

# **FAST Math Curriculum**

## **Volume 3**

**Department of Instructional Services**

**Fairfax County Public Schools  
Fairfax, Virginia**

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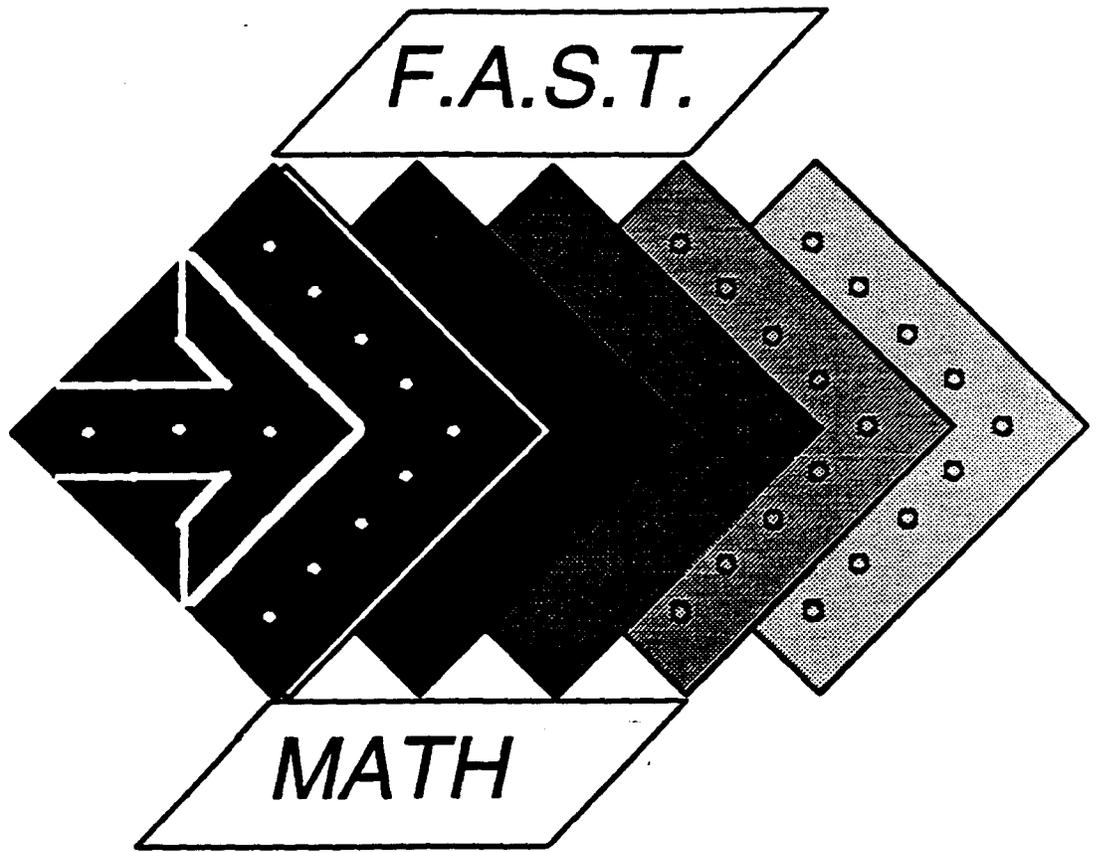
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## Volume III - *Draft*

**F**ocus on  
**A**chieving  
**S**tandards in  
**T**eaching Math

**Title VII, Project OBEMLA**

Fairfax County Public Schools  
Fairfax, Virginia

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## FAST Math Program Guidelines

The Elementary FAST Math curriculum (Vol 1 & 2) is presently being revised to align with the new FCPS elementary mathematics curriculum. It is expected that the newly revised curriculum will be completed some time during the 2000-2001 school year. At that time, a new EAME (Entry Assessment Mathematics Evaluation) test will also be available. A new Pre-Algebra component (Vol 3) is in draft form and is being piloted in some schools. During this interim period, the following guidelines may help your office evaluate students' math proficiency and facilitate appropriate placement for our ESL students.

### **Recommended Class Size:**

- It is recommended that FAST Math classes be limited to fifteen students. Students enrolled in this program are learning the English language **and** academic math content simultaneously.

### **Grading the EAME:**

- The answer key provided with the EAME in Vol. 1 allows for a variety of correct responses for many questions. Please analyze incorrect responses for careless errors.

### **Curriculum Highlights :**

- Elementary FAST Math Curriculum:

#### **What is included in this curriculum?**

The material in this curriculum (FAST Math Volumes I and II) is aligned to FCPS elementary mathematics Program of Studies, grades 1 - 6, and the Virginia Standards of Learning (SOL).

#### **Who qualifies?**

This curriculum is designed for LA , A-level, and B1 ESL students who are two or more years below their actual grade level in math.

#### **Where is it available?**

It is available to elementary schools with ESL programs for students in grades 4 - 6, all middle, high, transitional, and alternative schools.

- FAST Math Pre-Algebra Curriculum:

**What is included in this curriculum?**

This newly developed component to the FAST Math curriculum (Volume III) incorporates most of the middle school Pre-Algebra skills and provides content skills and academic language needed for Algebra I. It is aligned with the Virginia Standards of Learning (SOL) for 7th and 8th grades.

**Who qualifies?**

This curriculum is designed for middle and high school LA, A-level, and B1 ESL students who place at the sixth grade level or above on the EAME.

**Where is it available?**

This curriculum is available to all middle and high schools, as well as transitional and alternative schools.

For more information, please call the FAST Math office at 846-8687.

Name \_\_\_\_\_

Date \_\_\_\_\_

**FAST Math**  
**Algebra Readiness Assessment**

**PART I** Calculators may not be used.

**COMPUTATION**

1)  $237 - 59 = \underline{\hspace{2cm}}$       2)  $486 + 35 + 7 = \underline{\hspace{2cm}}$       3)  $253 \times 24 = \underline{\hspace{2cm}}$

4)  $372 \div 24 = \underline{\hspace{2cm}}$       5)  $4.23 + 85.49 = \underline{\hspace{2cm}}$       6)  $8.7 \times 0.9 = \underline{\hspace{2cm}}$

7)  $12.32 \div 8.8 = \underline{\hspace{2cm}}$       8)  $3 \frac{5}{8}$

$$\begin{array}{r} + 7 \frac{7}{8} \\ \hline \end{array}$$

**Write your answers in simplest form.**

9)  $\frac{5}{6} - \frac{3}{4} =$

10)  $\frac{2}{3} \times \frac{9}{10} =$

11)  $2 \frac{1}{4} \div \frac{3}{8} =$

**Write a percent for each fraction or decimal.**

12)  $\frac{59}{100} = \underline{\hspace{1cm}} \%$

13)  $\frac{17}{25} = \underline{\hspace{1cm}} \%$

14)  $0.8 = \underline{\hspace{1cm}} \%$

**Solve each problem.**

15) Find 35 % of 20.  $\underline{\hspace{2cm}}$

16) 10 out of 50 =  $\underline{\hspace{2cm}} \%$



Find the missing numbers in each pattern. Circle the answers.

17) 19, 65, 21, 62, 23, 59, 25 ?, ?

- a) 27, 56      b) 27, 62      c) 62, 27      d) 56, 27

18) 8, 5, 2, -1, -4, -7, ?, ?

- a) -10, -13      b) -8, -9      c) -9, -11      d) -10, -11

19)  $x^3$ ,  $x^6$ ,  $x^9$ ,  $x^{12}$ , ?, ?

- a)  $x^{15}$ ,  $x^{18}$       b) 36, 912      c)  $x^{13}$ ,  $x^{14}$       d)  $x^{11}$ ,  $x^{10}$

Circle the correct answers.

20)  $(-15) + 7 = \underline{\hspace{2cm}}$

- a) -22   b) -8   c) 8   d) None of these

21)  $(-12) + (-9) = \underline{\hspace{2cm}}$

- a) 21   b) -3   c) -21   d) None of these

22)  $4 - (-3) = \underline{\hspace{2cm}}$

- a) 1   b) -1   c) -7   d) None of these

23)  $(-9) \cdot (-6) = \underline{\hspace{2cm}}$

- a) 56   b) -54   c) -15   d) None of these

24)  $\frac{-12}{-4} = \underline{\hspace{2cm}}$

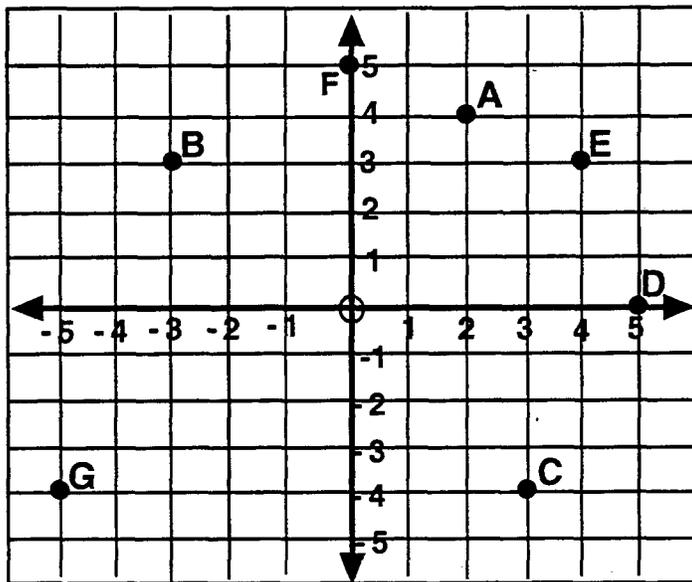
- a) -3   b) 3   c) -8   d) None of these

25)  $\frac{15}{-3} = \underline{\hspace{2cm}}$

- a) -5   b) 5   c) 12   d) None of these



Use the coordinate plane to find the answers for 26 - 28.  
Circle the correct answers.



26) The coordinates of point A are \_\_\_\_\_.

- a) (2, 4)    b) (4, 2)    c) (-2, -4)    d) (-4, -2)

27) The coordinates of point C are \_\_\_\_\_.

- a) (3, 4)    b) (3, -4)    c) (-3, 4)    d) (-4, -3)

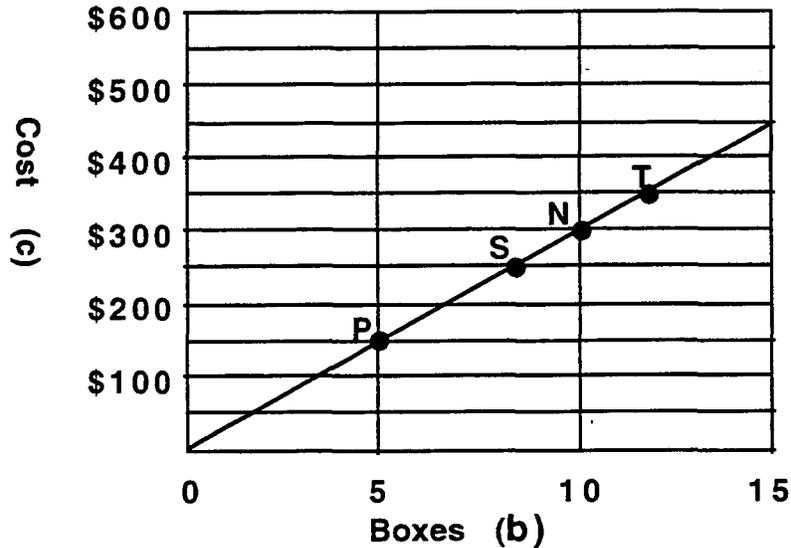
28) The point with the coordinates (5,0) is \_\_\_\_\_.

