Name: Key

Exponential & linear Practice

Determine whether the following scenarios would be best modeled using a linear or exponential model. Then, write an equation.

1.
- Ms. Hunter takes off 10 points for each day an assignment is turned in late. The assignments are worth 100 points each.
  linear $\boxed{y = -10x + 100}$
- There are 200 ladybugs in a certain population. The population is decreasing by 14% per day.
  exponential · $a_0 = 200, r = 14\% \approx 0.14, t = x$ $\boxed{y = 200(1 - 14\%)^x}$
- Your salary starts at $23000 and goes up by 5% per year.
  exponential $a_0 = 23{,}000, r = 5\%, t = x$ $\boxed{y = 23{,}000(1 + 5\%)^x}$
- A painter is going to charge $90 for paint and $35 an hour to paint your kitchen.
  linear $\boxed{y = 35x + 90}$

2. **Given the situations below, identify if it is a linear or exponential model or neither. Explain your reasoning.**

   a. A savings account that starts with $5000 and receives a deposit of $825 per month.
   linear $y = 825x + 5000$

   b. The value of a house that starts at $150,000 and increases by 1.5% per year.
   exponential $y = 150{,}000(1 + 1.5\%)^x$

   c. Tina owns 4 rabbits. She expects them to double each year.
   exponential $y = 4(2)^x$

   d. The cost of operating Jelly's Doughnuts is $1600 per week plus $.10 to make each doughnut.
   linear $y = 0.10x + 1600$

   e. The value of John's car that depreciates 20% per year
   exponential *no starting value, so we can't make a function

   f. The height of a ball that is thrown in the air
   U-shaped path, so quadratic function, so neither linear nor exponential

3. Which situation could be modeled with an exponential function?

   (1) the amount of money in Suzy's piggy bank which she adds $10 to each week linear
   (2) the amount of money in a certificate of deposit that gets 4% interest each year exponential
   (3) the amount of money in a savings account where $150 is deducted every month linear
   (4) the amount of money in Jaclyn's wallet which increases and decreases by a different amount each week neither

Part II – Exponential Growth & Decay Applications

4. The rent for an apartment was \$6,600 per year in 2012. If the rent increased at a rate of 4% each year thereafter, use an exponential equation to find the rent of the apartment in 2017.

$a_0 = 6{,}600$
$r = 4\%$
$t = 2017 - 2012 = 5$

$y = a_0(1+r)^t$
$y = 6{,}600(1+4\%)^5$
$\boxed{y = \$8029.91}$

5. The population of a town was 14,000 in 2010. If the population decreased at a rate of 1.5% each year thereafter, use an exponential function to find the population after 10 years.

$a_0 = 14{,}000$ $\quad t = 10$
$r = 1.5\%$

$y = a_0(1-r)^t$
$y = 14{,}000(1-1.5\%)^{10}$ $\quad y = 12036.2$

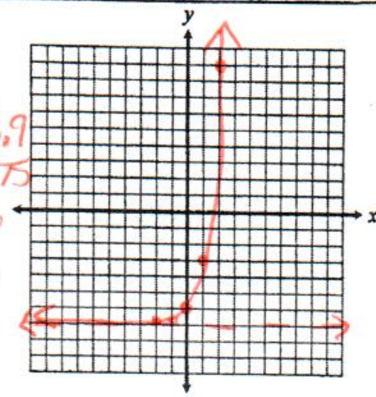
4. \$8029.91
5. 12036 people

Graph each exponential function using a table, then identify its key characteristics.

6. $f(x) = 4^x - 7$

a: 1
b: 4
h: 0
k: -7

x	y
-2	-6.9
-1	-6.75
0	-6
1	-3
2	9

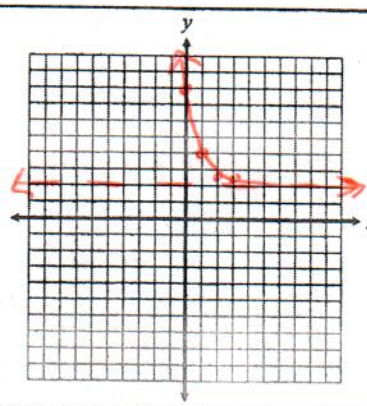


stretch/shrink/neither
Growth / Decay
Domain: $-\infty < x < \infty$
Range: $y > -7$
***y*-intercept:** $(0, -6)$
Asymptote: $y = -7$

