

3.8 - Transformations for Exponential Functions

Today we will INVESTIGATE:

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

Recall:

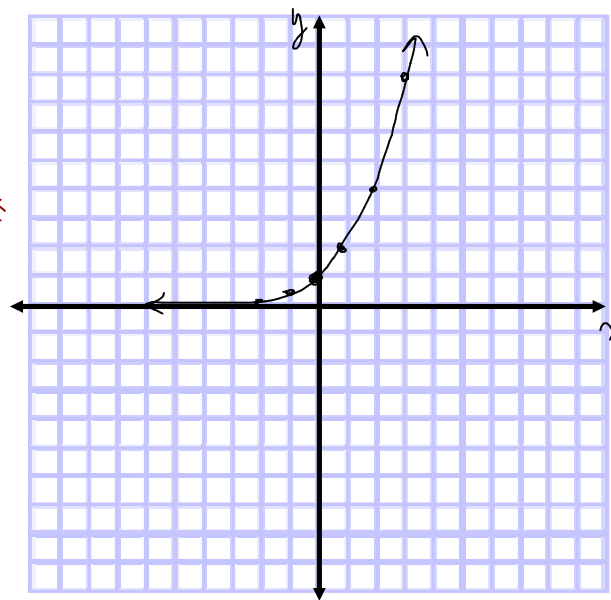
An asymptote: a line in which a curve approaches but never touches it!

a) $y=2^x$

i) Graph

	x	y
2^2	-2	$\frac{1}{4}$
2^{-1}	-1	$\frac{1}{2}$
2^0	0	1
2^1	1	2
2^2	2	4

$y=2^x$



ii) Transformations:

NO, this is base f^2

iii) Asymptotes:

H.A. $y=0$

iv) Domain:

$D: \{x \in \mathbb{R}\}$

Range:

$R: \{y \in \mathbb{R} \mid y > 0\}$

v) Increasing/Decreasing:

Increasing

vi) y-intercept:

$(0, 1)$

This is a BASE Function!

next you will try:

b) $y=2^x-6$

c) $y=-2^{x-3}$

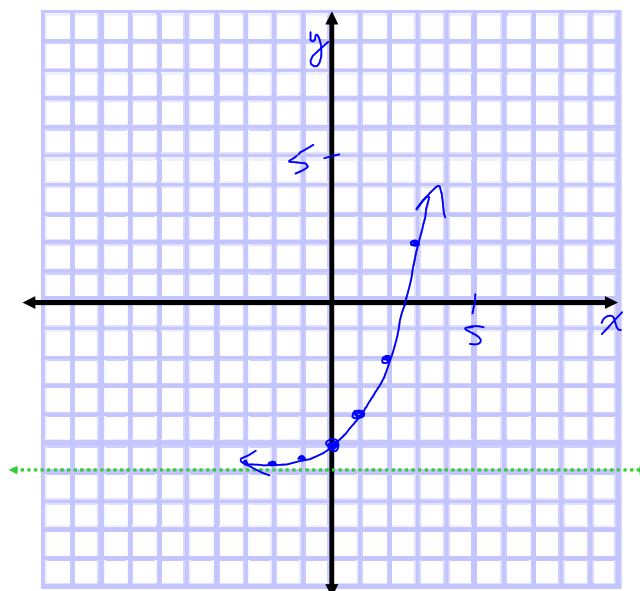
d) $y=2^{-x-1}$

e) $y=3(2)^x-8$

f) The inverse of $y=2^x$

b) $y = 2^x - 6$

i) Graph



ii) Transformations:

- Shift down 6

iii) Asymptotes:

HA $y = -6$

iv) Domain:

$$\{x \in \mathbb{R}\}$$

Range:

$$\{y \in \mathbb{R} \mid y > -6\}$$

v) Increasing/Decreasing:

Increasing

vi) y-intercept:

$$(0, -5)$$

c) $y = -2^{x-3}$

i) Graph
 - Reflection over x

- Right 3

ii) Transformations:

iii) Asymptotes:

H.A. $y = 0$

iv) Domain:

$\{x \in \mathbb{R}\}$

Range:

$\{y \in \mathbb{R} \mid y < 0\}$

v) Increasing/Decreasing:

