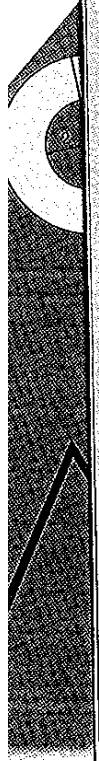


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LESSON

10

Rational Exponents



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Practice

Rewrite each radical expression as an exponential expression with a rational exponent.

1. $\sqrt{6^7}$

2. $\sqrt[4]{2^3}$

3. $\sqrt[5]{x^2}$

REMEMBER The index of the radical becomes the denominator of the fractional exponent.

Rewrite each exponential expression as a radical expression.

4. $5^{\frac{2}{3}}$

5. $12^{\frac{n}{2}}$

6. $y^{\frac{4}{5}}$

Simplify each expression by using the properties of exponents.

7. $(16^{\frac{1}{4}}) \cdot (16^{\frac{5}{4}})$

8. $\frac{27^2}{27^{\frac{2}{3}}}$

9. $(z^{\frac{1}{4}})^2$

REMEMBER To multiply exponential expressions with the same base, add the exponents.

Choose the best answer.

10. Which is equivalent to $x^{\frac{5}{3}}$?

A. $x^3 \sqrt{x^2}$

B. $x^2 (\sqrt[3]{x})$

C. $\sqrt[5]{x^3}$

D. $x^5 \sqrt{x^2}$

11. Which is equivalent to $\sqrt[6]{27n^{12}}$?

A. $3n^2$

B. $n\sqrt{3}$

C. $n^2\sqrt{3}$

D. $\sqrt{3n^3}$

Simplify each expression.

12. $(x^{\frac{1}{3}})(x^{\frac{4}{6}}) + (y^{\frac{1}{6}})^3$

13. $\left(\frac{a}{\sqrt[3]{a}}\right)^3$

14. $\left(\frac{b^{\frac{5}{2}}}{\sqrt{b}}\right) - (4b^4)^{\frac{1}{2}}$

15. $7(\sqrt[5]{32c^{15}})$

Solve each equation.

16. $2^y = \sqrt{8}$

17. $3\sqrt{3} = 3^{2x}$

18. $125^{\frac{a}{3}} = 5$

19. **TRANSFORM** Write the expression $\sqrt[3]{32}$ in three different but equivalent ways.

20. **ORDER** Write each expression as a power of 2 with a rational exponent.

$16^{\frac{1}{3}}$: _____

$2\sqrt{2}$: _____

$\sqrt[8]{4}$: _____

$\frac{1}{2}$: _____

Using the exponents, order the terms from least to greatest.

LESSON

31

Polynomials

Practice

Write *yes* if the expression is a polynomial and *no* if it is not.

1. $3x^2 + 2x - 7^{-2x}$

2. $13a^2b + 9c$

3. $-10z^7 + 16\frac{1}{2}$

4. $5 + 7p - 2^p$

Rewrite each polynomial in standard form. Simplify, if necessary.

5. $x^3 + 10x - 2x^6 + 12$

6. $12x + 7x^2 - 6 + (2x^2)^4$

REMEMBER To raise a power to a power, multiply the exponents.

Choose the best answer.

7. Which of the following polynomials is written in standard form?

A. $8x + 11x^2$

B. $(x^2)^3 - 90x + x^5$

C. $2x^4 + 8x^3 + 10$

D. $9x^2 + 5x - 2 - 2x^2$

8. Simplify: $(y - 6) - (4y + 7)$

A. $-3y - 1$

B. $-3y - 13$

C. $-3y + 1$

D. $3y + 1$

Simplify each expression. Write your answer in standard form.