7. $f(x) = 6 \cdot \left(\frac{1}{3}\right)^x + 2$

a: 6
b: 1/3
h: 0
k: 2

x	y
-2	56
-1	20
0	8
1	4
2	$2.\overline{6}$
3	$2.\overline{2}$

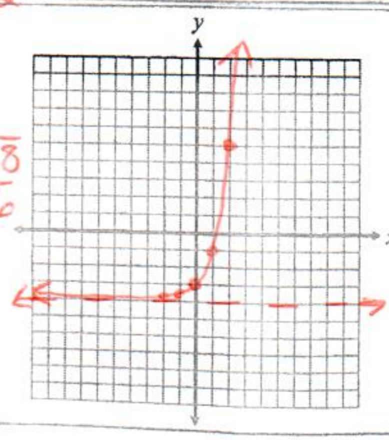


stretch/shrink/neither
Growth / Decay
Domain: $(-\infty, \infty)$
Range: $y > 2$
***y*-intercept:** $(0, 8)$
Asymptote: $y = 2$

8. $y = 3^x - 4$

a: 1
b: 3
h: 0
k: -4

x	y
-2	$-3.\overline{8}$
-1	$-3.\overline{6}$
0	-3
1	-1
2	5

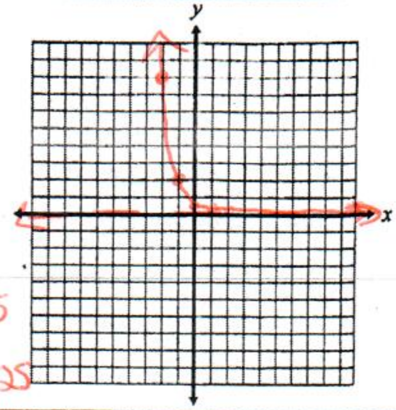


stretch/shrink/neither
Growth / Decay
Domain: $(-\infty, \infty)$
Range: $y > -4$
***y*-intercept:** $(0, -3)$
Asymptote: $y = -4$

9. $y=\frac{1}{2}\cdot\left(\frac{1}{4}\right)^x$

a: $\frac{1}{2}$
b: $\frac{1}{4}$
h: 0
K: 0

x	y
-2	8
-1	2
0	0.5
1	0.125
2	0.03125



stretch/shrink/neither

Growth / Decay

Domain: $-\infty < x < \infty$

Range: $y > 0$

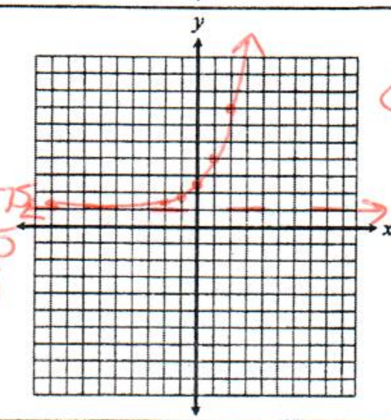
y-intercept: $(0, \frac{1}{2})$ or $(0, 0.5)$

Asymptote: $y = 0$

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

a: $\frac{3}{2} = 1.5$
b: 2
h: 0
K: 1

x	y
-2	1.375
-1	1.75
0	2.5
1	4
2	7



stretch/shrink/neither

Growth / Decay

Domain: $-\infty < x < \infty$

Range: $y > 1$

y-intercept: $(0, 2.5)$ or $(0, \frac{5}{2})$

Asymptote: $y = 1$

Topic 6: Exponential Growth & Decay Applications

EXPONENTIAL GROWTH FUNCTION	EXPONENTIAL DECAY FUNCTION:
11. $y = a_0(1+r)^t$	12. $y = a_0(1-r)^t$

a_0 = initial amount
r = rate (%)
t = time

13. A population of a city is 422,000 and increases by 12% each year. Use an exponential function to find the population of the city after 8 years.

$a_0 = 422{,}000$
$r = 12\%$
$t = 8$

$y = a_0(1+r)^t$
$y = 422{,}000(1+12\%)^8$
$y = 1{,}044{,}856.48 \approx \boxed{1{,}044{,}856 \text{ people}}$

rounded to whole # because it is people

14. A car bought for \$13,000 depreciates at 15% per year. Use an exponential function to find the value of the car after 5 years.

$a_0 = 13{,}000$
$r = 15\%$
$t = 5$

$y = a_0(1-r)^t$
$y = 13{,}000(1-15\%)^5$
$\boxed{y = \$5{,}768.17}$

15. Scott purchased a painting in 2006 for \$1,250. Since then, its value has increased by 6% each year. Use an exponential function find the value of the painting in 2017.

$a_0 = 1{,}250$
$r = 6\%$
$t = 2017 - 2006 = 11$

$y = a_0(1+r)^t$
$y = 1{,}250(1+6\%)^{11}$
$\boxed{y = \$2372.87}$