

8.6b Warm-Up:

Write an exponential decay function.

Find 5 points for your function.


$$y = b^x \cdot a$$

↑
fraction
or decimal
less than 1

Graph the functions $y = 3 \cdot \left(\frac{1}{2}\right)^x$ and $y = -\frac{1}{3} \cdot \left(\frac{1}{2}\right)^x$. Compare each
graph with the graph of $y = \left(\frac{1}{2}\right)^x$.

x	$y = \left(\frac{1}{2}\right)^x$	$y = 3 \cdot \left(\frac{1}{2}\right)^x$	$y = -\frac{1}{3} \cdot \left(\frac{1}{2}\right)^x$
-2	4	$3 \cdot 4 = 12$	$-\frac{1}{3} \cdot 4 = -\frac{4}{3}$
-1	2	$3 \cdot 2 = 6$	$-\frac{1}{3} \cdot 2 = -\frac{2}{3}$
0	1	$3 \cdot 1 = 3$	$-\frac{1}{3} \cdot 1 = -\frac{1}{3}$
1	$\frac{1}{2}$	$3 \cdot \frac{1}{2} = 1\frac{1}{2}$	$-\frac{1}{3} \cdot \frac{1}{2} = -\frac{1}{6}$
2	$\frac{1}{4}$	$3 \cdot \frac{1}{4} = \frac{3}{4}$	$-\frac{1}{3} \cdot \frac{1}{4} = -\frac{1}{12}$

