

## **Prealgebra Curriculum Overview**

### **The number system**

- Perform operations of multiplication and division using fractions
- Find common factors and multiples
- Evaluate absolute values
- Graph equations on the coordinate system
- Write numbers in scientific notation
- Write numbers in decimal notation
- Change a rational number to a decimal or percent
- Graph a number sentence on a number line
- Find the prime factorization of a number
- Recognize that the irrational number  $\pi$  can be approximated using a rational number
- Understand metric measure and choose the appropriate unit
- Understand standard measure and choose the appropriate unit
- Perform multiplication and division on variables to powers
- Evaluate a square root

### **Expressions and equations**

- Solve equations in one variable
- Create and solve proportions
- Use the commutative, associative, and distributive properties to simplify expressions and/or solve equations
- Simplify polynomial expressions
- Compare numbers using  $<$ ,  $>$ , and  $=$
- Find the slope of a line.
- Recognize slope as a constant rate of change and apply it to a real world setting
- Graph equations in the form  $y = mx + b$  and understand that  $m$  is the slope and  $b$  is the  $y$ -intercept
- Extend a pattern of discrete numbers and find a rule for the “next” term
- Order numbers from smallest to largest or vice versa
- Write a sentence or expression using algebraic notation
- Substitute a number into a variable expression and evaluate it
- Recognize that the solution to a system of two equations is the point where they intersect

### **Functions**

- Model a relationship using a function
- Graph a point or a geometric figure and perform a transformation
- Evaluate an expression written in function notation

**Geometry**

- Solve problems using the formulas for triangles, circles, and regular quadrilaterals
- Decompose a geometric figure to find its area
- Find the surface area and the volume of three-dimensional figures
- Create a net as a means to represent the surface area of a regular three-dimensional figure
- Solve problems using parallel and perpendicular lines
- Solve problems using angle measures
- Understand and apply the Pythagorean Theorem
- Understand congruence by creating congruence statements
- Understand congruence by accurately drawing congruent figures
- Analyze size changes on similar figures

**Statistics and probability**

- Construct and interpret a scatterplot, including finding the line of best fit
- Answer questions using a stem-and-leaf plot
- Answer questions using a box-and-whisker plot
- Create a box-and-whisker plot
- Find the mean and median of a data set
- Find theoretical probabilities

**Graphing calculator (optional exercises)**

- Understand the basic operations
- Use the function keys
- Use the edit keys
- Create graphs

## **Prealgebra**

### **Instructions for the Student/Parent**

- To use Summer Math Skills Sharpener, simply tear off a page and complete it. The program is designed to be used 3-4 days per week for 10 weeks.
- Detailed solutions to all the problems are included at the back of the book. Please complete an entire sheet prior to checking your answers. You may want to remove the solutions and store them in a place apart from the book.
- All concepts are part of a standard prealgebra curriculum. Please attempt all problems. In addition to the solutions, pink “Help Pages” have been included to assist you in completing the problems.
- A Table of Measurements is located in white at the back of the book.
- A yellow “Glossary of Terms” is located at the back of the book.
- Pages should be worked in order. While each page contains mixed concepts, individual concepts have been ordered from easier to more difficult.
- If you experience difficulty with certain concepts, address the problem with your teacher. He or she may recommend additional help in these areas.
- It is important to give every problem your best effort. Problems may seem challenging, but use a combination of the “Help Pages” and the “Solutions” to assist you for maximum success.
- The final page is a “Lesson Tracker.” It is for your own personal use or to hand in should your school require the completion of this book.

For problems 1 – 4, simplify.

1.  $\sqrt{49}$

2.  $\sqrt{81}$

3.  $-5^2$

4.  $(-5)^2$

5. Convert each of the following:

a. 32 in. = \_\_\_\_\_ ft.

b. 48 oz. = \_\_\_\_\_ lb.

c. 10 ft. = \_\_\_\_\_ yd.

d. 6 qt. = \_\_\_\_\_ gal.

