Graph Exponential Decay Functions (2)

Notes $y = a(b)^x$ (expo form)

Name Key 2014-15

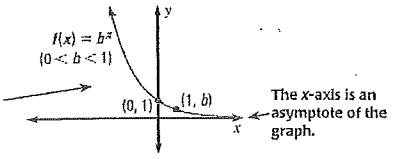
Hour _____ Date _____

Honors Algebra 2

KEY CONCEPT For Your Notebook

Parent Function for Exponential Decay Functions

The function $f(x) = b^x$, where $0 < b < 1$, is the parent function for the family of exponential decay functions with base b. The general shape of the graph of $f(x) = b^x$ is shown below.



The graph falls from left to right, passing through the points (0, 1) and (1, b).

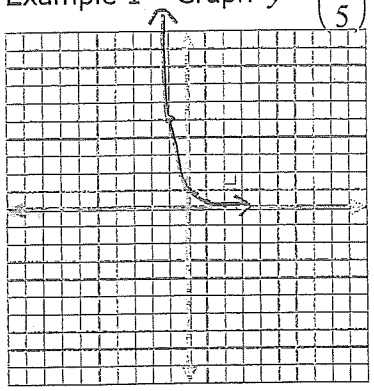
The x-axis is an asymptote of the graph.

The domain of $f(x) = b^x$ is all real numbers. The range is $y > 0$.

Expo Growth:
b > 1
as x-values increase graph moves away from x-axis

Expo Decay:
0 < b < 1
as x-values increase graph moves towards x-axis

Example 1 – Graph $y = \left(\frac{1}{5}\right)^x$.

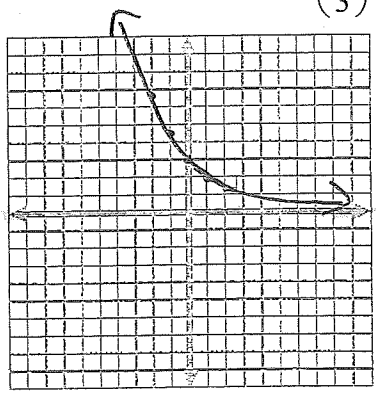


X	Y
−2	$(\frac{1}{5})^{-2} = 5^2 = 25$
−1	$(\frac{1}{5})^{-1} = 5^1 = 5$
0	$(\frac{1}{5})^0 = 1$
1	$(\frac{1}{5})^1 = 0.2$
2	$(\frac{1}{5})^2 = 0.04$

D: $(-\infty, \infty)$ R: $(0, \infty)$

HA: $y = 0$

Example 2 – Graph $y = 3\left(\frac{2}{3}\right)^x$

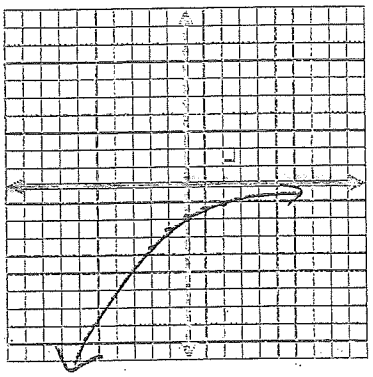


X	Y
−2	$3(\frac{2}{3})^{-2} = 6.75$
−1	$3(\frac{2}{3})^{-1} = 4.5$
0	$3(\frac{2}{3})^0 = 3$
1	$3(\frac{2}{3})^1 = 2$
2	$3(\frac{2}{3})^2 = 1.\overline{3}$