9. $(2a^2 - 3a + 5) + (-5a^2 + 9a - 2)$

10. $3(5b^2 - 1) + 2(2b^2 - 7b + 10)$

11. $(2y + 11) - (3y^2 + 2y - 1)$

12. $8(x^2 - 2) - 3(2x^2 + 3)$

13. $6x^2y(3 - xy^4)$

14. $(3z + 5)(3z - 5)$

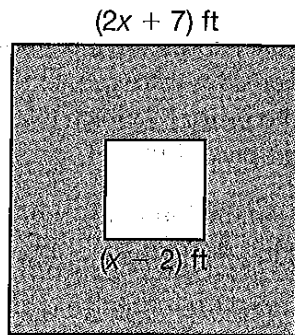
Simplify each expression and determine whether the result is a polynomial. Write *yes* if the expression is a polynomial and *no* if it is not. If it is not a polynomial, explain why not.

15. $(3ab^2 + 1)(a - 2)$

16. $\frac{1}{2}(4xy - 12y) - (3^x + 1)$

Solve.

17. The diagram below shows an unshaded square inside a shaded square.



What is the area of the large square (including the unshaded region)? _____

What is the area of the smaller unshaded square? _____

What is the area of the shaded region inside the larger square? _____

18. **PREDICT** Will the product of $7p^3r + 2r$ and $16s^2 - 3st$ be a polynomial? How do you know?

19. **CREATE** Create a polynomial using the variable q . Write it in standard form.

LESSON

33

Writing Equivalent Polynomial and Exponential Equations


Practice

Fully factor each expression.

1. $8a^3 - 4a^2$

2. $b^2 + 8b + 16$

3. $c^2 - 121$

HINT  Factor out the GCF of the coefficients and of any common variables.

4. $5d^2 - 50d + 125$


5. $x^2 + 7x - 8$

6. $2y^2z + 16yz + 30z$

7. $10x^3 - 70x^2 + 120x$

8. $s^3 + 64$

9. $9t^2 - 49$

HINT  $4^3 = 64$

LESSON

13

Average Rate of Change

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Practice

Fill in the blanks by writing an operation sign and a number to show how the $f(x)$ -values are changing in each unit interval. Then classify each function as *linear* or *exponential*.

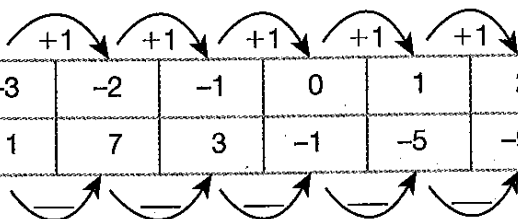
1.

x	-1	0	1	2	3	4
$f(x)$	$\frac{1}{6}$	1	6	36	216	1,296



2.

x	-3	-2	-1	0	1	2
$f(x)$	11	7	3	-1	-5	-9



Over each interval, does $f(x)$ change by an equal amount or an equal factor?

Fill in the blanks with an appropriate word or phrase.

- The average _____ between two ordered pairs (x, y) is the ratio $\frac{\text{change in } y}{\text{change in } x}$.
- In a linear function, the rate of change is also known as the _____.
- The average rate of change for a _____ function is constant.
- The average rate of change for an exponential function grows by equal _____ per unit interval.

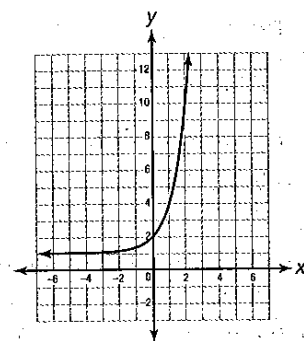
Use the graph for questions 7–10.

- Determine the average rate of change between $(-1, \frac{4}{3})$ and $(0, 2)$.

- Determine the average rate of change between $(0, 2)$ and $(1, 4)$.

- Determine the average rate of change between $(1, 4)$ and $(2, 10)$.

- Write a sentence or two comparing the average rates of change you found. (If they vary, describe how they vary.)