6. The wavelength of x-rays, in centimeters, is  $3.048 \times 10^{-9}$ . Rename this number in decimal notation. \_\_\_\_\_

7. 28 is what percent of 50?

a. Write the number sentence (equation) to represent this situation.

b. Solve this equation.

8. Everything in a store is discounted 10%. The original price of an iPad is \$529.99.

a. Find the new price. \_\_\_\_\_

b. If sales tax is 6%, then what will be the final cost? \_\_\_\_\_

9. Calculate each quotient. Use a bar to show repeating decimals.

a.  $\frac{2}{3}$  \_\_\_\_\_

b.  $\frac{1}{6}$  \_\_\_\_\_

c.  $\frac{5}{6}$  \_\_\_\_\_

d.  $\frac{1}{9}$  \_\_\_\_\_

e.  $\frac{1}{7}$  \_\_\_\_\_

f.  $\frac{1}{11}$  \_\_\_\_\_

10. What number am I?

- a. The sum of my digits is 9.
- b. I am odd.
- c. I am more than 100.
- d. I am a power of 3.

11. Write in exponential form.

- a.  $4 \times 4 \times 4 \times 4 \times 4$     b.  $2.1 \times 2.1 \times 2.1$     c.  $y \times y \times y \times y \times y \times y \times y$

\_\_\_\_\_

12. Below is a graph that shows the ages of the American Presidents at the time of their inauguration.



- a. What is the range of the ages? \_\_\_\_\_
- b. What is the median age? \_\_\_\_\_
- c. Theodore Roosevelt was the youngest President ever elected. How old was he at the time of his inauguration? \_\_\_\_\_
- d. How many Presidents were 50 or younger at the time of their inaugurations? \_\_\_\_\_

For problems 1 – 4, solve for  $x$ .

1.  $2x - 1 = 5$       2.  $\frac{2}{3}x + 1 = 7$       3.  $-x + 5 = 2$       4.  $\frac{3}{5}x = \frac{9}{10}$

5. Write the following sentence in algebraic notation: *The output is the product of six and the sum of five and a number.* \_\_\_\_\_

6. Simplify each of the following expressions:

a.  $7a + 9a$

b.  $8x - 10x$

c.  $6ab + 3ba$

7.      \*\*                  \*\*                  \*\*                  \*\*  
                                  \*\*                  \*\*                  \*\*  
    \*\*                  \*\*  
    \*\*

a. Draw the 5<sup>th</sup> figure above.

b. Each consecutive (next) figure has \_\_\_\_\_ more asterisks than the previous figure.

c. Predict the number of asterisks in figure 10. \_\_\_\_\_

8. a. Complete the table below.

$x$	0	1	___	___	4	5
$y$	10	7	4	1	___	___

b. Find the slope between any two points.

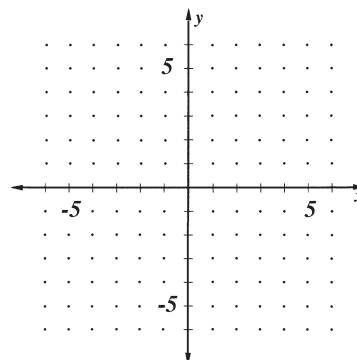
c. Create a rule to find any  $y$  value in terms of  $x$ . \_\_\_\_\_

d. Find  $y$  when  $x = 10$ . \_\_\_\_\_

9. If  $x = -4$ , find  $-2x^2 - x - 4$ .

10. a. Find three pairs of numbers that satisfy the equation:  $2x + y = 5$ .

b. Plot the points on the graph at the right and draw a line through them.



c. For every  $x$  change of one,  $y$  changes by \_\_\_\_\_. This is another description of slope.