D: $(-\infty, \infty)$ R: $(0, \infty)$

HA: $y = 0$

Example 3 – Graph $y = -2\left(\frac{3}{4}\right)^x$

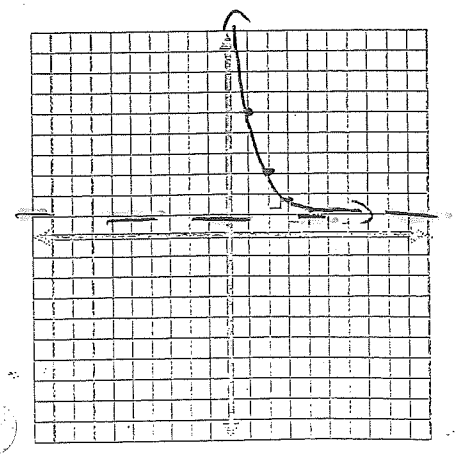


X	Y
−2	$-2(\frac{3}{4})^{-2} = -3.6$
−1	$-2(\frac{3}{4})^{-1} = -2.6$
0	$-2(\frac{3}{4})^0 = -2$
1	$-2(\frac{3}{4})^1 = -1.5$
2	$-2(\frac{3}{4})^2 = -1.12$

D: $(-\infty, \infty)$ R: $(-\infty, 0)$

HA: $y = 0$

Example 4 – Graph $y = 2\left(\frac{1}{3}\right)^{x-2} + 1$. State the domain and range. R: > 1



X	Y
0	$2(\frac{1}{3})^{(0-2)} + 1 = 19$
1	$2(\frac{1}{3})^{(1-2)} + 1 = 6$
2	$2(\frac{1}{3})^{(2-2)} + 1 = 3$
3	$2(\frac{1}{3})^{(3-2)} + 1 = 1.7$
4	$2(\frac{1}{3})^{(4-2)} + 1 = 1.5$

D: $(-\infty, \infty)$ or all real #s

R: $(1, \infty)$ or $y > 1$

HA: $y = 1$

The closer b is to 1, the slower the decay.

The closer b is to 0, the faster the decay.

$$b = \frac{(100-15)}{100} = \frac{85}{100} = 0.85$$

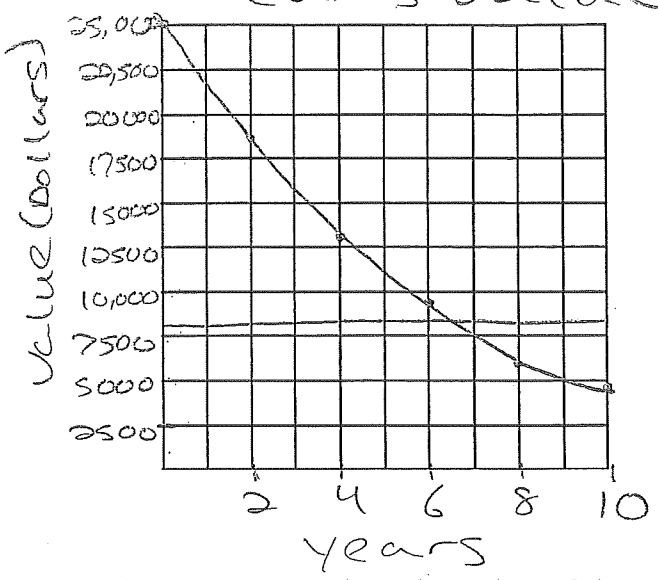
Example 5 – A new car costs $25,000. The value of the car decreases by 15% each year.

a. Write an exponential decay model giving the car's value y (in dollars) after t years. Estimate the value after 4 years.

$$y = 25{,}000(1-0.15)^x$$

$$y = 25{,}000(0.85)^4 = \$13{,}050.16$$

b. Graph the model.



y-axis scale
25,000/10 = 2,500 per interva

c. Use the graph to estimate when the value of the car will be $8,000.

≈ 6 ½ years later

* moving toward the x-axis as x-values increase.

Assignment – P. 489-491 #1-23 odd, 30-33.

