Lesson 6.1 • Recursive Routines

Name _____ Period _____ Date _____

1. Give the starting value and constant multiplier for each sequence. Then find the fifth term.

a. 4800, 1200, 300, . . .

b. $-21, 44.1, -92.61, \ldots$

c. $100, -90, 81, \ldots$

d. 100, 101, 102.01, . . .

e. $-5, 1.5, -0.45, \ldots$

f. 3.5, 0.35, 0.035, . . .

2. Use a recursive routine to find the first five terms of the sequence with the given starting value and constant multiplier.

a. Starting value: 12; multiplier: 1.5

b. Starting value: 360; multiplier: 0.8

c. Starting value: -45; multiplier: $-\frac{3}{5}$

d. Starting value: -9; multiplier: 2.2

e. Starting value: -1.5; multiplier: $\frac{1}{2}$

3. Use a recursive routine to find the first five terms of the sequence with the given starting value and percent increase or decrease.

a. Starting value: 16; increases by 50% with each term

b. Starting value: 24,000; decreases by 80% with each term

c. Starting value: 7; increases by 100% with each term

d. Starting value: 40; increases by 120% with each term

e. Starting value: 100,000; decreases by 35% with each term

4. Use the distributive property to rewrite each expression in an equivalent form. For example, you can write $500(1 + 0.05)$ as $500 + 500(0.05)$.

a. $40 + 40(0.8)$

b. $550 - 550(0.03)$

c. $W + Ws$

d. $25(1 - 0.04)$

e. $35 - 35(0.95)$

f. $10(1 + 0.25)$

g. $15 + 15(0.12)$

h. $0.02(1 - 0.15)$

i. $10{,}000(1 + 0.01)$

5. Burke's Discount Clothing has a "Must Go" rack. The price of each item on the rack is decreased by 10% each day until the item is sold. On February 2, a leather jacket on the rack is priced at $45.00.

a. Write a recursive routine to show the price of the jacket on subsequent days.

b. What will the jacket cost on February 6?

c. When will the jacket be priced less than $20.00?

Lesson 6.2 • Exponential Equations

Name _____ Period _____ Date _____

1. Rewrite each expression with exponents.

a. $(2.5)(2.5)(2.5)(2.5)(2.5)$

b. $(8)(8)(8)(9)(9)(9)(9)(9)(9)$

c. $(1 + 0.07)(1 + 0.07)(1 + 0.07)$

d. $6 \cdot 6 \cdot 7 \cdot 7 \cdot 8 \cdot 8$

2. An investment of \$700 increases by 0.3% each month.

a. What is the value of the investment after 5 months?

b. What is the value after 1 year?

3. A population of 25,000 increases by 1.2% each year.

a. What is the population after 4 years?

b. What is the population after 84 months?

4. Match each equation with a table of values.

a. $y = 3(0.09)^x$

i.

x	y
1	3.5
2	2.45
3	1.715

b. $y = 4(1.03)^x$

ii.

x	y
1	0.27
2	0.0243
3	0.0022

c. $y = 5(0.7)^x$

iii.

x	y
1	4.12
2	4.2436
3	4.3709

5. Match each recursive routine with the equation that gives the same value.

a. 1.25 [ENTER], Ans · 0.75 [ENTER]

b. 0.75 [ENTER], Ans · (1 + 0.25) [ENTER]

c. 1.25 [ENTER], Ans + Ans · 0.25 [ENTER]

d. 0.75 [ENTER], Ans · (1 − 0.25) [ENTER]

i. $y = 1.25(1.25)^x$

ii. $y = 0.75(0.75)^x$

iii. $y = 0.75(1.25)^x$

iv. $y = 1.25(1 - 0.25)^x$

6. The equation $y = 25{,}000(1 + 0.04)^x$ models the salary of an employee who receives an annual raise. Give the meaning of each number and variable in this equation.

