$ Range: $y > 4$

Asymptote: $y = 4$

SUMMARY: As x increases, y increases. We call this an exponential growth function.

Sketch the graph of $f(x)=\left(\frac{1}{4}\right)^x$.

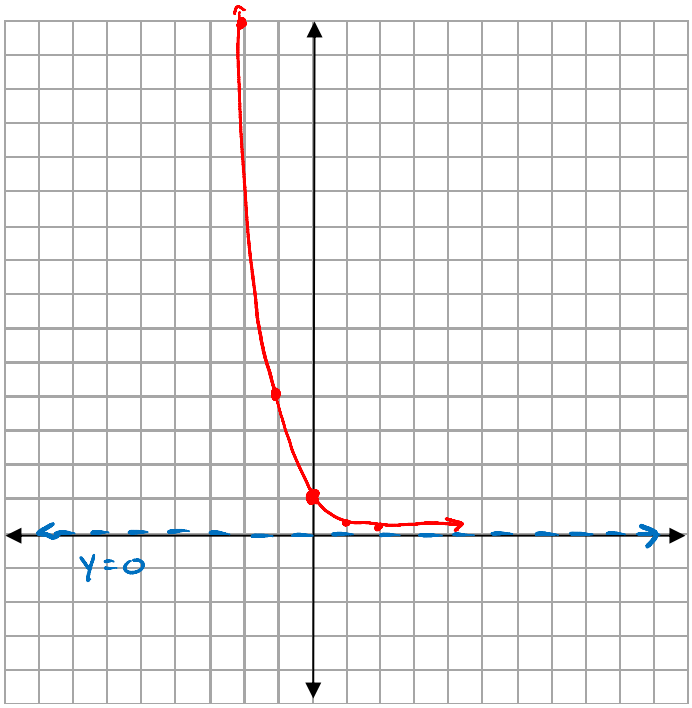
x	Y
-2	$\left(\frac{1}{4}\right)^{-2}=16$
-1	$\left(\frac{1}{4}\right)^{-1}=4$
0	$\left(\frac{1}{4}\right)^{0}=1$
1	$\left(\frac{1}{4}\right)^{1}=\frac{1}{4}$
2	$\left(\frac{1}{4}\right)^{2}=\frac{1}{16}$

x int: Algebraically: $\left(\frac{1}{4}\right)^x=0$ No solution!

x-int: DNE. y-int: (0, 1)

Domain: $\mathbb{R}$ Range: $y>0$

Asymptote: $y=0$



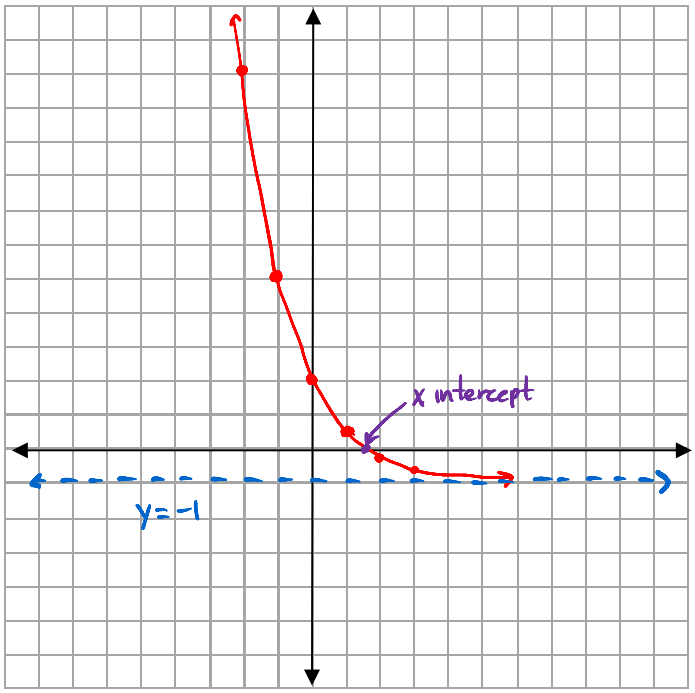
4. Sketch the graph of $f(x)=3\cdot\left(\frac{1}{2}\right)^x-1$.

x	Y
-2	$3\cdot\left(\frac{1}{2}\right)^{-2}-1=3\cdot4-1=11$
-1	$3\left(\frac{1}{2}\right)^{-1}-1=3\cdot2-1=5$
0	$3\left(\frac{1}{2}\right)^{0}-1=3\cdot1-1=2$
1	$3\left(\frac{1}{2}\right)^{1}-1=\frac{3}{2}-1=\frac{1}{2}$
2	$3\left(\frac{1}{2}\right)^{2}-1=\frac{3}{4}-1=-\frac{1}{4}$
3	$3\left(\frac{1}{2}\right)^{3}-1=\frac{3}{8}-1=-\frac{5}{8}$

x-int: (Between 1 & 2, 0) y-int: (0, 2)

Domain: $\mathbb{R}$ Range: $y>-1$

Asymptote: $y=-1$



Algebraically:

x int.

$3\left(\frac{1}{2}\right)^x-1=0$

$3\left(\frac{1}{2}\right)^x=1$

$\left(\frac{1}{2}\right)^x=\frac{1}{3}$

$\left(\frac{1}{2}\right)^1=\frac{1}{2}$ $\left(\frac{1}{2}\right)^2=\frac{1}{4}$ ∴ The x int. is between 1 & 2

SUMMARY: As x increases, y decreases. We call this an exponential decay function.