Section 7.2

P. 489-491

(1) $y = 1250(0.85)^t$

Initial amount - 1250

Decay factor - 0.85

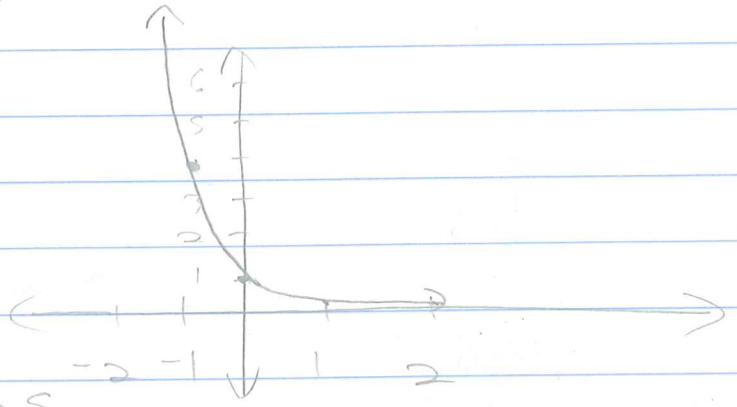
% decrease - 15%

(3) Decay

(5) Growth

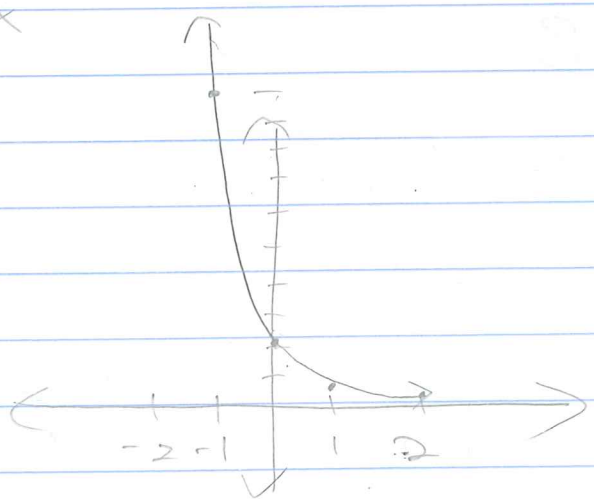
(7) $y = \left(\frac{1}{4}\right)^x$

x	y
-2	16
-1	4
0	1
1	0.25
2	0.0625



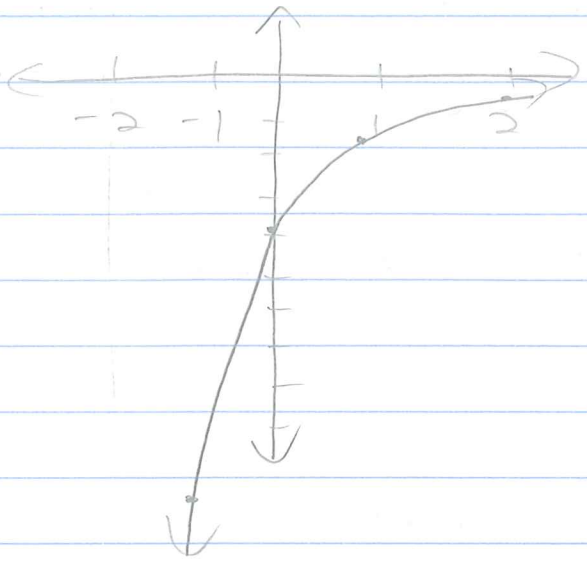
(9) $f(x) = 2\left(\frac{1}{5}\right)^x$