7. For each table, find the value of the constants a and b such that $y = a \cdot b^x$.

a.

x	y
0	5
2	20
4	80
5	160

b.

x	y
0	300
2	48
3	19.2
4	7.68

c.

x	y
0	100
1	110
2	121
3	133.1

Lesson 6.3 • Multiplication and Exponents

Name _____ Period _____ Date _____

1. Use the properties of exponents to rewrite each expression. Use your calculator to check that your expression is equivalent to the original expression.

a. $(-7)(w)(w)(w)(w)$

b. $(3)(a)(a)(b)(b)(b)(b)$

c. $(5)(p)(p)(p)(-3)(q)(q)$

d. $4x^2 \cdot 3x^4$

e. $(6c)\left(-2c^3\right)\left(3d^2\right)$

f. $\left(-4m^3\right)\left(2m + m^2\right)$

2. Write each expression in expanded form. Then rewrite the product in exponential form.

a. $4^3 \cdot 4^4$

b. $(-3)^5 \cdot (-3)^2$

c. $(-2)^8(-2)^7$

d. $\left(8^6\right)\left(8^3\right)$

e. $x^9 \cdot x^4$

f. $n \cdot n^9$

3. Rewrite each expression with a single exponent.

a. $\left(4^5\right)^5$

b. $\left(8^2\right)^7$

c. $\left(x^9\right)^4$

d. $\left(y^3\right)^{10}$

e. $\left(5^3\right)^7$

f. $\left[\left(-3\right)^3\right]^2$

g. $\left(z^8\right)^2$

h. $\left(10^9\right)^3$

i. $\left(0.5^2\right)^5$

j. $\left(100^3\right)^8$

k. $\left[\left(-6\right)^5\right]^4$

l. $\left(t^7\right)^2$

4. Use the properties of exponents to rewrite each expression.

a. $4x \cdot 3x$

b. $(6m)\left(2m^2\right)$

c. $\left(-5n^2\right)\left(4n^4\right)$

d. $xy^2 \cdot x^2y^4$

e. $\left(2x^4\right)^6$

f. $\left(-4m^5\right)^2$

g. $\left(-3m^4n^7\right)^3$

h. $\left(5x^2yz^5\right)^4$

i. $\left(-3x^4y^3\right)^3$

5. Evaluate each expression for the given value of the variables.

a. $2x^3$ for $x = -5$

b. $5y^4$ for $y = -3$

c. $x^2 - 3x + 2$ for $x = 4$

d. $-5x^3y^2$ for $x = -2$ and $y = -1$

6. Match expressions from this list that are equivalent but written in different forms. There can be multiple matches.

a. $\left(2x^2\right)^3$

b. $8x^5$

c. $\left(-4x^3\right)\left(-2x^3\right)$

d. $\left(6x^2\right)\left(2x^3\right)$

e. $(12)(x)(x)(x)(x)$

f. $(4x)\left(2x^5\right)$

Lesson 6.4 • Scientific Notation for Large Numbers

Name _____ Period _____ Date _____

1. Write each number in scientific notation.

a. 200 **b.** 5 **c.** -75

d. 48,900 **e.** $-9{,}043{,}000$ **f.** 6,703.1

g. $-3{,}500$ **h.** 12,500 **i.** -380

j. 320,000,000 **k.** 70,000,000,000 **l.** 8,097

2. Write each number in standard notation.

a. 3.14×10^3 **b.** 5.2×10^6 **c.** -7.08×10^1

d. 6.59×10^7 **e.** -1.8×10^5 **f.** 6.5×10^3

g. 3.25×10^5 **h.** 4.3×10^4 **i.** -5×10^6

j. 1.8×10^{10} **k.** -4.5×10^8 **l.** 2.007×10^2

3. Use the properties of exponents to rewrite each expression.

a. $2x^3(5x)$ **b.** $\left(-4m^2\right)^3$ **c.** $-3y^2\left(4y^5 - 2y^3\right)$

d. $5w\left(3w^8 - w^6\right)$ **e.** $3x^3\left(-2x^5\right)$ **f.** $\left(-5z^6\right)^2$

g. $-6r^3\left(r^4 - 3r^2\right)$ **h.** $x^3\left(2x^2 + 3x - 4\right)$ **i.** $\left(3x^2y^4\right)^2$

j. $\left(4s^2t^3u^4\right)^3$ **k.** $\left(m^2n\right)\left(m^9n^3\right)$ **l.** $x^{12} \cdot y^3 \cdot x$

