

(For scans)

* a key point is the y-intercept

Graphing Exponential Functions

Name _____

Key

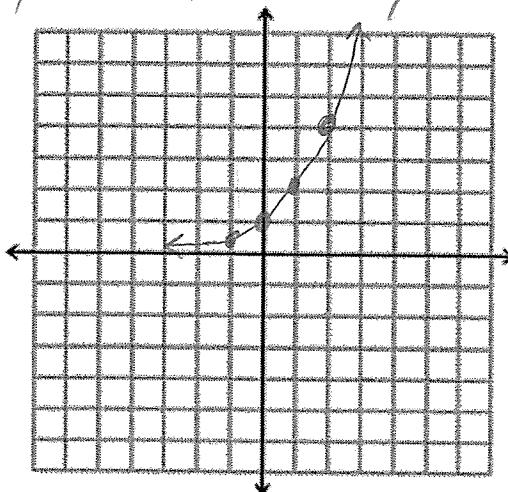
Must be able to graph quickly and mentally.

Graph $y = 2^x$. Label any intercepts and asymptotes.

D: $(-\infty, \infty)$ another point
 R: $(0, \infty)$ $(1, 2)$
 $(2, 4)$

Step 1 → y-int: $(0, 1)$ ↗ step 2: how does y change as x ↓?
 asymptote: $y = 0$ ↗ step 3: how does y change as x ↑?

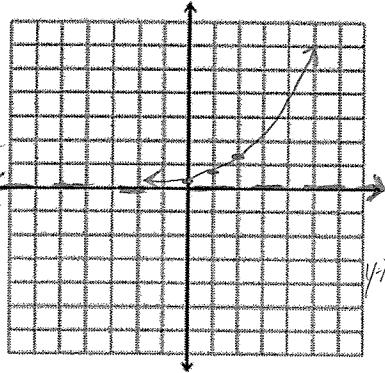
Increasing or Decreasing?
 Read left to right: Increasing



1. Compare the following graphs to $y = 2^x$. Label the asymptote, y-intercept, and one additional point for each graph.

↑ tell sts: make very dark if an x/y axis.

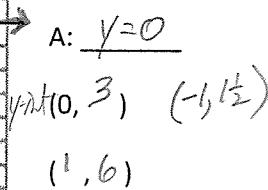
$y = \frac{1}{3} \cdot 2^x$



asymptote
 A: $y = 0$

y-int $(0, \frac{1}{3})$
 $(1, \frac{2}{3})$

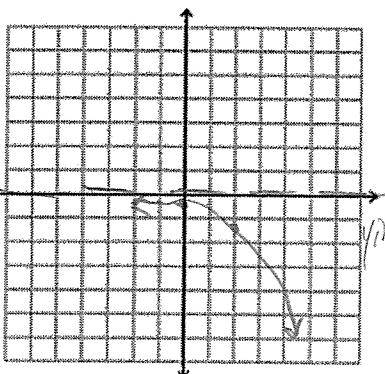
$y = 3 \cdot 2^x$



A: $y = 0$

y-int $(0, 3)$ $(-1, 1.5)$
 $(1, 6)$

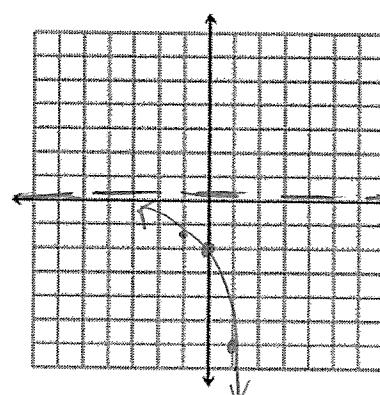
$y = -\frac{1}{3} \cdot 2^x$



A: $y = 0$

y-int $(0, -\frac{1}{3})$
 $(2, -\frac{4}{3})$
 $(-1, -\frac{1}{3})$

$y = -3 \cdot 2^x$



A: $y = 0$

y-int $(0, -3)$
 $(1, -6)$
 $(-1, -1.5)$

Describe the effect of a on the graph of $y = a \cdot 2^x$.