Use the information about function $f(x)$, given as a table below, and function $g(x) = 5^x$ for questions 11–14.

11. Using the table on the right, find the average rate of change for three unit intervals for function f .

x	$f(x)$
-1	$\frac{1}{4}$
0	1
1	4
2	16

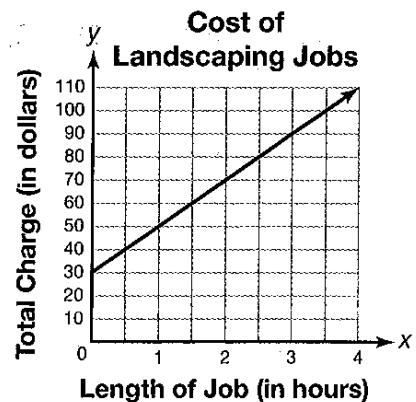
12. Complete the table to find four consecutive ordered pairs for the function $g(x) = 5^x$.

x	$g(x) = 5^x$	$g(x)$
-1	$g(-1) =$	
0	$g(0) =$	
1	$g(1) =$	
2	$g(2) =$	

13. Find the average rate of change for three unit intervals for function g .

14. Compare the changes in the values of functions f and g .

15. **INTERPRET** The graph shows how the total amount that a landscaper charges for a job changes depending on the number of hours she works. Identify the slope of the graph. Then interpret what this slope represents in this problem situation.



LESSON

8

Writing Linear Equations in Two Variables

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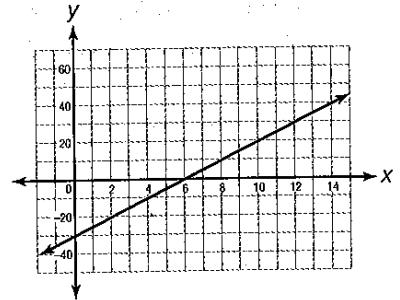
Practice

Write an equation to describe each situation.

1. A number y is 6 less than twice a number x . _____
2. Dorothy's age, d , is 1 more than half of Matthew's age, m . _____
3. The number of boys, b , in the class is 3 times the number of girls, g , in the class. _____

Choose the best answer.

4. A beekeeper pays \$30 to rent a booth at a farmers' market. She charges \$5 for each jar of honey. The graph shows this situation, which is modeled by the equation $y = 5x - 30$. Which of the following is true?
 - A. The value of x can be negative.
 - B. The value of y can be negative.
 - C. The value of x can be fractional.
 - D. The value of y cannot be zero.



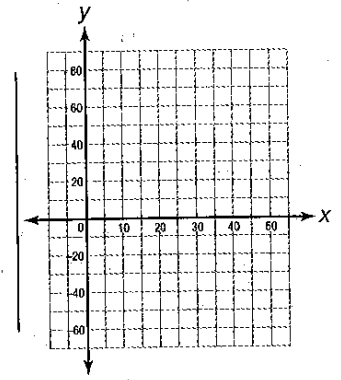
Identify the rate of change and initial value for each situation. Write and graph an equation for the situation, providing labels for the axes of the graph.

5. A baker sells cupcakes at a local festival. He pays \$50 to rent a booth, and he charges \$2.50 for each cupcake. Graph his profit or loss, in dollars, against the number of cupcakes he sells.

rate of change: \$_____ per cupcake

initial value: _____ dollars

equation: _____

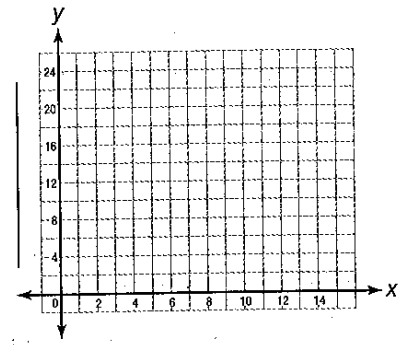


6. A cookie jar contains two dozen cookies. Every day, Nikki eats 2 cookies. Graph the number of cookies in the jar against the number of days since it was filled.