4. Write each number in scientific notation.

a. 425×10^3 **b.** 71.3×10^5 **c.** $-2{,}014 \times 10^1$

d. $800{,}000 \times 10^4$ **e.** -350.3×10^6 **f.** $15{,}000 \times 10^3$

g. $3{,}250 \times 10^2$ **h.** $425{,}000 \times 10^4$ **i.** -36.5×10^6

j. 10×10^{10} **k.** -45.07×10^3 **l.** $89{,}060 \times 10^5$

5. Find each product and write it in scientific notation without using your calculator. Then set your calculator to scientific notation and check your answers.

a. $\left(2 \times 10^4\right)\left(4 \times 10^3\right)$

b. $\left(-6.0 \times 10^5\right)\left(1.2 \times 10^7\right)$

c. $\left(1.5 \times 10^3\right)\left(2.0 \times 10^2\right)\left(3.2 \times 10^4\right)$

d. $\left(-4.5 \times 10^3\right)\left(-4.0 \times 10^6\right)$

6. A human heart beats about 65 times per minute. By the time you are 25 years old, approximately how many times will your heart have beaten? Express your answer in scientific notation.

Lesson 6.5 • Looking Back with Exponents

Name _____ Period _____ Date _____

1. Eliminate factors equivalent to 1 and rewrite the right side of this equation.

$$\frac{p^3q^5r^2}{pq^3r^2} = \frac{p \cdot p \cdot p \cdot q \cdot q \cdot q \cdot q \cdot q \cdot r \cdot r}{p \cdot q \cdot q \cdot q \cdot r \cdot r}$$

2. Use the properties of exponents to rewrite each expression.

a. $\frac{m^{10}}{m^4}$ **b.** $\frac{n^8}{n}$ **c.** $\frac{24x^9}{8x^5}$

d. $\frac{36x^5y^6}{4xy^3}$ **e.** $\frac{45m^7n^4}{-9m^4n^2}$ **f.** $\frac{-50x^{12}y^8}{-2x^{11}y^6}$

g. $\frac{42x^{10}y^5}{6x^3y}$ **h.** $\frac{-12m^5n^7}{-3m^4n^2}$ **i.** $\frac{-15\,r^{12}s^5}{5r^4s^2}$

3. Lana bought a car 8 years ago. Since she purchased it, the value of the car has decreased by 12% each year. The car is now worth about $5900.

a. Which letter in the equation $y = A(1 - r)^x$ could represent the value of the car 8 years ago when Lana bought it?

b. Substitute the other given information into the equation $y = A(1 - r)^x$.

c. Solve your equation in 3b to find the value of Lana's car when she bought it.

4. Use the properties of exponents to rewrite each expression.

a. $(-3x)^2\left(2x^2\right)^4$ **b.** $\frac{\left(-4y^2\right)^6}{\left(-4y^2\right)^5}$

c. $\frac{\left(4z^2\right)^3}{(2z)^2}$ **d.** $\left(3a^2b\right)^2(-2ab)^3$

e. $\frac{4.2 \times 10^9}{1.2 \times 10^5}$ **f.** $\frac{\left(5r^3s^6\right)\left(4rs^2\right)^2}{20r^4s^8}$

5. a. In 2004 Canada had a population of about 3.25×10^7 people. Canada has an area of approximately 3.51×10^6 square miles. Find the population density of Canada (the number of people per square mile).

b. In 2004 the United States had a population of about 2.93×10^8 people. The United States has an area of approximately 3.54×10^6 square miles. Find the population density of the United States.

c. How did the population densities of Canada and the United States in 2004 compare?