- a) C    b) G    c) F    d) D



Use the graph to help you find the answers for 29-33.  
Circle the answers.

Apple Cost by Box



29) How much do 5 boxes of apples cost?

- a) \$45                      b) \$150                      c) \$20                      d) \$450

30) What are the coordinates of the point marked N?

- a)  $b = 100$   
 $c = \$5$                       b)  $b = 5$   
 $c = \$200$                       c)  $b = 10$   
 $c = \$300$                       d)  $b = 50$   
 $c = \$15$

31) What point has the coordinates  $b = 5$  and  $c = \$150$ ?

- a) S                      b) T                      c) P                      d) N

32) As the value of  $b$  increases, what happens to the cost ( $c$ )?

- a) remains the same                      b) decreases                      c) increases                      d) moves to 0

33) If the cost is greater than \$300, then what is true of  $b$ ?

- a)  $b > 2$                       b)  $b < 5$                       c)  $b > 10$                       d)  $b < 10$



**Simplify using the Distributive Property. Write your answer.**

p. 5

34)  $2(4 + x) = \underline{\hspace{2cm}}$

35)  $5(y - 4) = \underline{\hspace{2cm}}$

36)  $3(2x + 3) = \underline{\hspace{2cm}}$

37)  $12(-2y + 3) = \underline{\hspace{2cm}}$

**Evaluate using Order of Operation. Write your answer.**

38)  $19 - 16 + 7 = \underline{\hspace{1cm}}$     39)  $12 + 4 \cdot 2 = \underline{\hspace{1cm}}$     40)  $(24 - 3) \cdot 6 = \underline{\hspace{1cm}}$

41)  $20 - 16 \div 4 = \underline{\hspace{1cm}}$     42)  $24 - 6 \cdot 9 = \underline{\hspace{1cm}}$     43)  $56 - (8 \cdot 2) + 6 = \underline{\hspace{1cm}}$



Name \_\_\_\_\_

Date \_\_\_\_\_

p. 6

### Algebra Readiness Assessment

#### PART II Calculators may be used.

Circle an algebraic expression to describe each word expression.

44) A number plus ten

a)  $10n$

b)  $n + 10$

c)  $n + (n + 10)$

d) None of these

45) Five times a number

a)  $5 + n$

b)  $5n$

c)  $5(n + 5)$

d) None of these

46) Eight divided by a number

a)  $\frac{8}{n}$

b)  $\frac{n}{8}$

c)  $n - 8$

d) None of these

47) The product of 18 and a number

a)  $18 + n$

b)  $18 - n$

c)  $18 \div n$

d) None of these

48) Twelve more than three times a number

a)  $12n + 3n$

b)  $3(n + 12)$

c)  $3n + 12$

d) None of these

49)  $y$  represents the length of one side of a square. Which algebraic expression represents the **perimeter**?

a)  $4y$

b)  $2y$

c)  $y + 4$

d) None of these

50)  $n$  represents an even number. Which algebraic expression represents the next greater **even number**?

a)  $2n$

b)  $2n + 2$

c)  $n + 2$

d) None of these



Circle the correct answer for each problem.

51) In the expression  $2^5$ , the best name for 5 is the \_\_\_\_\_.

- a) base                      b) number                      c) exponent                      d) factor

52)  $3^2$  means \_\_\_\_\_.

- a)  $3 \cdot 3$                       b)  $2 \cdot 2 \cdot 2$                       c)  $3 \cdot 2$                       d)  $3 + 2$

53)  $x^5 \cdot x^6 =$  \_\_\_\_\_

- a)  $2x^{30}$                       b)  $x^{30}$                       c)  $2x^{11}$                       d)  $x^{11}$

54)  $2^3 + 2^5 =$  \_\_\_\_\_

- a)  $2^8$                       b)  $2^{15}$                       c)  $4^8$                       d) 40

55)  $(-x)^6 =$  \_\_\_\_\_

- a)  $-x^6$                       b)  $-x \cdot x \cdot x \cdot x \cdot x \cdot x$                       c)  $-6x$                       d)  $-x \cdot -x \cdot -x \cdot -x \cdot -x \cdot -x$

56) Evaluate the expression  $y^2 \cdot y^3$  for  $y = 3$ .

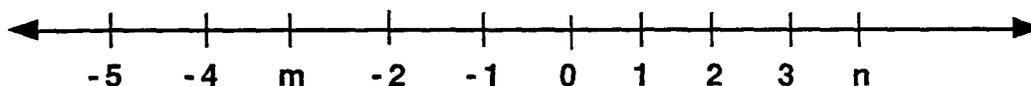
- a) 32                      b) 243                      c) 1,322                      d) 63

57)  $(-1)^{17} =$  \_\_\_\_\_

- a) 1                      b) -1                      c) 17                      d) -17



Use the number line below to find the answers for 58 - 62. Circle the answers.



- 58) The coordinate of point  $n$  is \_\_\_\_\_.  
 a) 4      b) -4      c) 0      d)  $x$
- 59) The coordinate of point  $m$  is \_\_\_\_\_.  
 a) -2      b) -4      c) 3      d) -3
- 60) To go from -2 to  $n$ , you need to \_\_\_\_\_.  
 a) add 6      b) add 7      c) subtract 6      d) add 3
- 61) To go from  $n$  to  $m$ , you need to \_\_\_\_\_.  
 a) add 7      b) subtract 7      c) add negative 4      d) subtract 8
- 62) Using the number line,  $n - 4 =$  \_\_\_\_\_.  
 a) 1      b) -1      c) -7      d) 0

**Simplify by combining like terms. Write your answers.**

- 63)  $12k - k =$  \_\_\_\_\_      64)  $6g + 2 + g =$  \_\_\_\_\_
- 65)  $8z + 2x + 4 + 2 =$  \_\_\_\_\_      66)  $16a - 20 + 16 - a =$  \_\_\_\_\_
- 67)  $20 - 19m - 25m - 6 =$  \_\_\_\_\_      68)  $25 - x^2 - 12 + 8x =$  \_\_\_\_\_



**Solve each equation.**

69)  $x - 8 = 17$

- a)  $x = 24$       b)  $x = 25$       c)  $x = 9$       d)  $x = 136$

70)  $12 = 7 + y$

- a)  $y = 19$       b)  $y = 5$       c)  $y = 84$       d)  $y = 6$

71)  $3p = 24$

- a)  $p = 8$       b)  $p = 72$       c)  $p = 6$       d)  $p = 21$

72)  $\frac{25}{x} = 5$

- a)  $x = 20$       b)  $x = 30$       c)  $x = 5$       d)  $x = 10$

73)  $2m + 6 = 12$

- a)  $m = 3$       b)  $m = 1$       c)  $m = 14$       d)  $m = 4$

**Study each table below. Circle the missing number for each table.**

74)

First Number	Second Number
1	4
3	6
?	9
9	12

- a) 10  
b) 18  
c) 6  
d) 8

75)

First Number	Second Number
1	1
3	9
6	36
n	?

- a)  $3n$   
b)  $n^2$   
c)  $6n$   
d)  $n + 3$



**Circle an expression to represent each problem.**

p. 10

76) Mr. Henderson is  $x$  years old. How old was he 5 years ago?

- a)  $x + 5$                       b)  $x - 5$                       c)  $x \div 5$                       d)  $x \cdot 5$

77) Each gallon of gas costs  $n$  cents. How much would 8 gallons cost?

- a)  $8 + n$                       b)  $n \cdot 8$                       c)  $n - 8$                       d)  $n \div 8$

**Solve each problem. Circle the correct answer.**

78) Teresa walked 4 kilometers yesterday. Today she walked 2 kilometers farther. How far did she walk today?

- a) 8 km                      b) 2 km                      c) 6 km                      d) 16 km

79) Jose is twice as tall as his little sister, who is 3 feet 2 inches tall. How tall is Jose?

- a) 3 feet 4 inches    b) 6 feet    c) 6 feet 2 inches    d) 6 feet 4 inches

80) Alex has 18 pieces of candy. He has 6 friends. If he gives each friend the same amount of candy, how many pieces does each friend get?

- a) 3                      b) 12                      c) 24                      d) 4

81) Safina has \$50 now. If she earns \$15 for **each** of the next three weeks, what is the total amount of money that Safina will have?

- a) \$65                      b) \$155                      c) \$95                      d) \$45



**FAST Math**  
**Algebra Readiness Assessment**  
Answer Key

**Part I**

1. 178
2. 528
3. 6,072
4. 15.5 or  $15\frac{1}{2}$
5. 89.72
6. 7.83
7. 1.4
8.  $11\frac{4}{8}$  or  $11\frac{1}{2}$
9.  $\frac{1}{12}$
10.  $\frac{3}{5}$
11. 6
12. 59%
13. 68%
14. 80%
15. 7
16. 20%
17. d) 56, 27
18. a) -10, -13
19. a)  $x^{15} \cdot x^{18}$
20. b) -8
21. c) -21
22. d) None of these
23. d) None of these
24. b) 3
25. a) -5
26. a) (2, 4)
27. b) (3, -4)
28. d) D
29. b) \$150
30. c)  $b = 10$ ,  $c = \$300$
31. c) P
32. c) increases
33. c)  $b > 10$
34.  $2x + 8$
35.  $5y - 20$
36.  $6x + 9$
37.  $-24y + 36$
38. 10
39. 20
40. 126
41. 16
42. -30
43. 46

## Part II

44. b)  $n + 10$
45. b)  $5n$
46. a)  $\frac{8}{n}$
47. d) None of these
48. c)  $3n + 12$
49. a)  $4y$
50. c)  $n + 2$
51. c) exponent
52. a)  $3 \cdot 3$
53. d)  $x^{11}$
54. d) 40
55. d)  $-x \cdot -x \cdot -x \cdot -x \cdot -x \cdot -x$
56. b) 243
57. b) -1
58. a) 4
59. d) -3
60. a) add 6
61. b) subtract 7
62. d) 0
63. 11k
64.  $7g + 2$
65.  $2x + 8z + 6$
66.  $15a - 4$
67.  $-44m + 14$
68.  $-x^2 + 8x + 13$
69. b)  $x = 25$
70. b)  $y = 5$
71. a)  $p = 8$
72. c)  $x = 5$
73. a)  $m = 3$
74. c) 6
75. b)  $n^2$
76. b)  $x - 5$
77. b)  $n \cdot 8$
78. c) 6 km
79. d) 6 feet 4 inches
80. a) 3
81. c) \$95

Name \_\_\_\_\_

Date \_\_\_\_\_

### Pre-Algebra Vocabulary Assessment

Write the letter of the definition next to the word.