a is the y-intercept: $(0, a)$

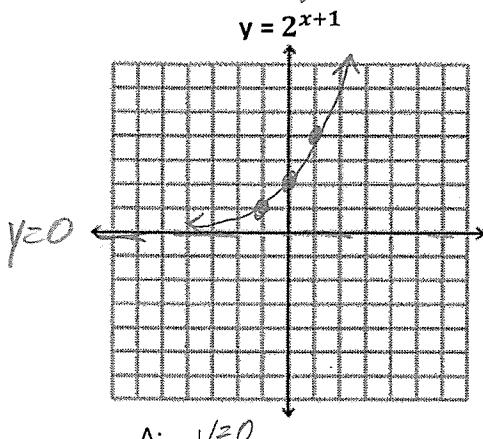
When a is negative → graph is reflection over the x-axis.

Ignoring the signs: When $|a| > 1$ ↗ y grows faster → vertical stretch → steeper.

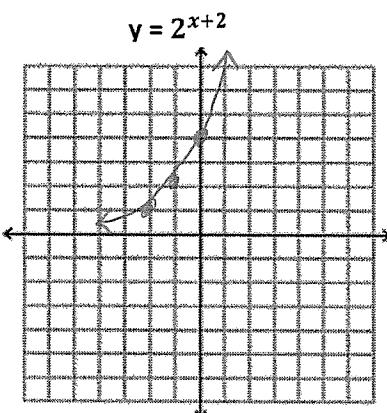
$0 < |a| < 1$ ↗ y grows slower → vertical shrinkage → less steep.

just like when we add/sub from input in linear quadr.

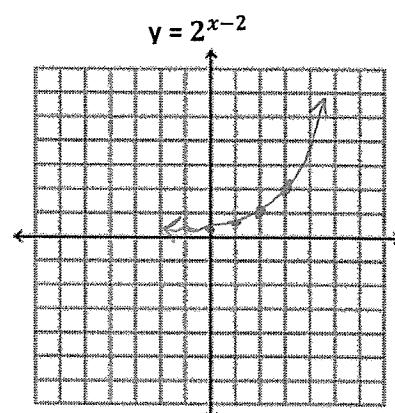
2. Compare the following graphs to $y = 2^x$. Label the asymptote, y-intercept, and one additional point for each graph.



$$\begin{array}{ccc} \text{left} & (0, 2) & (-1, 1) \\ & (1, 4) \end{array}$$



$$\begin{array}{cc} \rightarrow (0, 4) & (-1, 2) \\ (1, 8) & (-3, 1) \end{array}$$

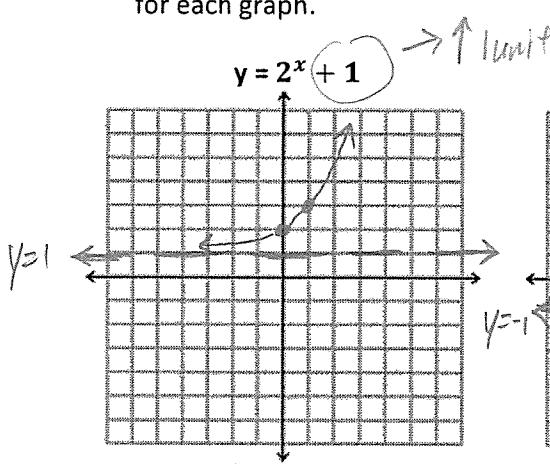


$$A: \underline{y=0}$$

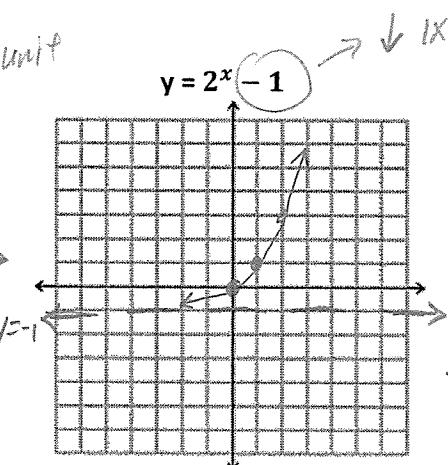
Describe the effect of h on the graph of $y = 2^{x-h}$.

"h" shifts the parent graph left/right, " $-h$ " shifts to the right h units, " $+h$ " shifts to the left.