rate of change: _____ cookies per day

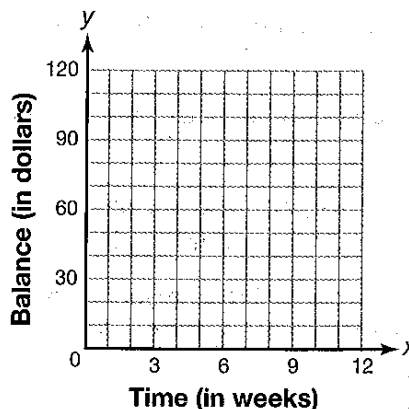
initial value: _____ cookies

equation: _____

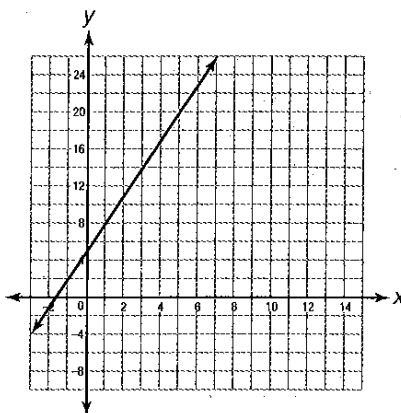


Solve.

7. **COMPARE** Ling's bank account has a balance of \$55. Every week, she will add \$20 to it. Bei Bei's bank account has a balance of \$120. Every week, she will withdraw \$10 from it. Write and graph an equation to describe how each girl's bank account will change. Compare the equations and their graphs.



8. **DESCRIBE** A puppy weighed 5 ounces (oz) at birth and gained 3 oz each week for the first 10 weeks. The equation that describes the puppy's weight after x weeks is $y = 3x + 5$, as graphed below.



Describe the limitations of the variable x in this situation. Which points on the graph are **not** solutions for the given situation?

LESSON

29

Constructing and Analyzing Scatter Plots

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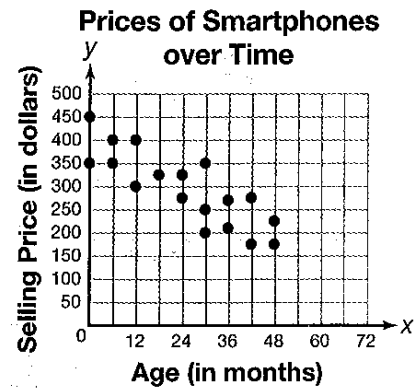
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Problem Solving

READ

The scatter plot shows the ages of various Model Z smartphones, in months, and the prices for which they sold. Predict how much Trent will pay if he buys a Model Z smartphone that is 5 years old.



PLAN

Draw a _____ to fit the data. Write the equation of the _____, and use it to predict the price for a phone that is 5 years, or _____ months, old.

SOLVE

On the scatter plot, draw a line that fits the data.

Choose two points on the line, (_____, _____) and (_____, _____).

Use the points to find the slope of the line. $m =$ _____

In this context, the slope represents _____.

Find the y-intercept of the line. Extend the line to the y-axis if necessary. $b =$ _____

The equation for the line is $y =$ _____.

In this context, the y-intercept represents _____.

To predict the cost of a 5-year-old smartphone, substitute 60 for x in the equation. \$_____

CHECK

Pick three data points from the scatter plot: (_____, _____), (_____, _____), (_____, _____).

Find the points with corresponding x -values on the line of fit:

(_____, _____), (_____, _____), (_____, _____).

Calculate the residual for each point. Each residual is relatively _____.