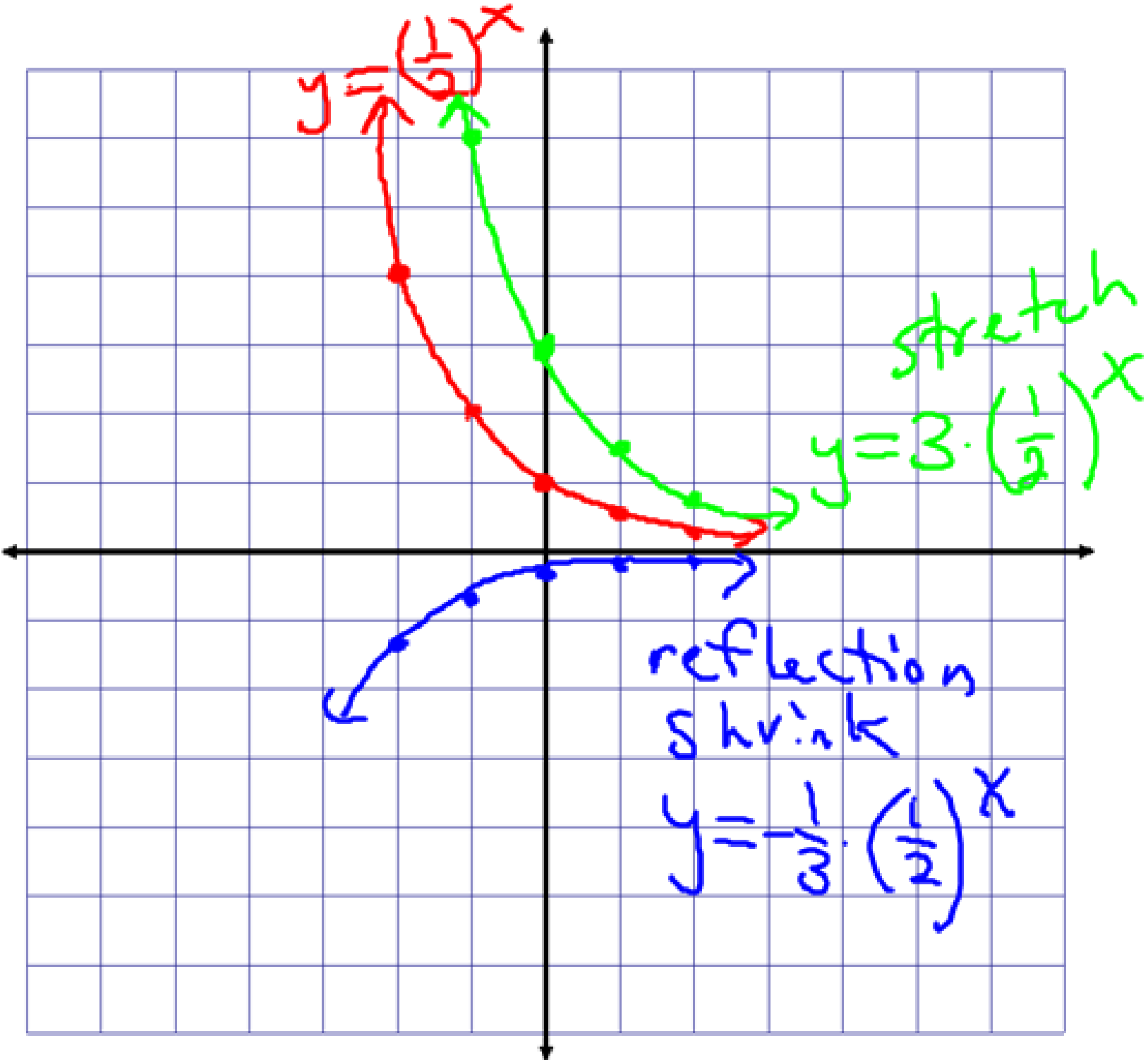
$$\left(\frac{1}{2}\right)^{-1} = 2$$

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

$$3 \cdot \frac{1}{2}$$

$$3 \cdot \frac{1}{4}$$

$$-\frac{1}{3} \cdot 4$$