3. Compare the following graphs to $y = 2^x$. Label the asymptote, y-intercept, and one additional point for each graph.



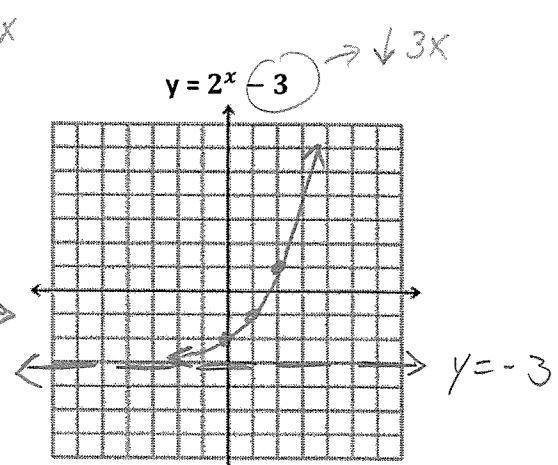
$$A: \underline{y=1} \quad (-1, 1\frac{1}{2}) \\ (0, 2) \quad (-2, 1\frac{1}{4}) \\ (1, 3)$$



$$A: \underline{y = -1}$$

(0, 0)

(1, 1)



$$A: \underline{y = -3}$$

(0, -2)

(1, -1)

Describe the effect of k on the graph of $y = 2^x + k$.

K shifts the graph (see y-int.) up/down y-axis:
 $+K \uparrow K$ units
 $-K \downarrow K$ units.

"K" is your asymptote (also shifted): $y = K$

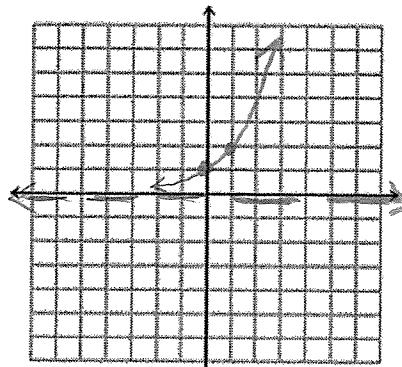
4. Graph each of the following. Label the asymptote, y-intercept, and one additional point for each graph.

$$y = 2^x$$

$$A: \underline{y=0}$$

$$(0, 1)$$

$$(1, 2)$$

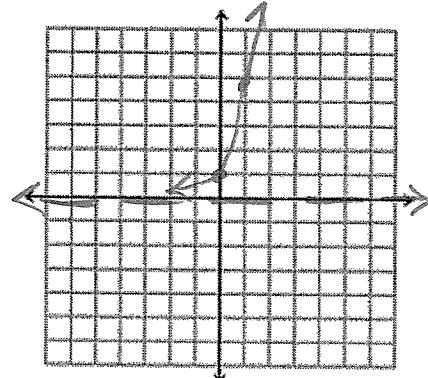


$$y = 5^x$$

$$A: \underline{y=0}$$

$$(0, 1)$$

$$(1, 5)$$



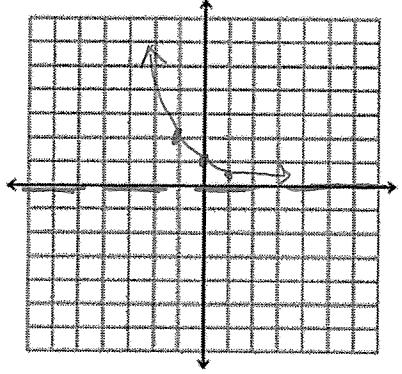
$$y = \left(\frac{1}{2}\right)^x$$

$$A: \underline{y=0}$$

$$(0, 1)$$

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

$$(-1, 2)$$



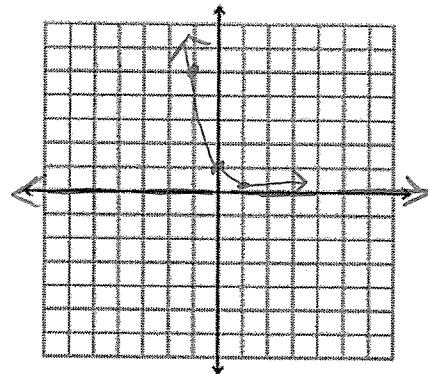
$$y = \left(\frac{1}{5}\right)^x$$

$$A: \underline{y=0}$$

$$(0, 1)$$

$$(1, \frac{1}{5})$$

$$(-1, 5)$$



Describe the graph of $y = b^x$ when $b > 1$ and when $0 < b < 1$ (increasing/decreasing?). What point do all of the graphs have in common?