Does the line fit the data well? _____ Is your answer a reasonable prediction? _____

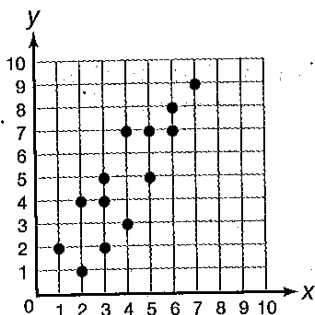
▶ A good prediction is that Trent will pay about _____ for a Model Z smartphone that is 5 years old.

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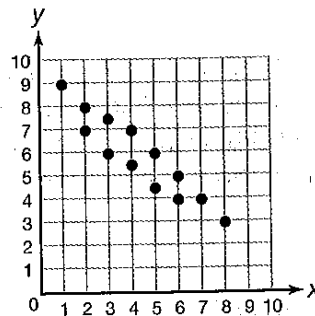
Practice


Describe the relationship shown in each scatter plot as either *positive* or *negative*.

1.



2.



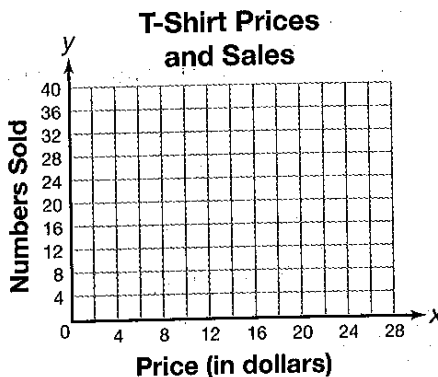
HINT  A line that slants from lower left to upper right has a positive slope.

Use the information and table below for questions 3 and 4.

The table below shows T-shirt sales data for a store one weekend.

Price, x (in dollars)	4	8	8	12	12	16	20	20	24	24
Number Sold, y	32	26	30	22	26	20	12	20	14	10

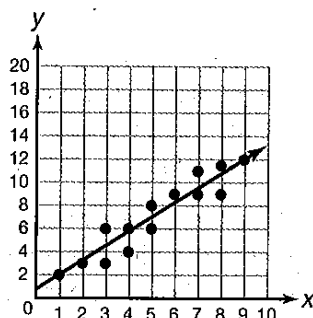
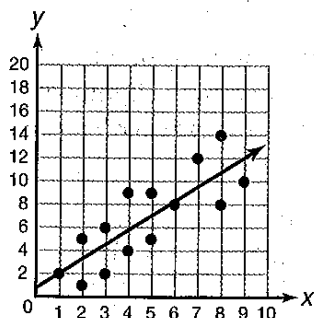
3. Create a scatter plot for the data. Then draw a line of fit for the data.



4. Find the slope of the line of fit. What does it represent in the context of this problem?

Assess the fit of the lines to the data.

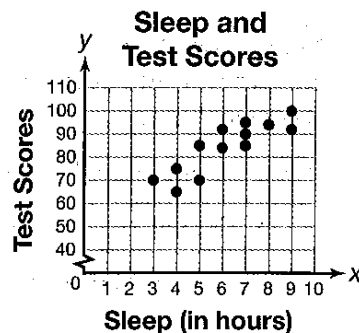
5. The lines of fit in the scatter plots below are identical.



Which line better fits the data in its scatter plot? How did you determine your answer?

Use the information and scatter plot to the right for questions 6 and 7.

The scatter plot shows the number of hours of sleep that students got the night before a test and their scores on the test.



6. **INTERPRET** Draw a line of fit for the scatter plot. Identify the slope and y-intercept of the line. What does each represent in the context of this problem?

7. **PREDICT** Write the equation of the line. Then use the equation to predict a student's test score if she gets only 2 hours of sleep before the next test.

Text

LESSON

30

Best Fit and Correlation





Problem Solving

READ

The table shows data for a cup of hot water that is cooling.

Find an equation for an exponential function that models the data. Then predict how many degrees Fahrenheit above room temperature the water will be if left to cool for 20 minutes.