x	y
-2	50
-1	10
0	2
1	0.4
2	0.08



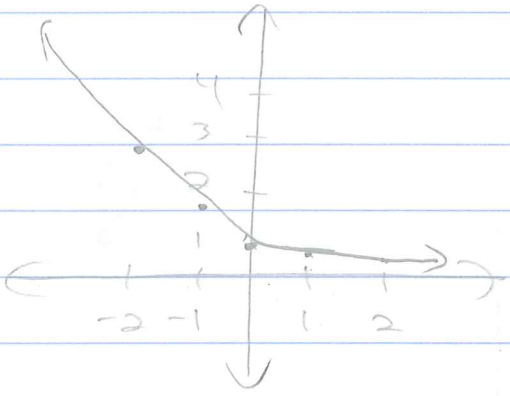
(11) $y = -4\left(\frac{1}{3}\right)^x$

x	y
-2	-36
-1	-12
0	-4
1	$-1.\overline{3}$
2	$-0.\overline{4}$



(13) $y = \left(\frac{3}{5}\right)^x$

x	y
-2	$2.\overline{7}$
-1	$1.\overline{6}$
0	1
1	0.6
2	0.36



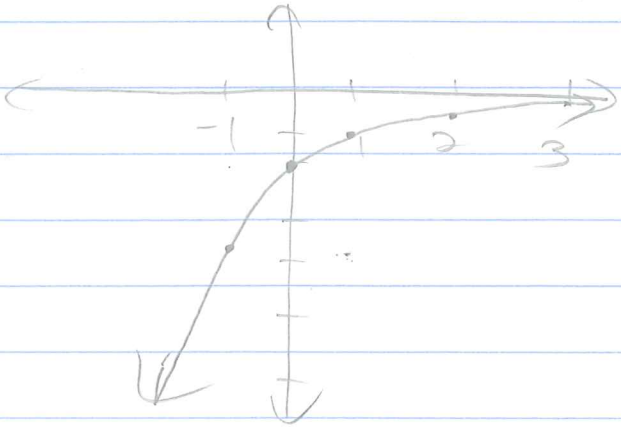
(15) B

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

x	y
-1	-4
0	-2
1	-1
2	-0.5
3	-0.25

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

R: $(-\infty, 0)$
or
$y < 0$

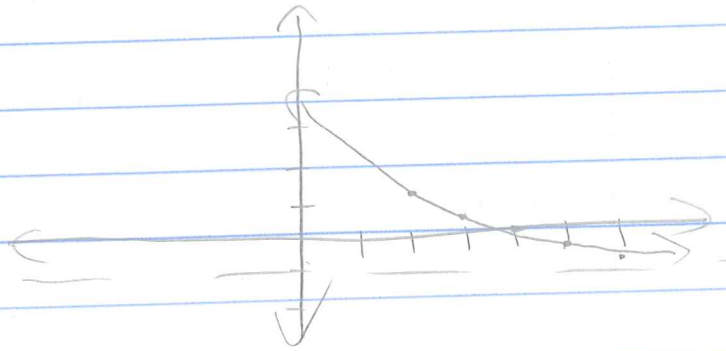


(19) $y = \left(\frac{2}{3}\right)^{x-4} - 1$

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

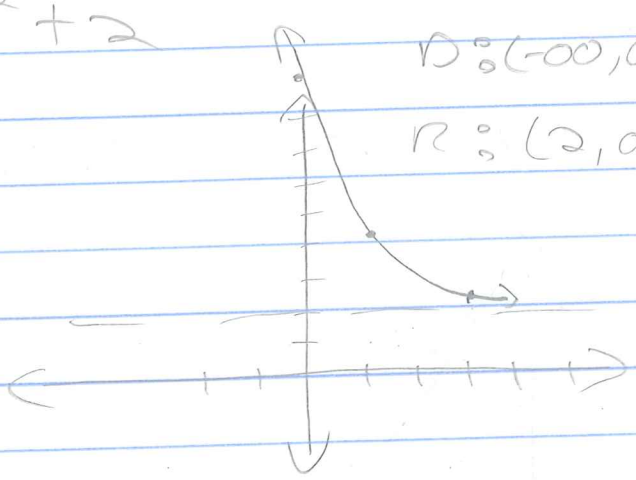
R: $(-1, \infty)$ or $y > -1$

x	y
2	1.25
3	0.5
4	0
5	$-0.\overline{3}$
6	-0.5



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

x	y
0	11
1	5
2	3