- |                       |   |
|-----------------------|---|
| ____ 1. data          | a. compares two numbers                         |
| ____ 2. pattern       | b. one section of four equal parts              |
| ____ 3. ratio         | c. first, second, third.....                    |
| ____ 4. integers      | d. information                                  |
| ____ 5. probability   | e. positive numbers, negative numbers, and zero |
| ____ 6. order         | f. not an exact answer                          |
| ____ 7. an estimate   | g. repeats again and again                      |
| ____ 8. quadrant      | h. lines that form right angles                 |
| ____ 9. perpendicular | i. chance                                       |
| ____ 10. substitute   | j. replace one for another                      |

**Circle the word that means the same as the definition given.**

1. any number multiplied by another number

- a.) constant      b.) factor      c.) decimal      d.) vertical

2. a way to show part of a whole

- a.) horizontal      b.) value      c.) fraction      d.) plane

3. part of a mathematical expression

- a.) increase      b.) greatest      c.) term      d.) origin

4. numbers that have only two factors

- a.) less      b.) prime      c.) negative      d.) composite

5. a number that tells us how many times to multiply the base

- a.) positive      b.) odd      c.) divide      d.) exponent

6. two equal ratios

- a.) proportion      b.) digit      c.) rational      d.) combine

7. distance from zero

- a.) power      b.) quotient      c.) absolute value      d.) two

8. part of one hundred

- a.) plot      b.) percent      c.) function      d.) minus

9. right side of number sentence not equal to the left side

- a.) median      b.) group      c.) even      d.) inequality

10. line on a coordinate plane

- a.) total      b.) axis      c.) mode      d.) square

Choose a word from the box to complete each sentence.

sum	mean	inverse	equation
product	multiples	simplify	evaluate
variable	distributive		

1. Your age is a \_\_\_\_\_ because it changes.
2. To \_\_\_\_\_ an expression, you must find its total value.
3. Add the numbers to find a \_\_\_\_\_.
4. You use the \_\_\_\_\_ property when you multiply each term inside the parentheses by a factor outside the parentheses.
5. Addition and subtraction are \_\_\_\_\_ operations.
6. In an \_\_\_\_\_, the two expressions are separated by an equal sign.
7. To find the \_\_\_\_\_ of two numbers, you will multiply.
8. The \_\_\_\_\_ of 3 are 0, 3, 6, 9, 12, 15.....
9. By combining like terms, we can \_\_\_\_\_ this problem.
10. Another word for "average" is the \_\_\_\_\_.



**Pre-Algebra Vocabulary Assessment  
Answer Key**

**Matching:**

1. d
2. g
3. a
4. e
5. i
6. c
7. f
8. b
9. h
10. j

**Multiple Choice:**

1. factor
2. fraction
3. term
4. prime
5. exponent
6. proportion
7. absolute value
8. percent
9. inequality
10. axis

**Fill in the blank:**

1. variable
2. evaluate
3. sum
4. distributive
5. inverse
6. equation
7. product
8. multiples
9. simplify
10. mean



# FAST Math

## Volume 3

### Pre-Algebra Curriculum

#### Objective

#### SOL Link

#### Introduction to Algebra

- |   |  |                  |
|---|--|------------------|
| 1 | Define variables, constants and expressions.                       | PFA 7.24         |
| 2 | Represent and write variables, constants, and expressions.         | PFA 7.23         |
| 3 | Write expressions to represent and solve problems.                 | PFA 7.23         |
| 4 | Evaluate expressions using substitution.                           | A 2              |
| 5 | Define equation and represent unknowns using variable expressions. | NS 7.3           |
| 6 | Combine like terms to simplify expressions.                        | PFA 7.24,<br>A 3 |

#### Numerical Reasoning

- |    |   |              |
|----|---|--------------|
| 7  | Recognize and review estimation strategies and choose an appropriate strategy to fit a given situation. | CE 6.7       |
| 8  | Find factors, multiples, primes, and composite numbers.   | NS 6.3, 7.27 |
| 9  | Investigate, develop, and use the rules of divisibility for the numbers 2, 3, 4, 5, 6, 7, and 9.        |              |
| 10 | Review exponents. Identify prime factorization in a variety of ways and write in exponential form.      | CE 8.2       |
| 11 | Explore the concept of square root.   | CE 8.2       |
| 12 | Write powers of ten as products of tens and in exponential form.  | PFA 6.2      |
| 13 | Multiply and divide by powers of ten.   | PFA 6.2      |
| 14 | Read and write numbers in scientific notation.  | PFA 6.2      |

<b><u>Objective</u></b>	<b><u>SOL Link</u></b>
15 Understand the relationship between fractions, decimals, and percents and convert one to the other through thousandths.	NS 6.1, 7.1
16 Distinguish between terminating and repeating decimals and write repeating decimals using the appropriate notation.	
17 Use order of operations to simplify expressions.	NS 7.3
18 Compare and order integers and identify absolute value.	CE 8.5
19 Recognize and describe rational and irrational numbers.	
20 Model integer operations using manipulatives and/or a number line.	CE 7.6
21 Apply integer rules to add, subtract, multiply and divide.	CE 7.6
22 Recognize, define the characteristics of, and use the associative property, properties of zero, and inverse operations.	NS 7.4
23 Recognize, define the characteristics of, and use the distributive property.	NS 7.4

### **Patterns and Functions**

24 Identify and extend number patterns.	PFA 6.21
25 Represent functions, function tables, and function rules using arrow notation.	PFA 7.22
26 Plot points on a coordinate grid. Investigate slope.	PFA 7.26
27 Use a coordinate grid to plot functions.	PFA 7.26

### **Ratio, Proportion, and Percent**

28 Identify the relationship between sets of data using a ratio model.	NS 6.2
29 Estimate the percent of a number using the percent bar model.	
30 Solve percent problems using the percent bar model.	CE 7.7
31 Set up and solve proportions.	CE 7.7
32 Use proportions to solve problems.	PFA 8.19
33 Find the sale and original price when given the discount.	CE 7.5
34 Determine the truth in statistics or advertising and adjust the misleading.	CE 7.5

**Objective****SOL Link****Equations and Inequalities**

- |    |  |                      |
|----|--|----------------------|
| 35 | Explore the concept of equations, including balance and working backwards. |                      |
| 36 | Use a concrete model to write and solve equations.                         | PFA 6.23             |
| 37 | Simplify and solve equations using one inverse operation.                  | PFA 6.23             |
| 38 | Solve problems using equations.  | PFA 6.23             |
| 39 | Simplify and solve two-step equations.                                     | PFA 7.25             |
| 40 | Solve inequalities.  | A 1                  |
| 41 | Graph linear equations and inequalities.                                   | PFA 8.17<br>A 1, A 3 |

**Geometry**

- |    |   |                  |
|----|---|------------------|
| 42 | Identify, draw, and define the characteristics of polygons through ten sides. Explore quadrilaterals.   | G 6.15<br>G 7.11 |
| 43 | Develop the strategies for and find the sum of the interior angles of any polygon.  |                  |
| 44 | Investigate the properties of symmetry and transformation including: slip/translation, flip/reflection, and turn/rotation.  | G 8.9            |
| 45 | Explore congruent and similar geometric figures. Write proportions to express similar relationships and solve for unknown sides.  | G 7.12           |
| 46 | Investigate and apply the Pythagorean Theorem to find the missing length of a side of a right triangle.   | G 8.11           |
| 47 | Identify and describe the characteristics of angles, including supplementary, complementary, vertical, and adjacent angles.   | G 8.7            |
| 48 | Construct the perpendicular bisector of a line segment and the bisector of an angle using a straight edge.  | G 6.16           |
| 49 | Identify the parts of a circle, including diameter, radius, circumference, arc, chord, and center.  |                  |
| 50 | Develop and apply formulas to find perimeter and area of rectangles, triangles, and parallelograms.   | M 7.8            |
| 51 | Investigate circles: relationship of diameter to circumference, concept of Pi ( $\pi$ ), and formulas to find area ( $A = \pi r^2$ ) and circumference ( $C = \pi d$ ). |                  |

<b><u>Objective</u></b>	<b><u>SOL Link</u></b>
52 Identify, name, and define the characteristics of space figures, including cones, prisms, pyramids, and cylinders.	G 6.17
53 Construct and draw space figures. Identify and verbalize the relationships among vertices, faces, and edges of a polyhedron.	G 8.10
54 Investigate surface area and volume of rectangular prisms.	G 7.13 M 8.8
55 Investigate surface area and volume of pyramids, cylinders, and cones.	M 7.9 M 8.8
<b><u>Probability, Statistics, and Data Analysis</u></b>	
56 Determine the probability of single outcome (independent) events, recognizing that the probability of certain events is 1, impossible events is 0, and all others lie between 0 and 1.	PS 6.2
57 Identify and describe the number of possible arrangements of several objects.	PS 7.18
58 Collect data and make inferences and predictions based on an analysis of the set of data.	PS 7.21 PS 8.13
59 Determine the mean, median, mode, and range of a given set of data and record the central tendency using the most appropriate measure.	PS 6.19 PS 7.20
60 Construct and describe the data represented in line plots.	PS 7.20
61 Construct and describe the data represented in stem and leaf plots.	PS 7.20
62 Construct and describe the data represented in box plots.	PS 7.20
63 Construct and describe data represented in scatter plots.	

# **Introduction to Algebra**





## Objective 1: Define variables, constants, and expressions.

### Vocabulary

operation  
constant  
variable  
expression  
constant expression  
variable expression

### Materials

Transparencies:

Constants, Variables, and Expressions  
Constants, Variables, and Expressions All  
Around Us!

Student Copies:

More Constants, Variables, and Expressions  
Constants, Variables, and Expressions All  
Around Us!  
Vocabulary Practice  
Constants and Variables in My Life

### Language Foundation

1. Introduce students to the terms **constant** and **variable**. Explain that a **constant** is something that always has the same value. It stays the same. A **variable** is the opposite. Its value can change. For example, the number of items in a dozen is a **constant** because it is always 12. Age is a variable because it changes. Brainstorm with the class other constants, such as the number of days in a year or the number of pennies in a dime, and other variables, such as the temperature outside or the hours students spend doing homework. Explain that the value of the variable may change quickly like time or may change more slowly like age.
2. Remind students that the four basic mathematical operations are addition, subtraction, multiplication, and division.
3. Ask students if they know what an expression is. Explain that the word **expression** is an example of a word in English that has more than one meaning. It can mean the expression on someone's face or something that people say, do or write that shows how they think or feel. It can be a phrase (a group of words) or a complete sentence. Explain that there are also expressions in math. These expressions are called **constant** and **variable expressions**.

