6.4 Start Thinking

When a department store offers a clothing discount of 20%, the customer pays 80% of the original price. Likewise, if a store is selling an item at a 50% discount, the customer pays 50% of the original price. Explain how to determine the percent a customer pays if the discount is 35%.

If a certain state's population has decreased by 4% in the past year, what percent of the original population is still living in that state? If the state's population has increased by 4% instead, what percent of the original population is still living in the state?

6.4 Warm Up

Use the simple interest formula, $I = Prt$, where I = interest, P = principle, r = interest rate, and t = time in years, to find the interest.

1. $P = \$3500$
$r = 5\%$
$t = 3$ years

2. $P = \$250{,}000$
$r = 7\%$
$t = 8$ years

3. $P = \$6000$
$r = 9\%$
$t = 3$ years

4. $P = \$15{,}000$
$r = 7\%$
$t = 7$ years

6.4 Cumulative Review Warm Up

Solve the equation. Check your solutions.

1. $|5n + 12| = |n|$

2. $|3b + 9| = |b + 5|$

Name_____ Date _____

6.4 Practice A

In Exercises 1–3, identify the initial amount *a* and the rate of growth *r* (as a percent) of the exponential function. Evaluate the function when *t* = 5. Round your answer to the nearest tenth.

1. $y = 50(1 + 0.25)^t$ **2.** $y = 172(1 + 0.3)^t$ **3.** $y = 1000(1.75)^t$

In Exercises 4 and 5, write a function that represents the situation.

4. Profits of $100,000 increase by 15% each year.

5. College enrollment of 41,000 increases by 7% every year.

6. The number of food trucks in a city has been increasing by 50% annually. There were two food trucks in the year 2010.

a. Write an exponential growth function that represents the number of food trucks *t* years after 2010.

b. How many food trucks will there be in the year 2030? Does this sound reasonable? Explain.

In Exercises 7–9, identify the initial amount *a* and the rate of decay *r* (as a percent) of the exponential function. Evaluate the function when *t* = 3. Round your answer to the nearest tenth.

7. $y = 12(1 - 0.35)^t$ **8.** $y = 360(1 - 0.9)^t$ **9.** $h(t) = 550(0.4)^t$

In Exercises 10 and 11, write a function that represents the situation.

10. A school population of 1200 decreases by 6% each year.

11. A stock valued at $49.50 decreases in value by 7% each year.

In Exercises 12 and 13, determine whether the table represents an *exponential growth function*, an *exponential decay function*, or *neither*. Explain.

12.

x	0	1	2	3
y	4	12	36	108

13.

x	0	1	2	3
y	200	100	50	25

In Exercises 14–16, determine whether the function represents *exponential growth* or *exponential decay*. Identify the percent rate of change.

14. $y = 3(0.4)^t$ **15.** $y = 18(1.3)^t$ **16.** $y = 41(1.07)^t$

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6.4 Practice B

In Exercises 1–3, identify the initial amount *a* and the rate of growth *r* (as a percent) of the exponential function. Evaluate the function when *t* = 5. Round your answer to the nearest tenth.

1. $f(t) = 220(1.015)^t$ **2.** $p(t) = 5.5(1.5)^t$ **3.** $h(t) = 2.5^t$

In Exercises 4 and 5, write a function that represents the situation.

4. A college's tuition of \$135 per credit hour increases by 5% each year.

5. A bee population of 3000 increases by 40% every year.

In Exercises 6–8, identify the initial amount *a* and the rate of decay *r* (as a percent) of the exponential function. Evaluate the function when *t* = 3. Round your answer to the nearest tenth.

6. $f(t) = 1420(0.895)^t$ **7.** $y = \left(\frac{3}{5}\right)^t$ **8.** $y = 9.2\left(\frac{1}{3}\right)^t$

In Exercises 9 and 10, write a function that represents the situation.

9. A \$25,000 car decreases by 16.7% each year.

10. A company's annual revenue of \$487,000 decreases by 4.2% each year.

In Exercises 11 and 12, determine whether the table represents an *exponential growth function*, an *exponential decay function*, or *neither*. Explain.