11. **FOUR 4's.** Using only four 4's, the operations  $(+, -, \times, \div)$ , and parentheses, write the expressions to equal the values of the digits. (The digits are the numbers 0-9.) For example  $4 \div 4 + 4 \div 4 = 2$

12. (Optional calculator) Evaluate:

$$\frac{-5 + \sqrt{5^2 - 4(1)(4)}}{(2)(1)}$$

1. The commutative and associative properties for real numbers can be used to simplify problems. Solve the following problems mentally by rearranging (commutative property) and regrouping (associative property) the numbers.
  - a.  $\$2.25 + \$2.98 + \$4.75 =$
  - b.  $-2 + 6 + 2 + 9 =$
  - c.  $-4.5 + 2.9 + -5.5 + 3.1 =$
  - d.  $\frac{1}{2} + \frac{3}{4} + \frac{1}{2} + \frac{1}{4} =$
2.
  - a.  $b^3$  means \_\_\_\_\_ is a factor \_\_\_\_\_ times.
  - b.  $b^5$  means \_\_\_\_\_ is a factor \_\_\_\_\_ times.
  - c.  $b^3 \cdot b^5$  means \_\_\_\_\_ is a factor \_\_\_\_\_ times. Therefore,  $b^3 \cdot b^5 = b \square$ .
  - d. Generalize:  $b^m \cdot b^n = b \square$ .
3. Dwayne drove from Chicago to St. Louis, a distance of 300 miles. The trip took 6 hours to complete.
  - a. Find his average rate of speed in miles per hour.
  - b. Convert his rate to feet per second.
4. A middle school intramural bowling team had the following scores for its first outing:  
25    55    70    88    95    101    115    130    150    168    172
  - a. What are the upper and lower extremes? \_\_\_\_\_
  - b. What is the range of scores? \_\_\_\_\_
  - c. What is the median score? \_\_\_\_\_
  - d. What is the lower quartile? \_\_\_\_\_
  - e. What is the upper quartile? \_\_\_\_\_
  - f. Represent this data using a box-and-whisker plot.

20   30   40   50   60   70   80   90   100   110   120   130   140   150   160   170   180



5. a. Accurately draw  $\triangle XYZ$  where  $XY = 2\text{in}$ ,  $YZ = 1\text{in}$ ,  $m\angle Y = 55^\circ$ .

b. Explain why all triangles drawn with these dimensions will be congruent.

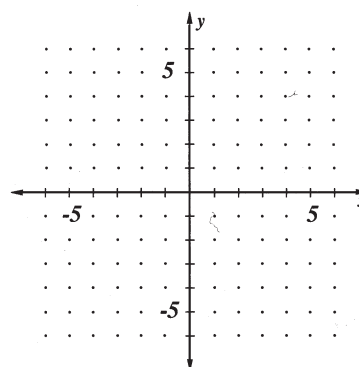
6. Given:  $\triangle ABC$ ,  $A = (-3, 3)$ ,  $B = (-5, 1)$ ,  $C = (-3, 1)$

a.  $T_{3-2}(\triangle ABC) =$

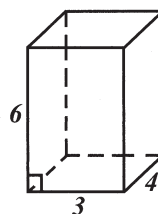
b.  $r_{x\text{-axis}}(\triangle ABC) =$

c.  $r_{y\text{-axis}}(\triangle ABC) =$

d. Draw the image of each on the coordinates at the right.



7. a. Draw a net for the figure pictured at the right.



b. Find the surface area.

8. a. In a plane, the intersection of two nonparallel lines is a \_\_\_\_\_.

b. In space, the intersection of two nonparallel planes is a \_\_\_\_\_.

c. In space, the intersection of three nonparallel planes is a \_\_\_\_\_.

d. Give a real world example of intersecting lines.

e. Give a real world example of intersecting planes.

**absolute value :** The distance a number is from zero on a number line. Distance is always positive.

ex.  $|2| = 2$ ,  $|-2| = 2$

**acute angle :** an angle measuring greater than 0 degrees and less than 90 degrees.

**algebraic equation :** a math sentence relating two expressions as equal.

**algebraic expression :** a combination of numbers and variables joined by the operations of arithmetic.

**altitude :** the perpendicular distance from the vertex of a triangle to the side opposite. Also, the perpendicular distance between parallel lines.