## Mathematics Component

### 1. Explore constants and variables.

- Use the overhead transparency Constants, Variables, and Expressions.
- For number 1, ask three students to give the value of a quarter. Record their responses on the transparency. (Responses should be the same.)
- For number 8, ask three students to give their height and record their responses on the transparency. (Responses should be different.)
- Lead students to notice that all of the responses for number 1 are the same, but the responses for number 8 are different. Discuss/review the terms **constant** and **variable** as described in the language foundation.
- Have the class discuss and categorize each of the first 15 items as either a constant or a variable. Record their responses beside each number on the transparency.

**Note:** This activity may generate discussion since some items may be categorized as either a constant or a variable depending on the justification given. Encourage student discussion. (See the answer key provided for possible responses.)

### 2. Explore ways to represent constants and variables.

- Write “1, 2, 3, 4, 5, ...” on the board. Ask students if counting numbers such as these would be described as constants or variables. Have them explain. (They are constants because their value does not change.)
- Explain to students that in mathematics constants are represented using numerals. Point to the examples on the board and repeat that numerals are constants.
- Explain that since the value of variables can change, they are represented by single letters, usually in lower case. Write several examples such as  $n$ ,  $x$ ,  $p$ , etc.
- Explain that sometimes the letter for a variable is given. Other times, the letter which will represent the variable can be chosen. Make sure the students understand that any letter may be chosen to represent a variable. For example, if selecting a letter to represent the variable “**hours worked at babysitting**,” they could select “**h**” (for hours), “**b**” (for babysitting), or even “**t**” (for time). However, once a letter is selected to represent a variable in a problem, they must consistently use it each time the variable is referenced.
- Go back to numbers 1 - 15 on the transparency and have students suggest a number or letter to represent each constant or variable.

### 3. Identify and define constant expressions.

- Have students look back at number 1 (value of a quarter) which they categorized as a constant on the transparency.
- Then ask them to look at number 16 at the bottom of the page. Read it aloud. Ask how number 1 and number 16 are the same. Lead them to see that the constant “value of a quarter” is in both. Underline the words “value of a quarter” with a colored marker.

- Ask students how number sixteen is different from number one. Lead them to realize that number sixteen includes an **operation**. Remind students that operations in math are addition, subtraction, multiplication, and division.
- Have students indicate the operation included in number 16. ( addition) Use a different colored marker to underline the words which represent an operation. (In this problem, “more than” represents addition.)
- Explain that if one or more operations is included along with a constant it is called a **constant expression**. A constant expression is composed only of constants and operations. For example, the numerical representation of the total of four apples and three apples ( $4 + 3$ ) is a constant expression because it contains only constants combined with an operation.
- Go back to number 2 (number of minutes in an hour) on the transparency and review that it is a constant.
- Look at number 17 at the bottom of the transparency and ask students how this item is the same and then different from number 2. (The constant “number of minutes in an hour” is the same, but number 17 also includes an operation.) Have students identify the operation. (subtraction)
- Underline the constant (number of minutes in an hour) with a colored marker and the words which represent the operation with a different colored marker. (In this problem, “less than” indicates subtraction.)
- Say, “Ten minutes less than the number of minutes in an hour is a **constant expression**.”
- Ask a few students to explain what a constant expression is using their own words. (A constant expression includes only constants with one or more operations.)

#### 4. Identify and define variable expressions.

- Go back and read number 3, categorized as a variable on the transparency. Then look at number 18.
- Have students identify the variable which is the same. (The variable is “the price of a candy bar.”) Underline the variable using a colored marker.
- Ask if either number 3 or number 18 includes an operation. (Yes, number 18 includes multiplication - twice the price of a candy bar.) Underline the words which represent an operation with a different colored marker. (twice)
- Explain that another kind of expression is one that includes at least one variable along with one or more operations. If an expression contains at least one variable, it is called a **variable expression**, regardless of the additional constants and/or variables it may contain. For example, the difference between the number of marbles Juan has and the number Alfredo has might be represented as  $(j - a)$ . Say, “The expression “ $j - a$ ” contains two variables. Variable expressions may contain more than one variable.”
- Go back to number 4 on the transparency (price of a car) and review that this is a variable.
- Have students look at number 19. Discuss and underline the variable (price of a car) and the words which represent an operation. (In this problem, “less than” represents subtraction.)

Tell students that this is a **variable expression**.

- The activity sheet More Constants, Variables, and Expressions is provided for additional practice.

5. Practice identifying constants and variables.

- Provide students with copies of the activity sheet Constants, Variables, and Expressions All Around Us.
- Either in class or as a homework assignment have students write phrases or draw pictures of real-life examples of constants, variables, and expressions. Do several examples together until students are clear on the assignment. Expressions may be confusing for some students.
- As a class or small-group activity, go over the lists and have each student read one item from their list as other students determine the category (constant, variable, or expression). For expressions, have students identify the constant(s)/variable(s) and the operation(s).

### Language Development Activities

- Dictionary  
Have students begin a dictionary of terms. Keeping a notebook of terms is a good way to teach organization and would allow students to go back and review vocabulary as needed. Discuss definitions as a class and then write the best definition on the board for the students to copy. Have students include three components for each dictionary entry: words, definitions, and examples or pictures.
- Vocabulary Reinforcement  
The activity page Vocabulary Practice will provide additional reinforcement of new terms introduced in this objective.
- Writing Prompt  
To reinforce the concept of **constants** and **variables**, ask students to think about the constants and variables in their lives. Brainstorm and discuss ideas as a class. Have students record their ideas on the activity page Constants and Variables in My Life. Tell students they should include the reasons why they think their choices are constants or variables.

### Additional Resources

The Algebra Lab, Middle School, Lessons 1 and 2

## Constants, Variables, and Expressions

### C? or V?

- \_\_\_\_\_ 1. value of a quarter
  - \_\_\_\_\_ 2. number of minutes in an hour
  - \_\_\_\_\_ 3. price of a candy bar
  - \_\_\_\_\_ 4. price of a car
  - \_\_\_\_\_ 5. hours worked at babysitting
  - \_\_\_\_\_ 6. miles driven in our car
  - \_\_\_\_\_ 7. number of days in October
  - \_\_\_\_\_ 8. height of a student
  - \_\_\_\_\_ 9. number of students in a math class
  - \_\_\_\_\_ 10. number of points scored in a game of soccer
  - \_\_\_\_\_ 11. number of states in the U.S.
  - \_\_\_\_\_ 12. number of ounces in a pound of candy
  - \_\_\_\_\_ 13. time that students get home after school
  - \_\_\_\_\_ 14. a student's heart rate
  - \_\_\_\_\_ 15. length of a meter stick in cm
- 

- \_\_\_\_\_ 16. 20¢ more than the value of a quarter
- \_\_\_\_\_ 17. 10 minutes less than the number of minutes  
in an hour
- \_\_\_\_\_ 18. twice the price of a candy bar
- \_\_\_\_\_ 19. \$500 less than the price of a car

Name: \_\_\_\_\_

## More Constants, Variables, and Expressions



Write the following in the correct box:

- 1) number of CDs in my collection
- 2) number of days in May
- 3) amount of money Michael Jordan has
- 4) number of eyes on my teacher's head
- 5) three times the price of a pair of jeans
- 6) distance from N.Y. City to Boston
- 7) 101 Dalmatians plus five more
- 8) value of a nickel
- 9) ten times the value of a dollar
- 10) number of fingers on my hand
- 11) amount of homework in a week
- 12) three more than the number of Snickers I eat in a week
- 13) ten miles less than the distance from Fairfax to Annandale

### Constants

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_
- 3) \_\_\_\_\_
- 4) \_\_\_\_\_
- 5) \_\_\_\_\_

### Variables

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_
- 3) \_\_\_\_\_

### Constant Expressions

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_
- 3) \_\_\_\_\_

### Variable Expressions

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_

Name \_\_\_\_\_

Date \_\_\_\_\_

## Constants, Variables, and Expressions All Around Us

Directions: Use words (or pictures) to describe things in your home that are constants, variables or expressions. List 5 of each.

Constant	Variable	Expression
Ex: number of windows	Ex: clothes my sister wears	Ex: twice the number of people in my family
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.
5.	5.	5.

Name \_\_\_\_\_

## Vocabulary Practice

Part I. Draw a **circle** around the letter that does not belong.

**1. Constants:**

- a. the number of hours in a day
- b. the number of eggs in a dozen
- c. the temperature

**2. Variables:**

- a. the number of students in a class
- b. the number of continents in the world
- c. the price of a soda

**3. Variable expressions:**

- a. the number of days in a month
- b. twice the price of a soda
- c. the number of hours spent on homework plus the number spent on chores

**4. Constant expressions:**

- a. twenty minutes more than the number of minutes in an hour
- b. the number of seconds in a minute
- c. the number of minutes in two hours less ten minutes

**5. Constants:**

- a. the number of ounces in a soccer ball
- b. the number of centimeters in a meter
- c. the number of grams in a kilogram

Part II. Write "T" on the line if the statement is true; "F" if it is false.