11.

x	2	4	6	8
y	5	10	15	20

12.

x	1	5	9	13
y	81	54	36	24

13. The table shows the total numbers of shares of an initial public offering purchased *t* days after it opens on the stock market.

x	1	2	3	4
y	6250	2500	1000	400

a. Determine whether the table represents an exponential growth function, an exponential decay function, or neither.

b. How many shares were purchased after the stock had been opened for 6 days?

In Exercises 14–16, rewrite the function to determine whether it represents *exponential growth* or *exponential decay*.

14. $y = (0.3)^{t-2}$ **15.** $y = 3(1.6)^{4t}$ **16.** $y = 9(0.68)^{t/3}$

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6.4 Enrichment and Extension

Using Your Knowledge of Exponential Growth and Decay

Complete the following exercises. You may have to estimate some of the outcomes.

1. A biologist is researching a newly discovered species of bacteria. At time $t = 0$ hours, he puts 100 bacteria into what he has determined to be a favorable growth medium. Five hours later, he measures 400 bacteria. Assuming exponential growth, what is the growth rate for the bacteria?

2. The number of bacteria in a colony is growing exponentially. At the start you have 10 bacteria, and after 4 hours, there are 300. Write an exponential function to model the population of bacteria after x hours. What is the growth rate of the bacteria? How many bacteria were there after 20 hours? When were there 1000 bacteria?

3. Laura invested $2000 in a three-year CD that pays 4% compounded annually. What is the compound interest rate and amount that will be in the bank after 3 years?

4. A certain radioactive substance has a half-life of about 2650 years. Write an equation describing the situation with the original quantity of the substance being 200 milligrams. How much will remain after 500 years? In how many years will there be half of the original left?

5. The price of computers drops drastically as technology improves. Every year the cost of computing decreases by 20%. If a laptop costs $1200 today, how much will it cost in 1 year? in 2 years?

6. The baseball cards LeRoy started collecting when he was 7 years old appreciated in value at a rate of 5% per year. If his collection was worth $215.75 when he was 10, how much were they worth when he was 15 years old?

7. Assume that you are observing the behavior of cell duplication in a lab. In one experiment, you started with one cell and the cells doubled every minute. Write an expression for the population of cells after 1 hour.

8. Hospitals utilize the radioactive substance iodine-131 in the diagnosis of conditions of the thyroid gland. The half-life of iodine-131 is 8 days. If a hospital acquires 6 grams of iodine-131, how much of this sample will remain after 20 days? About how long will it be until only 0.01 gram remains?

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6.4 Puzzle Time

What Looks Like Half A Lemon?

Write the letter of each answer in the box containing the exercise number.

Evaluate the function when $t = 4$. Round your answer to the nearest hundredth.

1. $y = 275(1 + 0.85)^t$

2. $y = 9(1 + 0.03)^t$

3. $f(t) = 16(1.7)^t$

4. $p(t) = 8.21(1.09)^t$

Evaluate the function when $t = 7$. Round your answer to the nearest hundredth.

5. $y = 725(1 - 0.1)^t$

6. $g(t) = 360(0.45)^t$

7. $r(t) = \left(\frac{11}{12}\right)^t$

8. $h(t) = 0.8\left(\frac{3}{5}\right)^t$

Write a function that represents the situation.

9. A \$33,000 vehicle decreases in value by 27% each year.

10. Your hourly wage of \$9.56 increases by 3% each year.

11. The amount of five fruit flies increases by 12.5% each day.

12. A \$4000 deposit that earns 2% annual interest compounded semiannually after t years.

Answers

L. 11.59

T. 0.02

E. 10.13

R. 0.54

H. 346.77

E. 1.35

A. 3221.21

H. 133.63

F. $f(t) = 5(1 + 0.125)^t$

H. $f(t) = 9.56(1.03)^t$

T. $f(t) = 4000(1.01)^{2t}$

O. $f(t) = 33{,}000(1 - 0.27)^t$

8	5	2		9	12	3	6	7		10	1	4	11