Time (in minutes)	Degrees Fahrenheit above Room Temperature
0	134
2	113
4	95
6	80
8	67
10	56

PLAN

Use a graphing calculator to perform a(n)

_____ regression.

Then use a calculator table to solve the problem.

SOLVE

Enter the data in your calculator as L1 and L2.

Perform the exponential regression but with a few extra steps.

Press **STAT**.

Move the cursor to the **CALC** menu. Then select **0:ExpReg**.

Now press **VAR**. Move the cursor to **Y-VARS**. Select **1:Function**. Then select **1:Y₁**.

Press **ENTER** twice.

The screen shows that the equation is _____.

Press **Y=**. Because of those extra steps, the equation is already entered as Y_1 .

Press **2nd** **GRAPH** to bring up the table of values.

Scroll down. The table shows that when $x = 20$, $y \approx$ _____.

CHECK

Substitute 20 for x in the equation for the curve of best fit and solve.

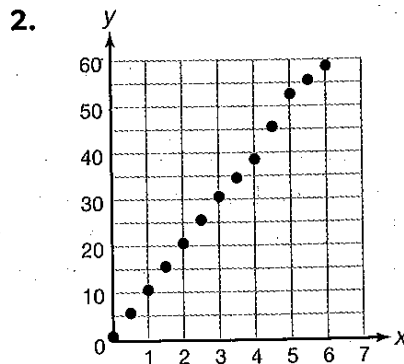
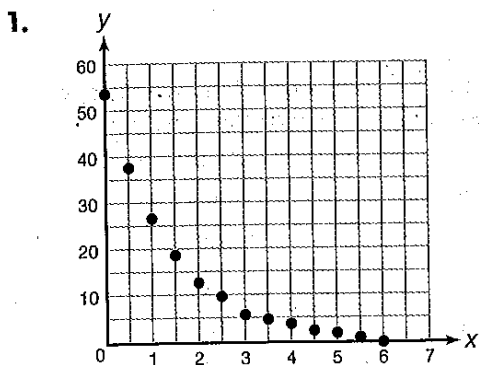
$y =$ _____

Do you get the same answer? Why or why not? _____

► After 20 minutes, the hot water will probably be about _____ °F above room temperature.

Practice

Use *line* or *curve* to tell which kind of model best fits each data set.



Use *strong*, *weak*, *positive*, *negative*, or *no linear correlation* to describe what each correlation coefficient, r , tells you about a bivariate data set.

3. $r = 0$

4. $r = 0.250$

5. $r = -0.895$

REMEMBER The closer r is to 1 or -1 , the stronger the correlation.

Write *true* or *false* for each statement. If false, rewrite the statement so it is true.

6. A line of best fit will help you predict values for variables with complete accuracy.

7. Not all bivariate data show a linear correlation, so sometimes data are better modeled by a curve than a line.

8. If regression analysis shows that there is a strong correlation between two variables, x and y , then x must cause y .

Choose the best answer.

Use a calculator for questions 9 and 10.

9. Which equation is the best model for the table of values shown below?

x	y
1	3
2	6.5
3	10
4	14
5	17

- A. $y = -0.55x + 3.55$
B. $y = 0.55x + 3.55$
C. $y = 3.55x - 0.55$
D. $y = -3.55x - 0.55$

Use the information and table for questions 11–13.

The table to the right shows the daily high temperatures on six days and the number of air conditioners and space heaters a store sold on those days.

Daily High Temperature (in °F)	Air Conditioners Sold	Space Heaters Sold
30	0	20
40	4	14
50	8	12
60	11	6
70	16	2
80	23	1

11. Find the equation of the line of best fit that models the relationship between high temperatures and air conditioner sales. Then, find the correlation coefficient.

12. Find the equation of the line of best fit that models the relationship between high temperatures and space heater sales. Then, find the correlation coefficient.

13. Compare and contrast the two lines of best fit and the correlation coefficients. How do the two lines differ? Which is a better fit for its data set? Explain your answers.