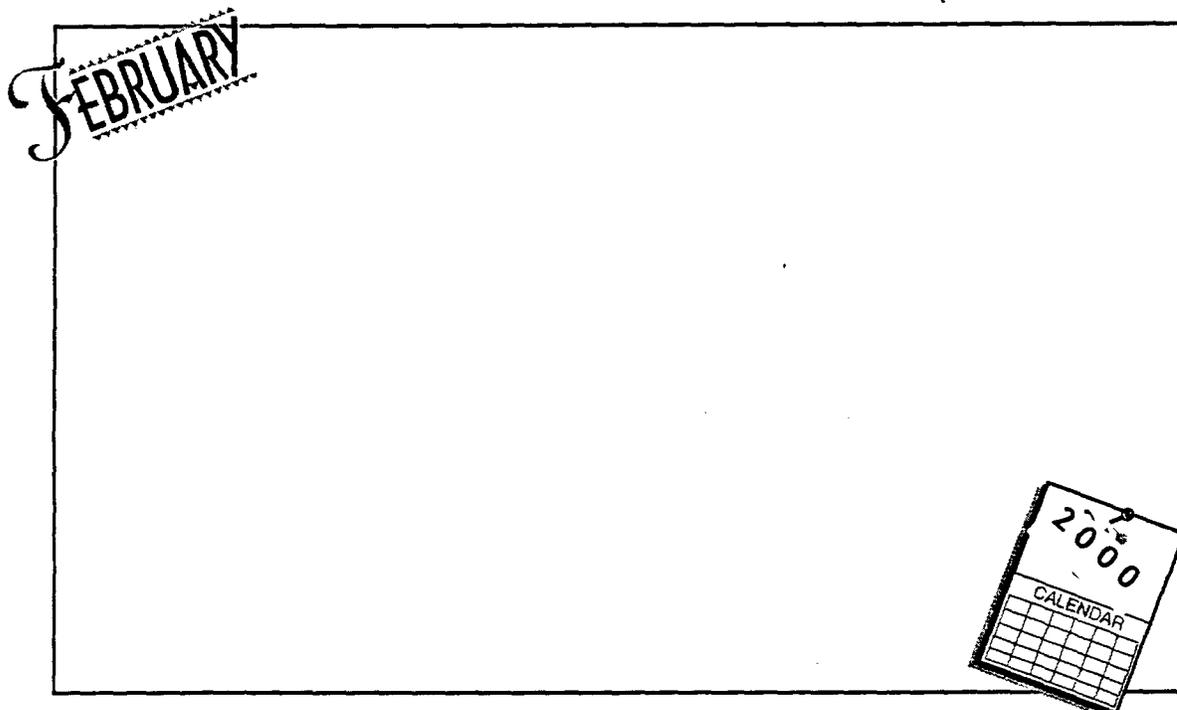
- \_\_\_\_\_ 1. A variable is the opposite of a constant.
- \_\_\_\_\_ 2. A constant expression must include a constant and multiplication.
- \_\_\_\_\_ 3. A variable is a number that stays the same.
- \_\_\_\_\_ 4. A constant is something that changes over time.
- \_\_\_\_\_ 5. A variable expression must include an operation or operations and a variable. It can also include constants.

# Vocabulary Practice -

p.2

## Part III Challenge.

Are the number of days in the month of February a constant or a variable?  
What about the number of days in a year? Explain your answer!



Name: \_\_\_\_\_

## Constants and Variables in My Life

A constant in my life is

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A variable in my life is

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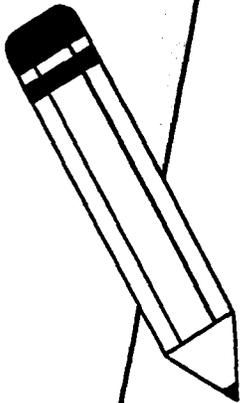
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## Answer Key Obj. 1

### Constants, Variables, and Expressions

1. **constant** - The value of a quarter is always \$.25.
2. **constant** - There are always 60 minutes in an hour.
3. **variable** - The price of a candy bar varies.
4. **variable** - The price of a car depends on the make and model, age, etc.
5. **variable**- Even if a student babysits the same children every day, the time will probably vary if only by a minute!
6. **variable** - The miles driven in a car can vary depending on distance, how many trips, etc.
7. **constant** - There are always 31 days in October.
8. **variable** - Students' heights will vary.
9. **variable** - The number varies depending upon which period math class and whether students are absent.
10. **variable** - The score depends on how well a team plays.
12. **constant**- There are always 16 ounces in a pound.
13. **variable** - Many factors may affect the time; for example, bus times may vary or a student may not go directly home after school.
14. **variable** - Heart rate changes depending on the activity level and emotional state. For example, after you run or when you are frightened it is faster.
15. **constant**- A meter stick is always the same measurement.
  
16. **a constant expression**
17. **a constant expression**
18. **a variable expression**
19. **a variable expression**

More Constants, Variables, and Expressions

Constants # 2, 4, 6, 8, 10

Variables # 1, 3, 11

Constant Expressions # 7, 9, 13

Variable Expressions # 5, 12

(#6 and #13 assume standard distance measurement from one point to another on a map. Some students may say that you can go from NY to Boston by many different routes. If students can justify their thinking, #6 and #13 could be either constant or variable.)

Vocabulary Practice

1) c

2) b

3) a

4) b

5) a

True - False

1) T

2) F

3) F

4) F

5) T

## Objective 2: Represent and write variables, constants, and expressions.

### Vocabulary

factor  
parentheses  
fraction bar

### Materials

Transparencies

Representing Multiplication  
Representing Division  
Words Associated with Operations  
Changing Words to Expressions  
Matching Expressions and Phrases

Student Copies

Representing Multiplication  
Representing Division  
Words Associated with Operations  
Using Tiles to Model Expressions  
Tile Templates  
Changing Words to Expressions  
Matching Expressions and Phrases  
Writing Expressions  
Review of Expressions  
Vocabulary Practice  
Vocabulary Review

### Language Foundation

1. Introduce the concept of **factors** to students.  
Tell them that in everyday life, we consider all the **factors** before making a decision. For example, if they are getting a puppy, students might consider size, gender, and color, as well as whether the puppy has long or short hair or is frisky or quiet. They could use all these factors in making a decision about the final product - their puppy. In math, you get a final product by multiplying all the **factors**.
2. Explain that **parentheses** are symbols used both in math and when writing English. In writing, parentheses are used to add words or to explain something. In math, parentheses are used to group numbers or to indicate multiplication.
3. In this lesson, **fraction bar** refers to another type of division symbol. It is used between the numerator and denominator in a fraction to denote division. ( $3/4$  means  $3 \div 4$ )

## Mathematics Component

Warm-up: Remind students that constants are things which always have the same value and in mathematics they are represented by numerals. Give several examples. (2, 5, 19, etc.) Variables are represented by a single letter (usually lower case) . Give several examples. (p, t, r, etc.)

1. Review symbols used to represent addition and subtraction.
  - Remind students that expressions are represented by combinations of numerals and /or letters along with operation symbols.
  - Ask students what symbol or sign is used in math to represent addition. (+) Ask what symbol or sign is used to represent subtraction. (-)
2. Review symbols used to represent multiplication and division.
  - Tell students that there are several different ways to represent multiplication. Ask if students know what one of the symbols looks like. (x)
  - Distribute the handout Representing Multiplication to each student.
  - Read the information beside number 1 together.
  - Explain that while it is not incorrect to use the “x” sign to represent multiplication, that symbol is used mostly in beginning math. Tell students that the symbol can be very confusing in algebra. Have students think about how variables are represented. Ask students why they think the “x” might be confusing in algebra. (It is very hard to determine if the “x” represents the operation of multiplication or is being used as a variable.) Explain that because of this confusion, in algebra other symbols are generally used to represent multiplication.
  - Use the transparency copy and read through the four other ways to represent multiplication. Have students highlight key points on their individual copies.
3. Review symbols used to represent division.
  - Distribute the activity sheet Representing Division to each student.
  - Explain that division also can be represented in different ways.
  - Use the transparency copy and read through the three ways that division can be represented. As each method is read, have students highlight key points on their individual copies.
  - Explain that in algebra, a bar is generally used to represent division.
4. Explore words that **are associated with** certain mathematical operations.
  - Remind students that addition is used to “put together.” For example,  $3 + 2$  shows that 3 is “put together” with 2.
  - Ask students if they know any words, such as “plus,” which might suggest that things are being put together and addition is being used. Have students brainstorm a list of words as you record them on the board.

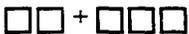
- Review that subtraction is the operation used to “take away,” or find a “missing part.” For example  $11 - 4$  shows that 4 is “taken away” from 11.
- Ask students to brainstorm a list of words which might suggest that subtraction is being used. Record the list on the board.
- Repeat this same procedure for multiplication and division allowing students to share words with which they are already familiar.
- \* Provide students with a copy of the handout Words Associated with Operations. Using a transparency copy, review the words and the operation associated with each. However, be sure to emphasize that the word or phrase does not automatically indicate the operation. The **meaning** of a phrase or a sentence is what determines the operation.

- Examples: 1) How much is 20 more than than 30? (addition)  
 2) Fifteen is how much more than ten? (subtraction)

5. Explore creating and writing mathematical expressions.

- Algebra tiles can be used to help students visualize expressions. They are a good way to introduce students to creating and writing mathematical expressions. Have students work in pairs. Give each pair ten “variable” and ten “ones” tiles. If algebra tile manipulative sets are not available, teachers can use the Tile Templates provided and have the students cut out sets of their own.

- Model for students on the overhead that the  tile represents a variable  $n$  and the  tile represents the number 1.

- Show students that the expression  $2 + 3$  can be represented by 

Next, show that the expression  $3n + n$  can be represented by 

Now, ask students how they think the expression  $2n + 4$  can be represented using the tiles.

Lead students to see that 2 variable tiles and 4 ones tiles are needed.



Group the tiles with a circle as you point out  $2n$  and 4.



- Practice a few more examples with students and then let them work in pairs to complete the activity sheet Using Tiles to Model Expressions.

6. Practice translating between mathematical and word expressions.

- Give students a copy of Changing Words to Expressions and place a transparency of the activity on the overhead.

As the class works through each problem on the transparency with you, be sure to point out that the order of the words in English does not determine the order of the terms in the mathematical expression. For example, the mathematical expression for “three less than 12” would be  $12 - 3$ . The mathematical expression depends on the meaning of the words.

- Distribute a copy of Matching Expressions and Phrases to each pair of students. Tell students they they will work with a partner to match each word expression to the appropriate mathematical expression. Remind students that the order of the words in English does not determine the order of the terms in the mathematical expression. Allow time for groups to complete the activity. Then use a transparency copy of the activity page to discuss and share answers. Problems 3, 4, 6, and 7 have more than one correct answer. (See the answer key.)
- The activity pages Writing Expressions and Review of Expressions will provide further practice in translating between word expressions and mathematical expressions using variables.

### **Language Development Activities**

- Journals/Math Writing Prompts  
To help develop writing skills in math, have students keep a math journal about their math learning experiences. Some suggested writing prompts are: What students are feeling about math, what they don't understand, what they've learned, what was the easiest thing (or hardest) the past week, what they have questions about, what they are having trouble with, what they like best (or least) in math, etc.
- Vocabulary Reinforcement  
Two activity pages, Vocabulary Practice and Vocabulary Review , are provided to reinforce vocabulary and concepts presented in the lesson and to review terms from the previous lesson.

### **Additional Resources**

The Algebra Lab, Middle School, Lesson 1, Activities 1 and 2; Lesson 2, Activities 1 and 2.

## Representing Multiplication

Multiplication is read as “times” and may be represented in several ways:

Symbol	When	Say
1) $x$ the letter x	... mostly in beginning math	<u>Example:</u> $3 \times 4$ Say: “ <b>three times four</b> ”
2) $( )$ parentheses	... multiplication with constants	<u>Example:</u> $(3)(4)$ or $(3)4$ or $3(4)$ Say: “ <b>three times four</b> ”
3) Nothing!	... a constant <u>times</u> a variable  <u>or</u> two variables <u>multiplied</u> together	<u>Example:</u> $3x$ Say: “ <b>three x</b> ”  <u>Example:</u> $xy$ Say: “ <b>xy</b> ”
4) $\cdot$ a raised dot	... multiplication of “factors”	<u>Example:</u> $3 \cdot 4$ Say: “ <b>three times four</b> ”  <u>Example:</u> $x \cdot x$ Say: “ <b>x times x</b> ” <u>or</u> <b>x squared</b> ”
5) $3^2 \leftarrow$	... number of times a “base” is multiplied by itself	<u>Example:</u> $3^4$ Say: “ <b>three to the fourth power</b> ”  <u>Example:</u> $x^3$ Say: “ <b>x cubed</b> ” or “ <b>x to the third power</b> ”

## Representing Division

Division is read as “divided by” and may be represented in 3 ways.