(*The World Almanac and Book of Facts 2005*, p. 848)

Lesson 6.6 • Zero and Negative Exponents

Name _____ Period _____ Date _____

1. Rewrite each expression using only positive exponents.

a. 4^{-3} **b.** $(-7)^{-2}$ **c.** x^{-5}

d. $12x^{-4}$ **e.** $\frac{m^{-1}}{n}$ **f.** $-5m^6n^{-9}$

g. $\frac{3s^{-7}w^8}{4}$ **h.** $\frac{6xy^{-1}z^2}{7m}$ **i.** $\frac{x^{-3}yz^{-2}}{m}$

2. Insert the appropriate symbol ($<$, $=$, or $>$) between each pair of numbers.

a. $5.25 \times 10^3 \square 52.5 \times 10^2$ **b.** $3.5 \times 10^{-5} \square 350 \times 10^{-6}$

c. $0.0024 \times 10^{-3} \square 2.4 \times 10^{-6}$ **d.** $0.75 \times 10^6 \square 75 \times 10^5$

3. Find the exponent of 10 that you need to write each number in scientific notation.

a. $0.00076 = 7.6 \times 10^{\square}$ **b.** $76{,}000 = 7.6 \times 10^{\square}$

c. $0.923 = 9.23 \times 10^{\square}$ **d.** $-0.00000045 = -4.5 \times 10^{\square}$

e. $6{,}090{,}000 = 6.09 \times 10^{\square}$ **f.** $0.000000017 = 1.7 \times 10^{\square}$

4. Ms. Frankel has been working for the same company for 15 years. She has received a 4.5% raise each year since she started. Her current salary is $42,576.

a. Write an expression of the form $42{,}576(1 + 0.045)^x$ for Ms. Frankel's current salary.

b. What does the expression $42{,}576(1 + 0.045)^{-7}$ represent in this situation?

c. Write and evaluate an expression for her salary 15 years ago.

d. Write expressions without negative exponents that are equivalent to the exponential expressions from 4b and c.

5. Evaluate each expression without using a calculator. Then check your answers with your calculator.

a. 2^{-5} **b.** $\left(4^{-3}\right)\left(9^0\right)$ **c.** $(-6)^{-2}$

d. $x^0(-2)^{-3}$ **e.** $27\left(3^{-3}\right)$ **f.** $-45\left(3^{-2}\right)$

6. Convert each number to standard notation from scientific notation, or vice versa.

a. 2.79×10^4 **b.** 6.591×10^{-3} **c.** 0.0000448

d. 969,000,000 **e.** 1.39×10^{-6} **f.** 9.5×10^2

Lesson 6.7 • Fitting Exponential Models to Data

Name _____ Period _____ Date _____

1. Rewrite each value as either $1 + r$ or $1 - r$. Then give the rate of increase or decrease as a percent.

a. 1.4 **b.** 0.72 **c.** 0.09

d. 1.03 **e.** 1.25 **f.** 0.5

g. 0.99 **h.** 1.5 **i.** 2.25

2. Use the equation $y = 240(1 - 0.03)^x$ to answer each question.

a. Does this equation model an increasing or decreasing pattern?

b. What is the rate of increase or decrease?

c. What is the y-value when x is 5?

3. Use the equation $y = 58(1 - 0.35)^x$ to answer each question.

a. Does this equation model an increasing or decreasing pattern?

b. What is the rate of increase or decrease?

c. What is the y-value when x is 4?

4. Use the equation $y = 902(1 + 0.02)^x$ to answer each question.

a. Does this equation model an increasing or decreasing pattern?

b. What is the rate of increase or decrease?

c. What is the y-value when x is 8?

5. Write an equation to model the growth of an initial deposit of \$500 in a savings account that pays 3.5% annual interest. Let B represent the balance in the account, and let t represent the number of years the money has been in the account.

6. Write an equation to model the decrease in value of a truck purchased for \$26,400 that depreciates by 8% per year. Let V represent the value of the truck, and let t represent the number of years since the truck was purchased.

7. Use the properties of exponents to rewrite each expression with only positive exponents.

a. $\dfrac{m^6}{m^8}$ **b.** $\dfrac{5n^7}{20n^{12}}$ **c.** $\dfrac{-48x^5y}{6x^5y^4}$

d. $\dfrac{15x^2yz^9}{9xy^3z^4}$ **e.** $\dfrac{45m^4n^{12}}{(-5m^3n^5)^2}$ **f.** $\dfrac{(-2xy^2z^0)^4}{(8x^5y)(4x^2y^3z)}$