- ① • When b , the base, is bigger (and $b > 1$) \rightarrow the graph is steeper "increasingly"
- ② • When $0 < b < 1$, graph is decreasing (decaying) | ④ b^x and $(\frac{1}{b})^x$ are reflections over y-axis
- ③ • All past graphs have in common: y-intercept

5. Compare the following graph to $y = 2^x$. Label the asymptote, y-intercept, and one additional point.

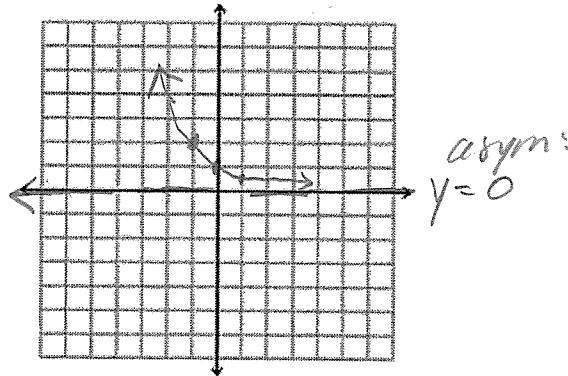
$$y = 2^{-x}$$

$$\text{y-int: } (0, 1)$$

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

$$(2, \frac{1}{4})$$

$$(-1, 2)$$



⑤ When $0 < b < 1$, the smaller the fraction, the faster the decay. In examples above, only $\frac{1}{2}$ remains vs. $\frac{1}{4}$ remains.

How do the graphs of $y = 2^x$ and $y = 2^{-x}$ compare?

They are reflections of each other, over the y-axis.

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

6. Describe the transformations of each function from the parent graph of $y = 2^x$ then sketch each graph without a graphing calculator. Find the domain, range, y-intercept, and asymptote.

a) $y = 2^{x+4} - 15$ shifts down 15x

Transformations:
shifts left 4x

$$\begin{array}{ll} (1, 17) & (-5, -14\frac{1}{2}) \\ (-4, -14) & (-6, -14\frac{3}{4}) \end{array}$$

D: $(-\infty, \infty)$

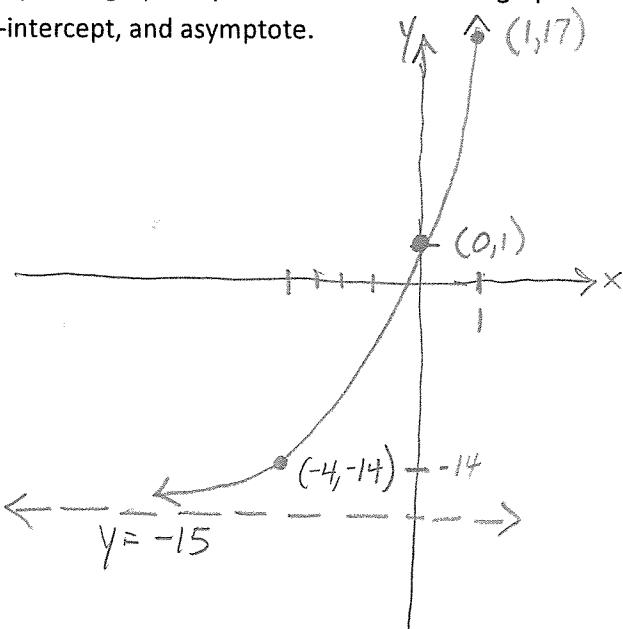
R: $(-15, \infty)$

y-int: $(0, 1)$

asymptote: $y = -15$

Increasing or Decreasing?

increasing



b) $y = -3(2^x) + 5$

Transformations:

reflect over x-axis

shift up 5x $(-1, 3.5)$

$$(1, -1)$$

$$(2, -7)$$

$$(-2, 4\frac{1}{4})$$

D: $(-\infty, \infty)$

R: $(-\infty, 5)$

y-int: $(0, 2)$

$$y = -3(2^0) + 5 = 2$$

asymptote: $y = 5$

Increasing or Decreasing?

Decreasing