Symbol	When	Say
1) $\div$	... to show that what is before the symbol is divided by what is after the symbol	<u>Example:</u> $3 \div 4$  Say: <b>“three divided by four”</b>
2) $\overline{\hspace{1cm}}$	... mostly in arithmetic	<u>Example:</u> $4 \overline{)3}$  Say: <b>“three divided by four”</b>
3) $\frac{\hspace{1cm}}{\hspace{1cm}}$	... in a fraction to show division	<u>Example:</u> $\frac{3}{4}$  Say: <b>“three divided by four”</b>

## Words Associated with Operations

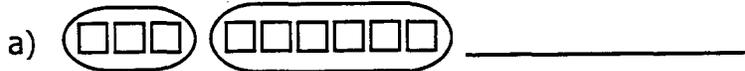
<b><u>Addition</u></b>	<b><u>Subtraction</u></b>	<b><u>Multiplication</u></b>	<b><u>Division</u></b>
add	subtract	multiply	divide
plus	minus	times	divided by
and	less	product	quotient
increased by	less than	as a factor	separated into equal groups
more than	fewer than	twice	shared equally
greater than	decreased by	double	over
sum	difference	triple	
total of	shorter	groups of	
combined	lower	of	
	from		
	take away		

Name: \_\_\_\_\_

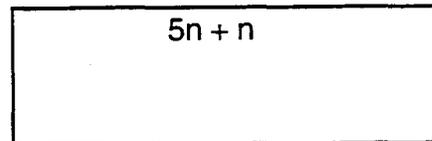
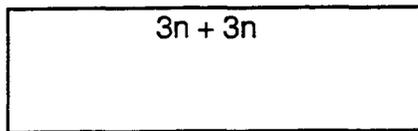
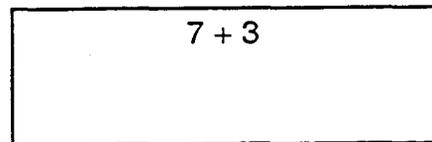
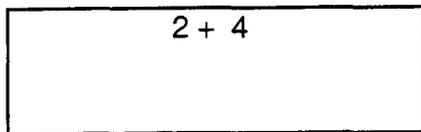
## Using Tiles to Model Expressions

### Using Similar Tiles

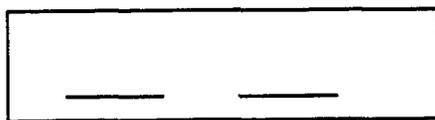
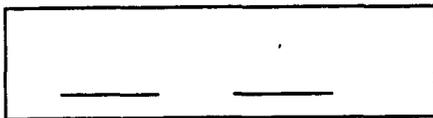
Part 1 Write the expression for each diagram.



Part 2 Use tiles to show each expression. Model first with your tiles, then draw the tiles.

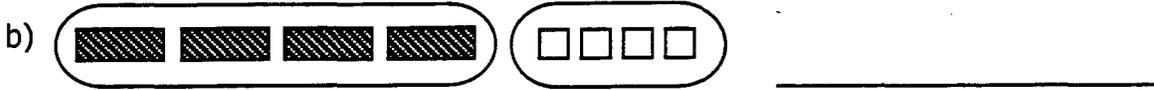
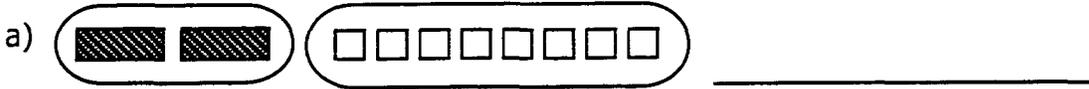


Part 3 Show 2 different ways to put the tiles into two groups.  
Write the expression for each group. (Use a + symbol)

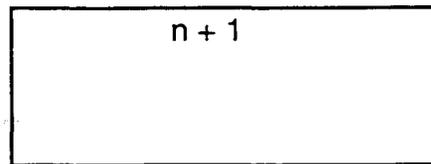
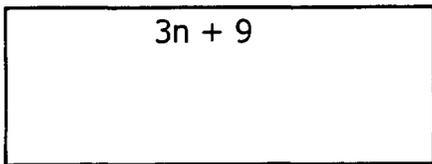
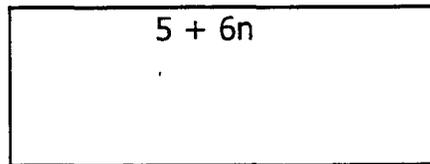
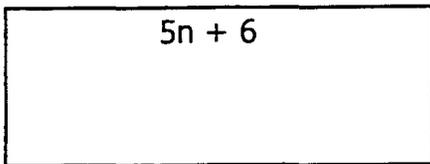


**Using Mixed Tiles**

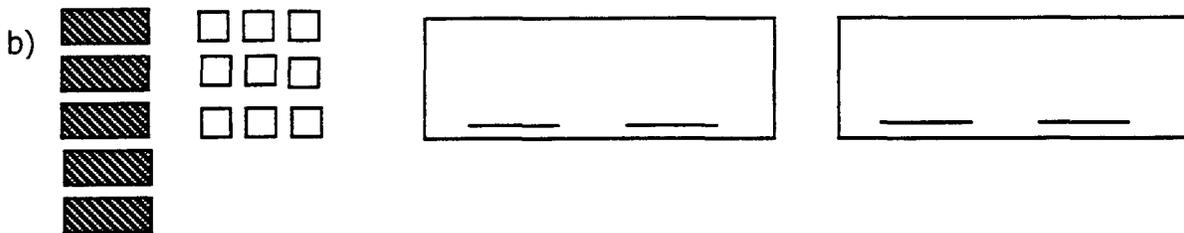
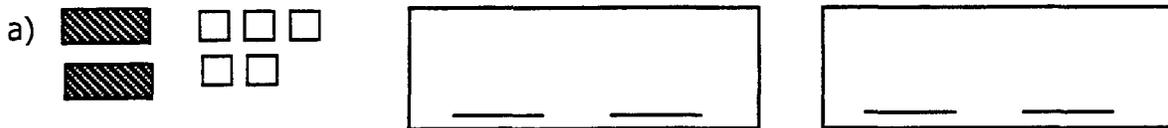
Part 1 Write the expression shown by each diagram



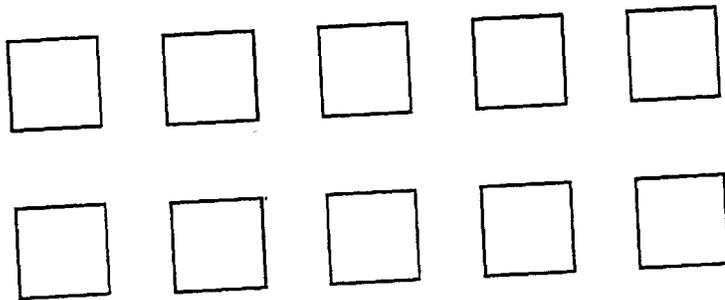
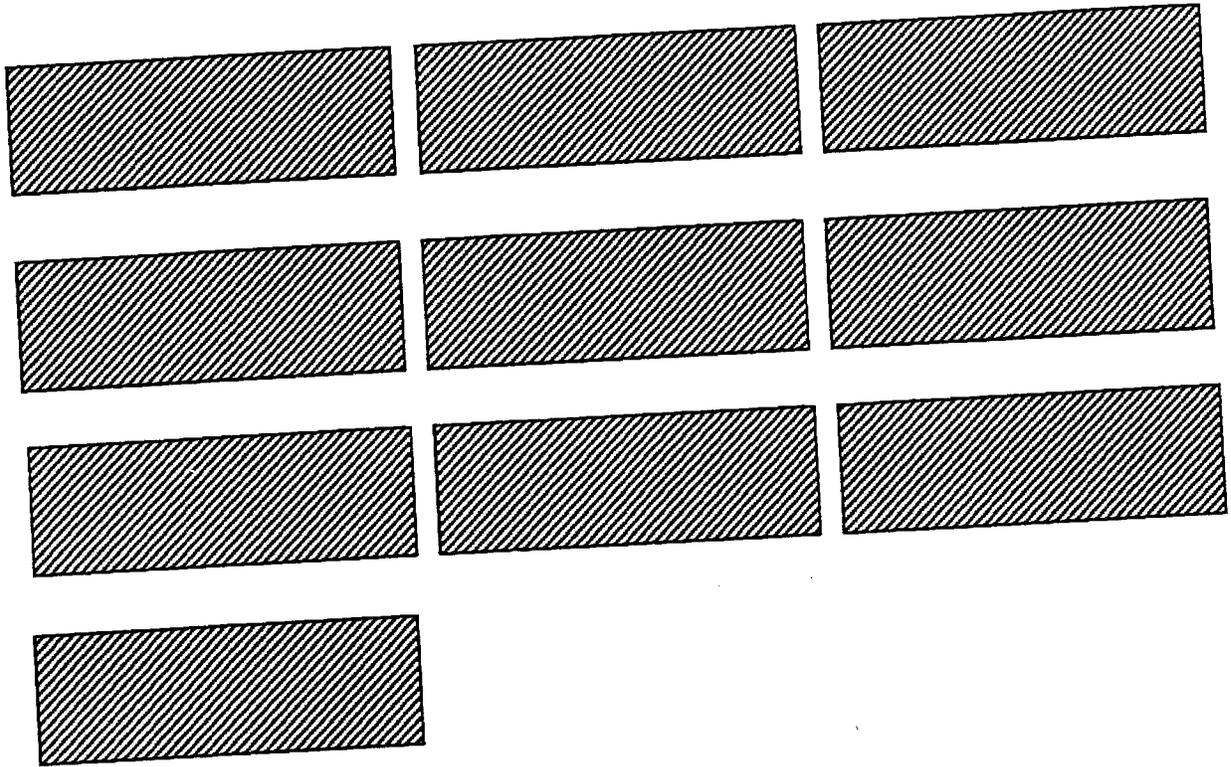
Part 2 Use tiles to show each expression.  
Model first with your tiles, then draw.



Part 3 Show 2 different ways to put the tiles into two groups.  
Write the expression for each group. (Use a + symbol)



# TILE TEMPLATES





## Changing Words to Expressions

Can you match the words with an algebraic expression?

