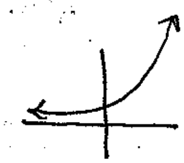
Name ____________________ Date ____

6.4 Notetaking with Vocabulary

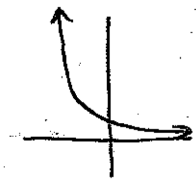
I can use and model exponential functions.

- I can identify and use exponential growth and decay functions.
- I can interpret and rewrite exponential growth and decay functions.
- I can solve real life problems involving exponential functions.



$b>1$

$y = a \cdot b^x$



$0<b<1$

Core Concepts

Exponential Growth Functions

A function of the form $y = a(1+r)^t$ where $\underline{a > 0}$ + and $r > 0$, is an

given as %

$\boxed{\text{initial amt}}$ $\boxed{\text{growth rate (in decimal form)}}$

$\boxed{\text{final amount}} \rightarrow y = a\underbrace{(1 + r)}_{b = \text{ base}}{}^t \leftarrow \boxed{\text{time}}$

b = base $\boxed{\text{growth factor}}$

Exponential Decay Functions

A function of the form $y = a(1-r)^t$ where $\underline{a > 0}$ + and $0 < r < 1$, is an

$\boxed{\text{initial amt.}}$ $\boxed{\text{decay rate (decimal)}}$

$\boxed{\text{final amount}} \rightarrow y = a\underbrace{(1 - r)}_{\text{base}}{}^t \leftarrow \boxed{\text{time}}$

base $\boxed{\text{decay factor}}$

Practice

1. In 2005, there were 100 rabbits in Polygon Park. The population increased by 11% each year.

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

a. Write an exponential growth function that represents the population t years after 2005.

$a = 100$

$r = 11\% = .11$

$y = 100(1+.11)^t$

$\boxed{y = 100(1.11)^t}$

b. What will the population be in 2025? Round your answer to the nearest whole number.

$t = 20$

$y = 100(1.11)^{20}$

$y \approx 806$

There will be about 806 rabbits in 2025.

In Exercises 2–5, determine whether the table represents an *exponential growth* unction, an *exponential decay function*, or *neither*. Explain.

2. x↑1

x	y
0	20
1	30
2	45
3	67.5

$y_2 - y_1$

$30-20=10$

$45-30=15$

Not linear

$\frac{y_2}{y_1}$

$\frac{30}{20} = \frac{3}{2} = 1.5$

$\frac{45}{30} = \frac{3}{2} = 1.5$

$\frac{67.5}{45} = \frac{3}{2} = 1.5 = b$

ratio is constant

exponential growth

$1.5 > 1$

$y = a \cdot b^x$

$y = 20(1.5)^x$

3. ↑by1

x	y
−1	160
0	40
1	10
2	2.5

$y_2 - y_1$

$40-160=-120$

$10-40=-30$

Not the same

Not linear

$\frac{y_2}{y_1}$

$\left.\begin{array}{l} \frac{40}{160} = \frac{1}{4} = .25 \\ \frac{10}{40} = \frac{1}{4} = .25 \\ \frac{2.5}{10} = \frac{1}{4} = .25 \end{array}\right\}$ Constant

exponential decay

$y = 40(.25)^x = 40\left(\frac{1}{4}\right)^x$

4.

x	y
1	32
2	22
3	12
4	2

5.

x	y
−1	4
0	10
1	25
2	62.5

In Exercises 6–8, ① determine whether each function represents *exponential growth* or *exponential decay*. ② Identify the percent rate of change.

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

6. $y = 4(0.95)^t$

① decay

$.95 < 1$

② $r = ?$

$.95 = 1 - r$

$-1 \quad -1$

$\frac{-.05}{-1} = \frac{-r}{-1}$

$.05 = r$

5% decrease

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

7. $y = 500(1.08)^t$

① growth

$1.08 > 1$

② $1.08 = 1 + r$

$-1 \quad -1$

$.08 = r$

8% increase

$y = \left(\frac{3}{4}\right)^t$

8. $w(t) = \left(\frac{3}{4}\right)^t$

① decay

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

$\frac{3}{4} = 1 - r$

$-1 \quad -1$

$-\frac{1}{4} = -r$

$\frac{1}{4} = r = .25$

25% decrease

Compound Interest

Compound interest is the interest earned on the principal *and* on previously earned interest. The balance y of an account earning compound interest is

$I = Prt$

simple interest

Account balance

$$A$$

$$y = P\left(1 + \frac{r}{n}\right)^{nt}.$$

P = Principle - initial amount inversted / borrowed

t = # of years

r = annual interest rate % - use the decimal

n = # of times compounded per year

	n
annually	1
Semi-annually	2
quarterly	4
monthly	12
daily	365

In Exercises 9 and 10, write a function that represents the balance after *t* years.

9. \$3000 deposit that earns 6% annual interest compounded quarterly.

P r n

$$y = 3000\left(1 + \frac{.06}{4}\right)^{4t}$$

$$y = 3000(1.015)^{4t}$$

10. \$5000 deposit that earns 7.2% annual interest compounded monthly.

$$y = 5000\left(1 + \frac{.072}{12}\right)^{12t}$$

$$y = 5000(1.006)^{12t}$$