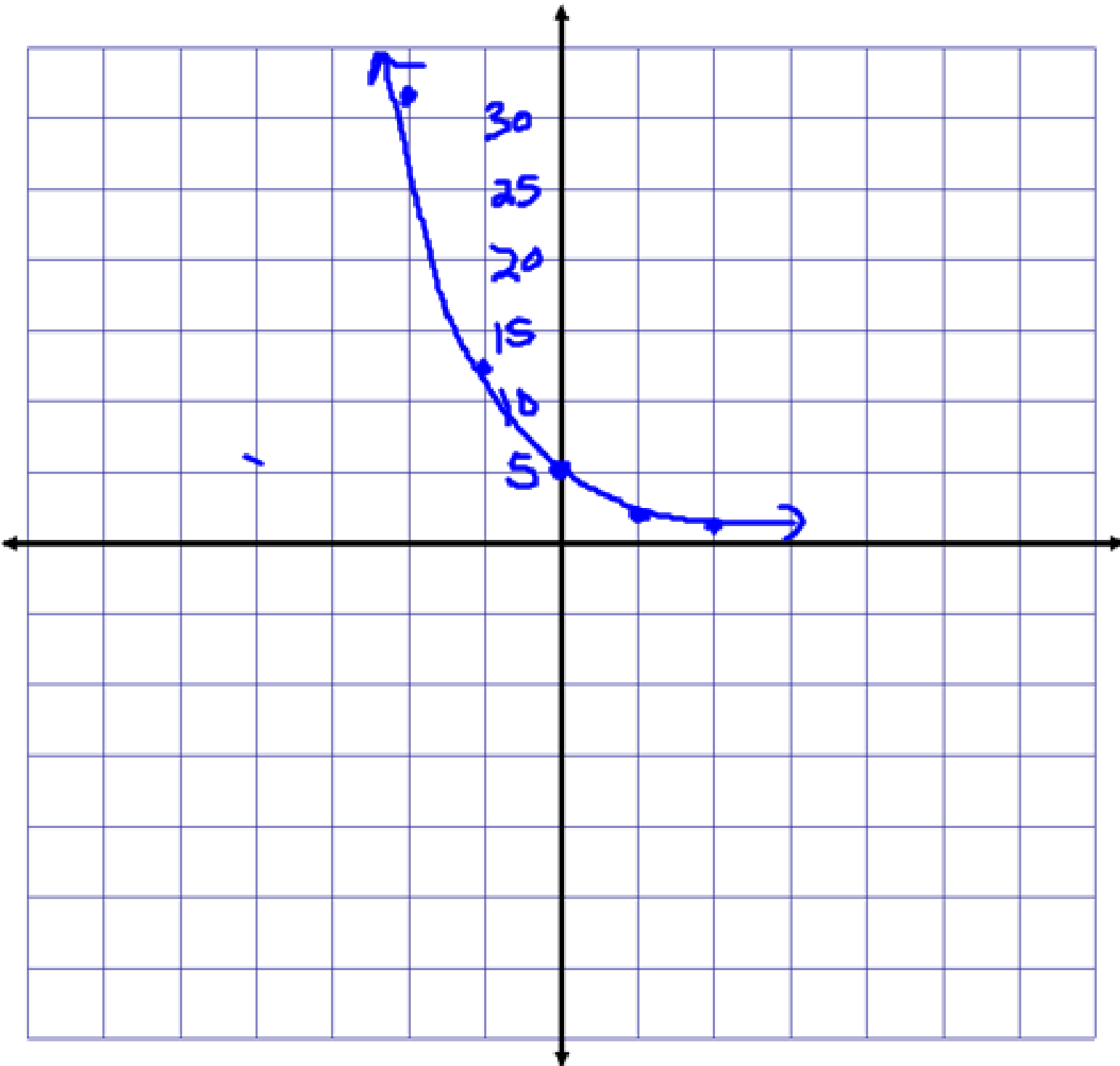


Graph $y = 5 \cdot (0.4)^x$. Compare the graph with the graph of $y = (0.4)^x$.

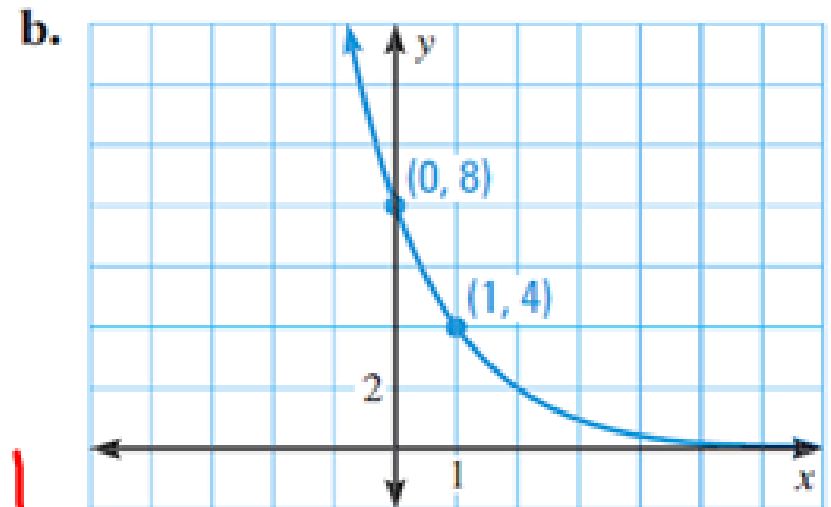
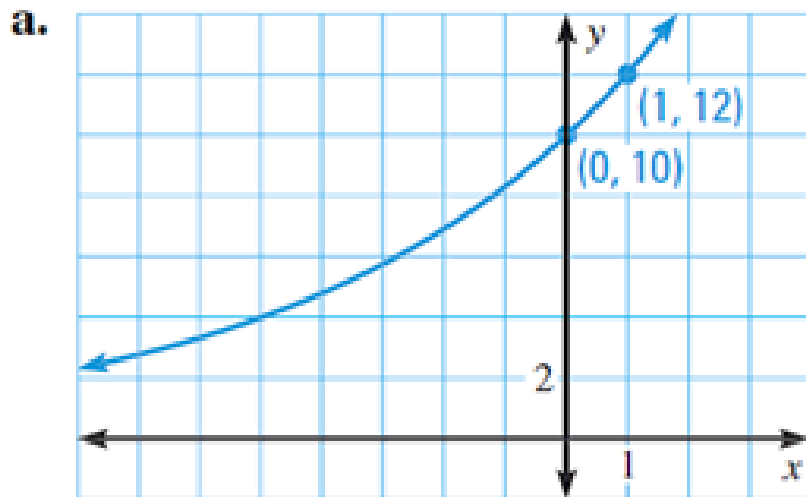
$5 \div .16$