3	$2.\overline{3}$
4	$2.\overline{1}$

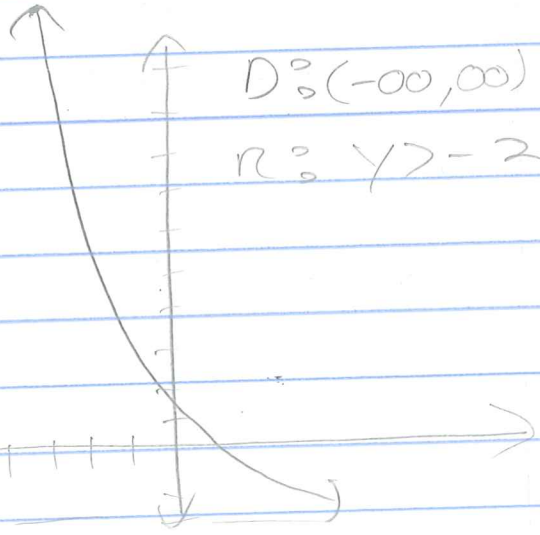


D: $(-\infty, \infty)$ all reals

R: $(2, \infty)$ or $y > 2$

(23) $g(x) = 6\left(\frac{1}{3}\right)^{x+5} - 2$

x	y
-7	96
-6	48
-5	24
-4	12
-3	6
-2	3
-1	1.5



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

R: $y > -2$

(30) $A = I(0.71)^t$

a) $A = 200(0.71)^{1.5}$

$= 119.65mg$

b) $A = 325(0.71)^{3.5}$

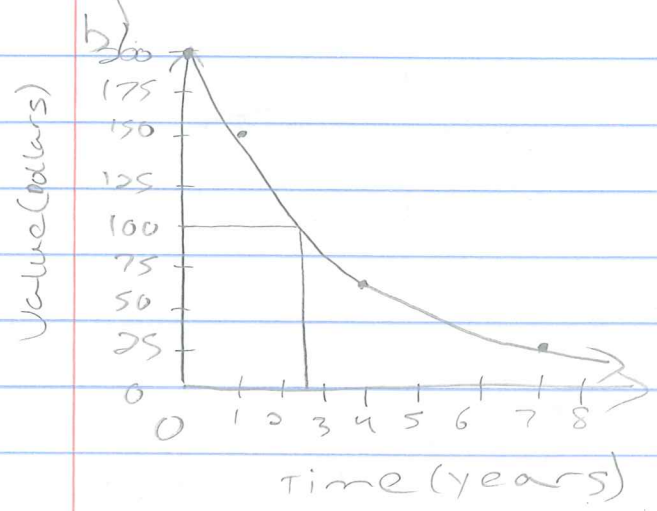
$= 98.01mg$

c) $A = 400(0.71)^5$

$= 72.17mg.$

(31) a) $Y = 200(0.75)^t$

b)



c) $100 = 200(0.75)^t$

$\approx 2\frac{1}{2}$ years

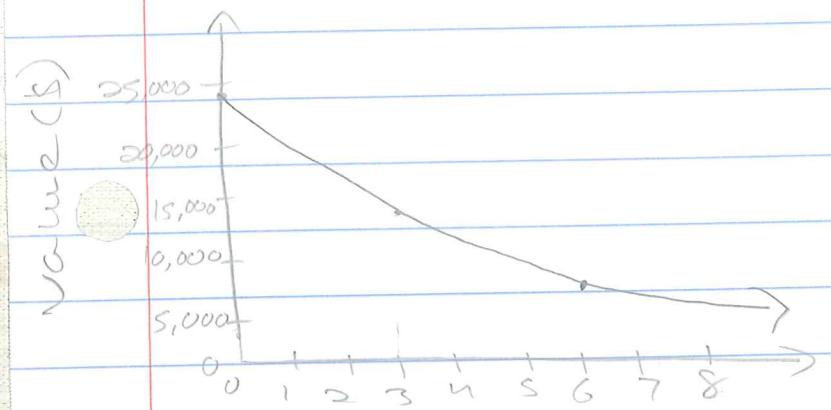
(32) a) $\frac{1832}{1906} \approx 0.96$

$\frac{1762}{1832} \approx 0.96$

$\vdots$

$A = 1985(0.96)^t$

(33) a) $V = 24{,}000(0.845)^t$



$\approx$ 5 years

b) $V = 24{,}000(0.845)^{50}$

$= \$5.29$

No. Cars usually don't last 50 years.