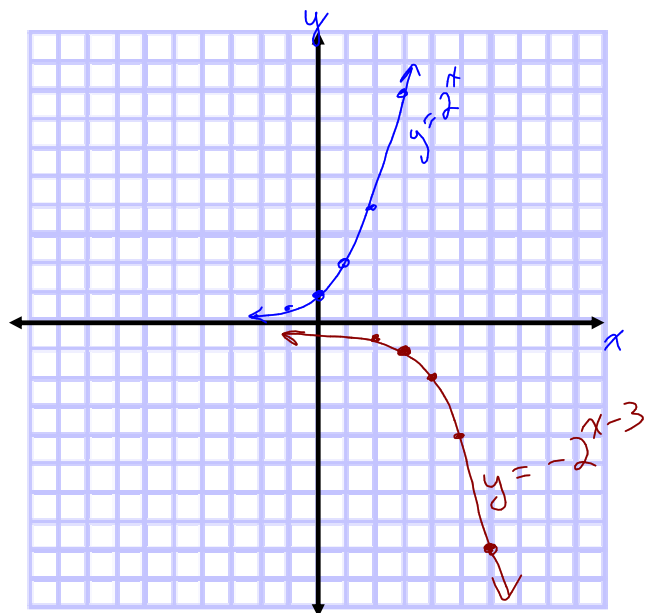
Decreasing

vi) y-intercept:

$(0, -\frac{1}{8})$

$$-2^{0-3}$$

$$= -\frac{1}{8}$$



$$(x, y) \rightarrow (x+3, -y)$$

$$(0, 1) \rightarrow (3, -1)$$

$$(-1, \frac{1}{2}) \rightarrow (2, -\frac{1}{2})$$

$$(1, 2) \rightarrow (4, -2)$$

$$(2, 4) \rightarrow (5, -4)$$

$$(3, 8) \rightarrow (6, -8)$$

d) $y = 2^{-x-1}$

i) Graph

★ Factor!
 $y = 2^{-(x+1)}$

- Reflection over y-axis
- Shift left 1

ii) Transformations:

iii) Asymptotes:

HA $y = 0$

iv) Domain:

$\{x \in \mathbb{R}\}$

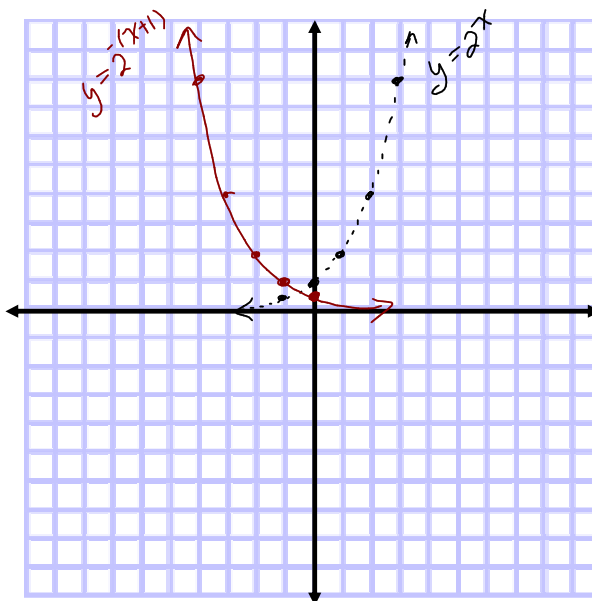
Range:

$\{y \in \mathbb{R} \mid y > 0\}$

v) Increasing/Decreasing:

vi) y-intercept:

$(0, \frac{1}{2})$



$(x, y) \rightarrow (-x-1, y)$

$(-1, \frac{1}{2}) \rightarrow (0, \frac{1}{2})$

$(0, 1) \rightarrow (-1, 1)$

$(1, 2) \rightarrow (-2, 2)$

$(2, 4) \rightarrow (-3, 4)$

$(3, 8) \rightarrow (-4, 8)$

e) $y = 3(2)^x - 8$

i) Graph

- Vert. stretch by factor of 3

- Shift down 8

ii) Transformations:

iii) Asymptotes:

H.A. $y = -8$

iv) Domain:

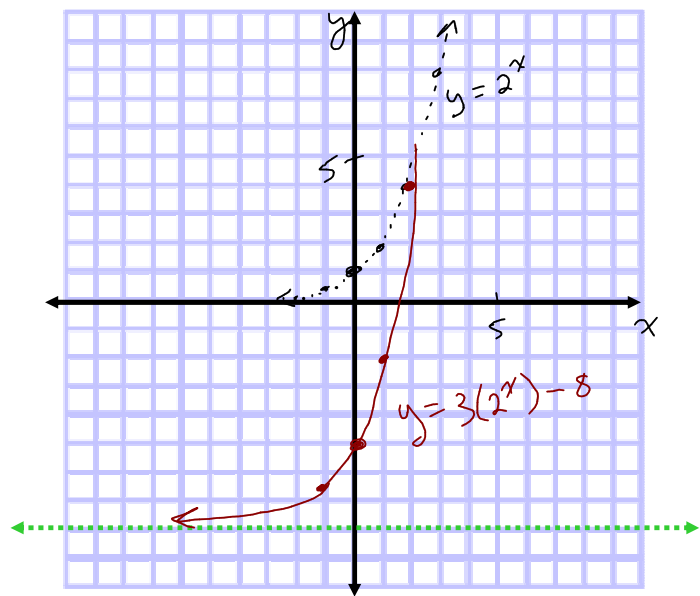
$\{x \in \mathbb{R}\}$

Range: $\{y \in \mathbb{R} \mid y > -8\}$

v) Increasing / Decreasing:

vi) y-intercept:

$(0, -5)$



$(x, y) \rightarrow (x, 3y - 8)$

$(-1, \frac{1}{2}) \rightarrow (-1, -6.5)$

$(0, 1) \rightarrow (0, -5)$

$(1, 2) \rightarrow (1, -2)$

$(2, 4) \rightarrow (2, 4)$

$(3, 8) \rightarrow (3, 16)$

f) The inverse of $y=2^x$

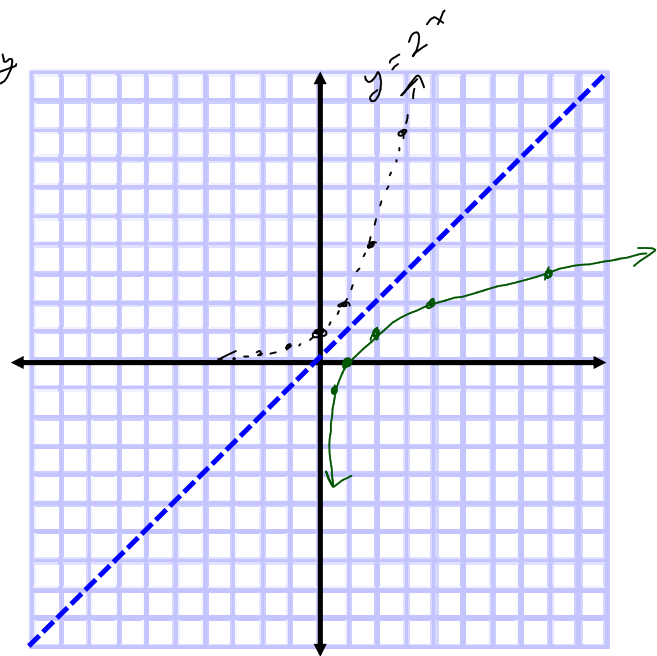
i) Graph

- $(-1, \frac{1}{2}) \rightarrow (\frac{1}{2}, -1)$
- $(0, 1) \rightarrow (1, 0)$
- $(1, 2) \rightarrow (2, 1)$
- $(2, 4) \rightarrow (4, 2)$
- $(3, 8) \rightarrow (8, 3)$

Algebraically

$$y = \log_2 x$$

SWAP
 $(x, y) \rightarrow (y, x)$



ii) Transformations:

Reflection over $y=x$

iii) Asymptotes:

V.A. $x=0$

iv) Domain:

$$\{x \in \mathbb{R} \mid x > 0\}$$

Range:

$$\{y \in \mathbb{R}\}$$

v) Increasing/Decreasing:

vi) y-intercept:

NONE

Homework - Handout 3.8A Graphing Exponential Functions