- |                                 |                   |
|---------------------------------|-------------------|
| ___ 1) $n$ doubled              | a) $n - 8$        |
| ___ 2) $n$ increased by six     | b) $n + 2$        |
| ___ 3) $n$ decreased by eight   | c) $n \div 2$     |
| ___ 4) two more than $n$        | d) $\frac{1}{2}n$ |
| ___ 5) five less than $n$       | e) $2n$           |
| ___ 6) one half of $n$          | f) $10 + n$       |
| ___ 7) three times $n$          | g) $n + 6$        |
| ___ 8) $n$ divided by 2         | h) $3n$           |
| ___ 9) the product of $n$ and 7 | i) $n - 5$        |
| ___ 10) the sum of 10 and $n$   | j) $7n$           |

Name \_\_\_\_\_  
Date \_\_\_\_\_

Transparency / Student Copy

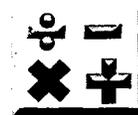
### Matching Expressions and Phrases

Match each mathematical expression with one English phrase which describes it.

<u>Mathematical Expression</u>	<u>English Phrase</u>
1) $5 + w$	A) five increased by $w$
2) $w + 5$	B) five decreased by $w$
3) $w - 5$	C) half the total of five and $w$
4) $5 - w$	D) five less than $w$
5) $5(w)$	E) five fewer than half of $w$
6) $5w$	F) five groups with $w$ in each
7) $\frac{w}{5}$	G) five more than twice $w$
8) $\frac{5}{w}$	H) the product of five and $w$
9) $2w + 5$	I) $w$ divided by five
10) $\frac{5 + w}{2}$	J) the quotient of five and $w$
11) $\frac{w}{2} - 5$	K) five more than $w$
	L) $w$ decreased by five

Name \_\_\_\_\_

## Writing Expressions



**For each English phrase, write an expression on the blank.**

1. the sum of 9 and a number  $n$  \_\_\_\_\_
2. 61 added to a number  $p$  \_\_\_\_\_
3.  $m$  minus 270 \_\_\_\_\_
4. a number  $q$  subtracted from 8 \_\_\_\_\_
5. the product of a number  $p$  and 4 \_\_\_\_\_
6. a number  $y$  divided by 75 \_\_\_\_\_
7. 14 times a number  $c$  \_\_\_\_\_
8.  $x$  number of people divided into 5 groups \_\_\_\_\_
9. Maria's age if she is 6 years younger than her brother ( $b$ ) \_\_\_\_\_
10. Her brother's age if Maria is  $m$  years old. \_\_\_\_\_
11. A dozen eggs is 12. The number of eggs in  $r$  dozen. \_\_\_\_\_
12. The number of dozen in  $s$  eggs. \_\_\_\_\_

**For each expression, write an English phrase on the blank.**

13.  $j - 2$  \_\_\_\_\_
14.  $\$3.65 + \$4.99$  \_\_\_\_\_
15.  $\frac{(a+b)}{3}$  \_\_\_\_\_
16.  $32q$  \_\_\_\_\_
17.  $7w + d$  \_\_\_\_\_

Name: \_\_\_\_\_

## Review of Expressions



Name the variable in each expression.

- 1)  $20 + x$  \_\_\_\_\_
- 2)  $5m$  \_\_\_\_\_
- 3)  $7a + 13$  \_\_\_\_\_
- 4)  $18 - b$  \_\_\_\_\_
- 5)  $38 \div r$  \_\_\_\_\_

Name the operation(s) in each expression.

- |                       |                       |
|-----------------------|-----------------------|
| 1) $24 \cdot 3$ _____ | 4) $d + 10$ _____     |
| 2) $x \div 5$ _____   | 5) $8n$ _____         |
| 3) $15 - 6x$ _____    | 6) $3m \div 12$ _____ |

Write an algebraic expression. Choose your own letter for each variable.

- 1) add 3 to a number \_\_\_\_\_
- 2) a number times 10 \_\_\_\_\_
- 3) 20 is divided by a number \_\_\_\_\_
- 4) a number minus 50 \_\_\_\_\_
- 5) 2 times a number plus 8 \_\_\_\_\_
- 6) subtract 38 from a number \_\_\_\_\_
- 7) 23 times a number \_\_\_\_\_
- 8) a number divided by 16 \_\_\_\_\_
- 9) 9 less than a number \_\_\_\_\_
- 10) The product of a number and 4 \_\_\_\_\_



## Review of Expressions

p.2

Write these expressions in words.

- 1)  $x + 10$  \_\_\_\_\_
- 2)  $5 - s$  \_\_\_\_\_
- 3)  $2y + 3$  \_\_\_\_\_
- 4)  $6 \div p$  \_\_\_\_\_
- 5)  $9m$  \_\_\_\_\_
- 6)  $y - 4$  \_\_\_\_\_
- 7)  $\frac{8}{a}$  \_\_\_\_\_

Fill in the chart

	<b>Word Expression</b>	<b>Operation</b>	<b>Algebraic Expression</b>
1)	b minus four	subtraction	$b - 4$
2)	twenty more than r		
3)	six times g		
4)	k divided by nineteen		
5)	twice n		
6)			$10y$
7)			$w - 2$
8)			$3d + 4$
9)			$z \div 5$
10)			$12 + g$

Name \_\_\_\_\_

## Vocabulary Practice

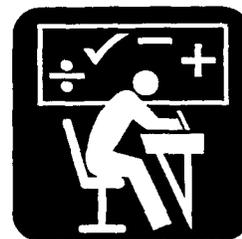
Part I. Sentence Completions. Complete the sentences with the correct math term.

addition	multiplication	subtracting
division	multiplying	variable
factors	parentheses	variable expression
fraction bar		

1. The operation that uses factors to find a product is called \_\_\_\_\_ .
2. The operation that has a sum is called \_\_\_\_\_ .
3. An expression with at least one variable and one operation is called a \_\_\_\_\_ .
4. A letter that represents a number is called a \_\_\_\_\_ .
5. The expression  $x \div 7$  is an example of the operation called \_\_\_\_\_ .
6. \_\_\_\_\_ are used to group numbers and show multiplication.
7. A \_\_\_\_\_ is a symbol for division used between the numerator and denominator in a fraction.
8. You get a final product by multiplying all the \_\_\_\_\_ .
9. When you double or triple a number you are \_\_\_\_\_ .
10. When you take away from a number you are \_\_\_\_\_ .

Name: \_\_\_\_\_

## Vocabulary Review



Part I. Draw a **circle** around the letter that does not belong.

1. Addition:

- A. increased by                      B. decreased by                      C. combined

2. Subtraction:

- A. product                              B. less than                              C. difference

3. Multiplication:

- A. twice                                  B. product                                  C. quotient

4. Division:

- A. separated into equal groups                      B. times                                  C. over

5. Subtraction:

- A. minus                                  B. take away                                  C. and

Part II. Write "T" on the line if the statement is **true**; "F" if it is **false**. If the statement is false, correct it and make the statement true.

- \_\_\_\_\_ 1. The word plus means you should subtract.
- \_\_\_\_\_ 2. A " $-$ " is the mathematical symbol used for the term less than.
- \_\_\_\_\_ 3. A variable is represented by a number.
- \_\_\_\_\_ 4. A constant is represented by a number.
- \_\_\_\_\_ 5. A " $\div$ " is the mathematical symbol used for the term times.

## Answer Key Obj.2

### Using Tiles to Model Expressions - Similar Tiles

Part 1

- a)  $3 + 6$
- b)  $1 + 5$
- c)  $2n + 3n$

Part 2 ①  $\square\square + \square\square\square\square$

③  $\square\square\square\square\square\square + \square\square\square$

②  $\text{shaded}\text{shaded}\text{shaded} + \text{shaded}\text{shaded}\text{shaded}$

④  $\text{shaded}\text{shaded}\text{shaded}\text{shaded}\text{shaded} + \text{shaded}\text{shaded}\text{shaded}$

Part 3 Answers will vary. For example a)  $2 + 6$ ;  $1 + 7$ ;  $4 + 4$ ;  $3 + 5$  .....  
 b)  $n + 4n$ ;  $2n + 3n$ ;  $3n + 2n$  .....

### Using Tiles to Model Expressions - Mixed Tiles

Part 1

- a)  $2n + 8$
- b)  $4n + 4$

Part 2 ①  $\text{shaded}\text{shaded}\text{shaded}\text{shaded}\text{shaded} + \square\square\square\square\square\square$

③  $\square\square\square\square\square + \text{shaded}\text{shaded}\text{shaded}\text{shaded}$

②  $\text{shaded}\text{shaded}\text{shaded} + \square\square\square\square\square\square\square\square$

④  $\text{shaded}\text{shaded} + \square$

Part 3 Answers will vary. For example a)  $2n + 5$  or  $5 + 2n$   
 b)  $5n + 9$  or  $9 + 5n$

### Changing Words to Expressions

- 1) e    6) d
- 2) g    7) h
- 3) a    8) c
- 4) b    9) j
- 5) i    10) f

### Matching Expressions and Phrases

- 1 - A
- 2 - K
- 3 - D or L
- 4 - B
- 5 - F or H
- 6 - F or H
- 7 - I
- 8 - J
- 9 - G
- 10 - C
- 11 - E

### Writing Expressions(Possible...)

- |                         |                           |
|-------------------------|---------------------------|
| 1. $9 + n$ or $n + 9$   | 8. $x \div 5$             |
| 2. $p + 61$             | 9. $b - 6$                |
| 3. $m - 270$            | 10. $m + 6$               |
| 4. $8 - q$              | 11. $12r$                 |
| 5. $4p$ or $p(4)$       | 12. $s \div 12$ or $s/12$ |
| 6. $y \div 75$ ; $y/75$ | 13-17. answers may vary   |
| 7. $14c$                |                           |

## Review of Expressions

### Name the variable

- 1) x
- 2) m
- 3) a
- 4) b
- 5) r

### Name the operation

- 1) multiplication
- 2) division
- 3) subtraction & multiplication
- 4) addition
- 5) multiplication
- 6) multiplication & division

### Write an algebraic expression

- 1)  $n + 3$
- 2)  $10n$
- 3)  $20 \div n$
- 4)  $n - 50$
- 5)  $2n + 8$
- 6)  $n - 38$
- 7)  $23n$
- 8)  $n \div 16$
- 9)  $n - 9$
- 10)  $4n$

### Write these expressions in words. (Answers will vary on some questions. Some suggested answers are given below.)

- 1) a number plus 10
- 2) 5 minus a number s
- 3) two times y and 3
- 4) six divided by a number p
- 5) the product of 9 and m
- 6) 4 less than y
- 7) the quotient of 8 and a

### Fill in the chart

- 2) addition,  $r + 20$
- 3) multiplication,  $6g$
- 4) division,  $k \div 19$
- 5) multiplication,  $2n$
- 6) ten times y, multiplication
- 7) 2 less than w, subtraction
- 8) 3 times d plus 4, multiplication & addition
- 9) z divided by 5, division
- 10) the sum of 12 and g, addition

### Vocabulary Practice

- 1) multiplication
- 2) addition
- 3) variable expression
- 4) variable
- 5) division
- 6) parentheses
- 7) fraction bar
- 8) factors
- 9) multiplying
- 10) subtracting

### Vocabulary Review

- 1) B
- 2) A
- 3) C
- 4) B
- 5) C

#### Part II

- 1) F, plus  $\rightarrow$  minus or subtract  $\rightarrow$  add
- 2) T
- 3) F, number  $\rightarrow$  letter or variable  $\rightarrow$  constant
- 4) T
- 5) F, times  $\rightarrow$  divided by  $\div \rightarrow$  X, ( )



### **Objective 3: Write expressions to represent and solve problems.**

#### **Vocabulary**

collection  
CDs  
classical  
jazz  
rap

#### **Language Foundation**

1. Ask students what kinds of things they collect. Explain that coins, stamps, beanie babies, or items which form a set are called a **collection**.
2. Tell students that today they will be working with a collection of **CDs** which represent different kinds of music: **classical, jazz, and rap**. If possible, give students a chance to listen to each kind. As you play each type, let students describe the music in their own words.

