Essential Ideas

WORKING BACKWARDS

Abe and Bea had baked a batch of cookies. They told Reg, Al, and Lara that they could each have one-third of the cookies. Later, Reg went into the kitchen and took one-third of the cookies. An hour after that, not knowing that Reg had already taken his share, Lara claimed one-third of the remaining cookies. A few minutes later Al, thinking he was the first to find the cookies, devoured one-third of what was left.

1. If 8 cookies are left, how many must Abe and Bea have baked?

TWO NEGATIVES

2. Find the sign of the result.

a. $3 - 5$ b. $3 - (-5)$

c. $-5 - (3)$ d. $-5 - (-3)$

3. Find the sign of the result.

a. $-(5)(-3)$ b. $-(5 - 3)$

c. $-[-3 - (-5)]$ d. $-(-5)(-3)$

POSITIVE, NEGATIVE, OR ZERO?

4. For each expression, write *P, N,* and/or 0, depending on whether it can possibly be positive, negative, or 0. (Try various values for the variables to help you decide. For example, -2, 0, and 2.) Explain your answers.

a. $5x$ b. $-2x^2$

c. $-9y$ d. $5y^2$

e. z^3 f. $-a^4$

SIMPLIFYING EXPRESSIONS

Simplify each expression.

5. $12x - 6xy - (-3x) - (-2y)$

6. $-3x^2 - (3)2 + x^2 - (2 - x^2)$

7. $x - (x - 5) - (5 - x)$

FROM WORDS TO ALGEBRA

8. a. Translate each step into algebra.

1) Think of a number.

2) Add 4.

3) Multiply the result by 2.

b. If I got 46, what was my original number?

9. a. Translate each step into algebra.

1) Think of a number.

2) Multiply by 2.

3) Add 4.

b. If I got 46, what was my original number?

c. Compare your answer to part (b) with your answer to part (b) in problem 8. Were your answers the same or different? Explain.

COMPARING EXPRESSIONS

10. Find a value of x for which

a. $-8x - 1$ is less than $8x + 3$;

b. $-8x - 1$ is greater than $8x + 3$;

c. $-8x - 1$ is equal to $8x + 3$.

MULTIPLICATION TABLES

Find these products. Combine like terms.

11. $(x + 3)(2x + 4)$

12. $(x + 3)(2x + 4y)$

13. $(x + 3 + y)(2x + 4y)$

Fill in the blanks.

14.

____	x	-3	$5y$
	$2x^2$	$-6x$	$10xy$

15.

____	____	____	____
$3y$	$-6x^2y$	$15y^3$	$-3y$

16. ____ $(x - 2) = 2 - x$

OPPOSITES AND RECIPROCALS

17. Simplify each expression. Look for shortcuts.

a. $9 \cdot \frac{1}{3} \cdot \frac{2}{3} \cdot 5 \cdot \frac{3}{2}$

b. $[5x - (-5x)] - [5x - (-5x)] - 16x$

c. $0.5 \cdot 25 \cdot 0.02 \cdot 2$

18. Gabe and Abe were arguing about xy. Gabe said that the opposite of xy is yx. Abe said that the opposite of xy is $-xy$. Lara overheard them, and said she thought that the opposite of xy is $-yx$. Write an explanation that will settle their argument.

19. What numbers are

a. greater than their reciprocal?

b. less than their reciprocal?

c. equal to their reciprocal?

d. less than their opposite?

e. equal to their opposite?

20. a. Which of the following is the reciprocal of $3x$?

$$\frac{1}{3x}, \frac{3}{x}, \text{ or } \frac{1}{3}$$

b. Check your answer by substituting two different numbers for x and showing that the product of $3x$ and its reciprocal is 1 in both cases.

INVERSE FUNCTIONS

Write the inverse of each of the following functions.

21. a. The function adds 2 to x and multiplies the result by 4.

b. The function multiplies x by 4 and adds 2 to the result.

c. $y = 7x - 4$

22. a. The function takes the opposite of x.

b. The function takes the opposite of x, adds 5, and divides the result by 2.

c. $y = \frac{3 - x}{6}$

Scientists sometimes use the Kelvin temperature scale. To convert Kelvin temperatures to Celsius, you subtract 273. For example, the melting temperature of iron is 1808° Kelvin, or 1535° Celsius.

23. Lead melts at 600° Kelvin. What temperature is that in Fahrenheit? (Use the information from Lesson 8.)

24. Explain how to convert Kelvin temperatures to Fahrenheit, and how to convert Fahrenheit to Kelvin. (Hint: Use arrows to show each step of the conversion.)

25. a. Make a function diagram for the function $y_1 = (x/2) + 1$.

b. Make the function diagram of its inverse and find the rule.

c. Find the function that results from combining y_1 and its inverse. Does the order in which you combine the functions matter? Explain.

SOLVING EQUATIONS

Use the cover-up method to solve these equations.

26. $\frac{24}{x - 5} + 3 = 9$ **27.** $\frac{x - 5}{24} + 3 = 9$

28. $\frac{5 - x}{24} + 3 = 9$ **29.** $\frac{24}{5 - x} + 3 = 9$

30. Compare the solutions to each pair of equations. (Use related multiplication equations.)

a. $\frac{2}{M} = 6$ and $\frac{6}{M} = 2$

b. $\frac{8}{M} = 4$ and $\frac{4}{M} = 8$

c. $\frac{20}{M} = 5$ and $\frac{5}{M} = 20$

d. Make up another example like this.

31. Describe the pattern you found in problem 30. Explain why it works.