x	y
-2	31.25
-1	12.5
0	5
1	2
2	.8

$$\begin{aligned}5 \cdot (0.4)^{-2} &= 5 \cdot \frac{1}{4^2} = 5 \cdot \frac{1}{16} = 31.25 \\5 \cdot (0.4)^{-1} &= 5 \cdot \frac{1}{4} = 12.5 \\5 \cdot (0.4)^0 &= 5 \cdot 1 = 5 \\5 \cdot (0.4)^1 &= 5 \cdot .4 = 2 \\5 \cdot (0.4)^2 &= 5 \cdot .16 = .8\end{aligned}$$



Tell whether the graph represents *exponential growth* or *exponential decay*. Then write a rule for the function.



growth

$y = 1.2^x \cdot 10$

$12 \div 10 = 1.2$

x	0	1
y	10	12

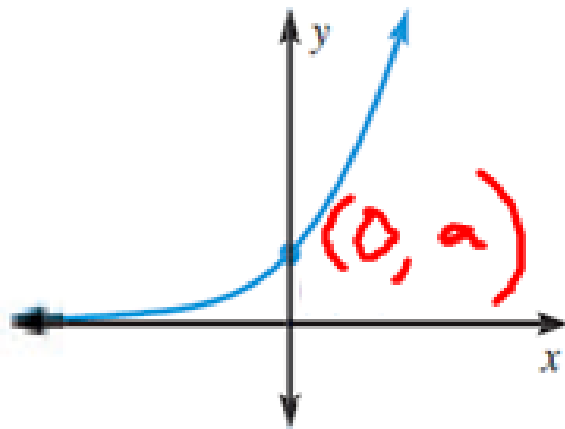
decay

x	0	1
y	8	4

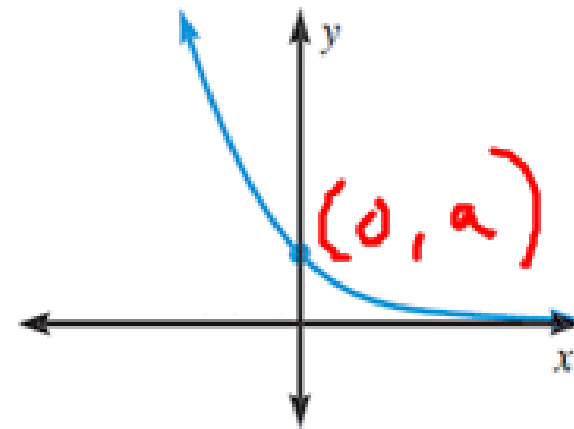
$y = 0.5^x \cdot 8$

$4 \div 8 = 0.5$

Exponential Growth



Exponential Decay



$$\begin{array}{l} y = b^x \cdot a \\ y = b^0 \cdot a \\ y = 1 \cdot a \end{array}$$

Exponential Decay Model

a is the *starting amount*

$$y = a(1 - r)^t$$

r is the *rate*

$1 - r$ is the

t is the *time*

decay rate

A farmer bought a tractor in 1999 for \$30,000. The value of the tractor has been decreasing at a rate of 18% per year.

- a. Write a function that models the value of the tractor over time.

$$y = 30000(1 - .18)^t = 30000(.82)^t$$

- b. What was the approximate value of the tractor in 2005?

$$2005 - 1999 = 6 \text{ yrs} \quad y = 30000(.82)^6$$

- c. What will the approximate value be in 2012?

$$2012 - 1999 = 13$$
$$y = 30000(.82)^{13}$$

\$2,273

$$30000(.304\dots)$$

\$9,120.

$$y = \left(\frac{1}{4}\right)^x$$

Homework:

pp 535-8

#'s 20-30 E, 32-34,
38-40, 47, 50, 54-58 E

Quiz next time over
growth and decay!!

x	y
-2	16
-1	4
0	1
1	$\frac{1}{4}$
2	$\frac{1}{16}$