#### **Materials**

CDs representing classical, jazz, and rap music  
(optional)

#### Transparencies

Collections Packet (A-F)  
Solutions to Collections  
Collection Markers (for teacher use on  
overhead)

#### Student Copies

Collection Packet (A-F)  
Solutions to Collections answer sheets  
one per pair or small group  
Collection Markers  
cut apart and copied on 3 different colors of  
paper

## Mathematics Component

Note: The activities in this lesson give students a chance to solve problems by physically manipulating data. Students also gain additional practice working with constants, variables, and expressions. A quick review of these three terms is recommended before beginning the lesson. The activities may be done at one time or separated into several lessons.

**Before beginning the lesson**, teachers will need to cut the activity page Collection Cubes into three pieces along the dotted lines and run each piece on a different color paper. There are different markers to represent each of the 3 types of CDs in the activity: **j** = jazz, **c** = classical, and **r** = rap. A sturdy material such as colored tag board may make the markers easier for students to handle. Laminating the pages before cutting out the markers would allow them to be used again in the future. Each group of students will need approximately 20 of each type of colored marker. Make a transparency of the markers and cut out a few for use when modeling on the overhead.

1. Distribute materials for collections activity.

- Distribute a Collections Packet containing the activity sheets for Collections A - F to each pair or small group of students. Also give each group:
  - one Solutions to Collections sheet
  - a zip-lock plastic bag containing 3 kinds of colored paper markers as explained above
- Tell students that they will write only on the Solutions to Collections sheet not on the pages in the Collections Packet.

2. Represent the information in Mario's Collection with constants, variables, and expressions.

- Using a transparency copy of the first activity page, Collections A, read the introductory paragraph at the top of the page aloud.

**Mario's Collection:**

- Point to problem 1 at the bottom of the page and the 3 lines of information below it. Explain that the 3 lines give information about the CDs in the collection. Say, "We will use this information to find out how many of each kind of CD are in the collection."
- Have students name the three kinds of CDs (jazz, classical, and rap) and lead a discussion on different variables which could be used to represent each kind. Remind students that any variable could be used; however, tell them that for this activity they will all use the same variables to represent the CDs - **j** (jazz), **c** (classical), and **r** (rap). Ask students why **j**, **c**, and **r** might be good variables to use for the three types of CDs. (These are beginning letters for each of the three kinds of CDs.)
- Have students look at their Solutions to Collections sheet. Each of the numbered collections has six spaces for answers. Students will be filling in information for each of the three types of CDs - **j** (jazz), **c** (classical), and **r** (rap). Students will fill in the top 3 answers first, and then after working with the paper markers, they will fill in the bottom 3 answers.

with the paper markers, they will fill in the bottom 3 answers.

- Begin with Collection A. Point to and read the first line of Mario's collection. (2 jazz) Ask students what variable represents the jazz CDs. (j) Write  $j = \underline{\quad}$  on the board. Say, "What constant tells the number of jazz CDs in Mario's collection?" (2)
  - Use a transparency copy to model writing  $j = 2$  as the first answer on the solutions page. Have students do the same on their sheets.
  - Point to and read the second phrase "1 more classical than jazz" on the second line. Ask students what variable is being used to represent the classical CDs. (c) Write  $c = \underline{\quad}$  on the board. Ask students if there is a **constant** that tells the number of classical CDs in Mario's Collection. (No) Lead students to understand that they must write an **expression** to represent these CDs.
  - Remind students that an expression contains variables and/or constants along with an operation. Ask, "What expression describes the classical CDs?" Elicit an understanding that  $j + 1$  may be used to represent the classical CDs. Model filling in  $c = j + 1$  on the Solutions to Collections sheet and have students do the same on their sheets.
  - Point to and read the third phrase "9 CDs in all." Write  $j + c + r =$  on the board and ask students what this expression represents. (It represents the number of jazz CDs plus the number of classical CDs plus the number of rap CDs or the total number of CDs.) Ask, "What constant represents the total number of CDs in this collection." (9) Model recording  $j + c + r = 9$  on the solutions page and have students do the same on their sheets.
3. Identify the exact number of each type of CD in Mario's Collection.
- Tell students that now they will represent the 3 types of CDs using colored paper markers. Show students the three colors of paper markers that they will use. Explain that each type of CD will be represented by a different colored marker:  $j =$  jazz,  $c =$  classical, and  $r =$  rap.
  - Tell students that they will look at the information they have filled in so far for Mario's Collection and use the markers to help find the exact number of each kind of CD.
    - Read  $j = 2$  and ask how many colored markers they should put into the case to represent the jazz CDs. (2) Using a transparency copy of Collections A, place 2 of the appropriate colored markers into the case and have each group do the same on their sheets.
    - Read  $c = j + 1$  and ask students how many markers they should put in the case to represent the classical CDs. Elicit an understanding that since there are 2 jazz CDs and there are  $j + 1$  classical CDs, there are 3 classical CDs. Place 3 of the appropriate color markers into the case and have students do the same on their sheets.
    - Read  $j + c + r = 9$  and ask students what this expression means. (It means that there are 9 CDs in the total collection. Ask students to count the number of markers in the case representing jazz and classical CDs. (5) Ask, "What kind of CD is not represented in the case? (rap) How many rap CDs should be put in the case?" Allow students to discuss

their reasoning and then model the solution. (There should be 4 rap CDs because there are 5 in the case so far and there are 9 in the total collection.)

- Model recording the correct number for each type of CD on the Solutions to Collections sheet and have students do the same:

$$j = 2$$

$$c = 3$$

$$r = 4$$

- Complete the remaining problems in Collections A (Susan, Maria, and Ming's collections) as a class.
4. Work in pairs to complete Collections B - F.
- **Before students continue** on their own, remind them that for each collection they will:
    1. **Read** one line of information at a time.
    2. **Represent** each type of CD with variables and/or constants and record their answers on the **Solutions to Collections** paper.
    3. **Use markers** to show the number of each type of CD in the case.
    4. **Record** the exact number of each type of CD on their papers.
  - If students are not ready to work with their partner(s) on Collections B, continue working as a class.

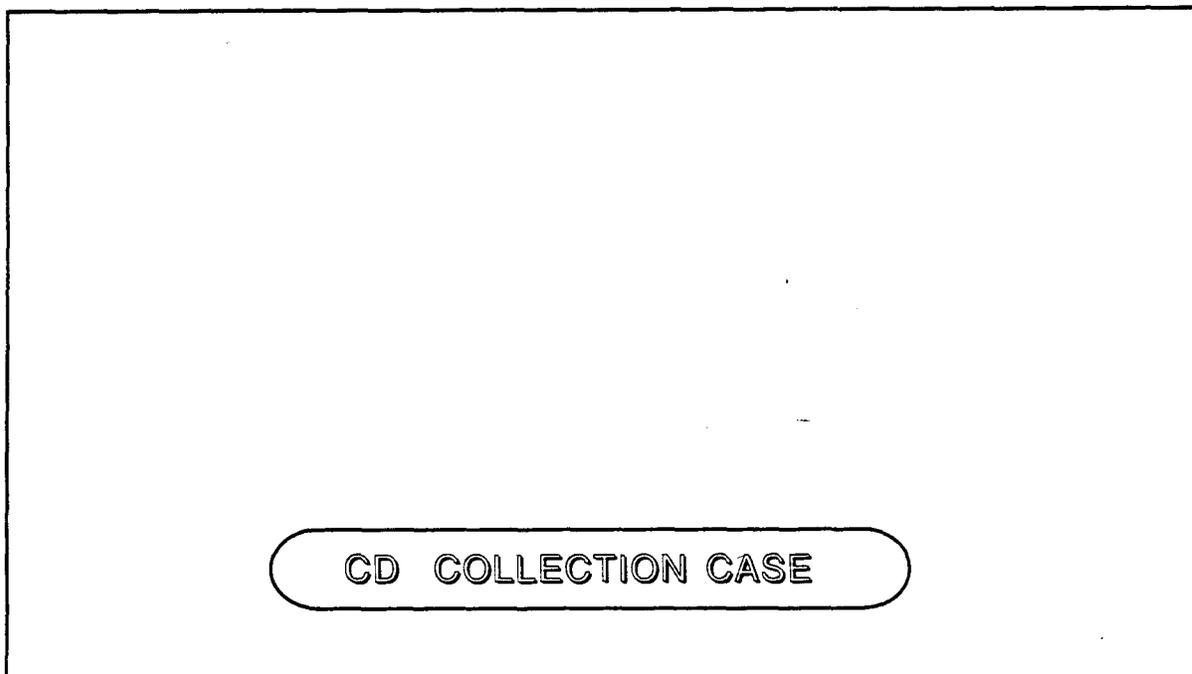
**Note:** Encourage all students to participate in the decisions made by their group. The job of recorder may be rotated for each page of Collections to give all students a chance to practice their writing skills.

### **Additional Resources**

The Algebra Lab, Middle School Lesson 1, activities 4-5

# Collections A

The students in music class are putting together a collection of CDs. They are trying to learn about different kinds of music. All the collections have **jazz**, **classical**, and **rap**. Use markers to represent the different kinds of music and solve the problems.



- 1) Mario's collection:  
2 jazz  
1 more classical than jazz  
9 CDs in all

- 3) Susan's collection:  
4 classical  
1 more rap than classical  
11 CDs in all

- 2) Maria's collection:  
3 rap  
1 fewer jazz than rap  
6 CDs in all

- 4) Ming's collection:  
6 rap  
1 fewer classical than rap  
14 CDs in all