**angle :** the union of two rays (the sides) at a point (the vertex).

**area :** the number of unit squares or parts of unit squares required to tile a two dimensional figure.

ex. parallelogram :  $A = hb$       trapezoid :  $A = \frac{1}{2}h(b_1 + b_2)$       triangle :  $A = \frac{1}{2}hb$

rectangle :  $A = hb$       circle :  $A = \pi r^2$       square :  $A = s^2$

**arithmetic sequence :** sequence with a constant difference.

**base :** in the expression  $b^n$  the variable  $b$  is the base.

**binomial :** a polynomial containing two terms.

**circle :** the set of all points (the radius), equidistant from a certain point (the center).

**circumference :** the perimeter of a circle. The ratio of the circumference to the diameter is  $\pi$ .

$c = \pi d$  gives the circumference for a circle with diameter  $d$ .

**coefficient :** the number in a term.

ex.  $-2x$ , the  $-2$  is the coefficient.

**complementary angles :** two angles that have a sum of  $90^\circ$ .

**composite :** a number that has more than two factors.

**ORDER OF OPERATIONS :** Parentheses, powers, multiplication, division, addition, subtraction.

(use "Pretty Please, My Dear, Aunt Sally" to help remember)

ex.  $(2 - 3) \times 4 - 8 \div 2^2$

1. Parentheses first :  $-1 \times 4 - 8 \div 2^2$
2. Powers second :  $-1 \times 4 - 8 \div 4$
3. Multiplication and/or Division third :  $-4 - 2$
4. Addition and/or Subtraction of LIKE terms last :  $-6$

**ALGEBRA LANGUAGE :**

**VARIABLE :** A variable is a symbol that can be replaced by a number.

ex.  $x + 8 = 13$ . The  $x$  is a variable. In this case,  $x = 5$  ( $x$  is replaced by 5) makes this a true sentence.

A variable also can be a part of an expression.

ex.  $4m$ . The  $m$  is the variable. The 4 is the coefficient of  $m$ .

**ALGEBRAIC EXPRESSION :** When numbers and variables are joined by the operations of arithmetic an algebraic expression is formed.

ex. Two less than  $x$  is written as  $x - 2$ .

Three times  $a$  is written as  $3a$ .

Notice that any substitution of a number for the variable in an expression is true.

**ALGEBRAIC SENTENCE :** An algebraic sentence occurs when algebraic expressions are joined by a math verb.

Math verbs are  $<$ ,  $>$ ,  $\leq$ ,  $\geq$ ,  $=$ ,  $\neq$ , and  $\approx$ . Think of writing a math sentence as translating from English language to math language.

ex. Twice a number is 8.  $2x = 8$

Four more than a number is three times its opposite.  $4 + n = 3(-n)$  or  $4 + n = -3n$

Three times a number is greater than 20.  $3n > 20$

**EQUATION :** When two expressions are equal, the math sentence is an equation.

ex.  $3x - 2 = 10$

**FORMULA :** A formula is an equation that states that a single variable equals an expression.

ex.  $A = bh$

## Lesson 12 pg. 25

- ①  $\frac{3}{5} = \frac{x}{24}$       ②  $\frac{4}{5} = \frac{x}{85}$       ③  $\frac{2}{3}x = \frac{2}{11}$   
 $3 \cdot x = 2 \cdot 24$        $5 \cdot x = 4 \cdot 85$        $\frac{3}{2} \cdot \frac{2}{3}x = \frac{2}{11} \cdot \frac{3}{2}$   
 $3x = 48$        $5x = 340$        $x = \frac{3}{11}$   
 $x = 16$        $x = 68$        $x = \frac{3}{11}$
- ④  $\frac{1}{4}x = -8$   
 $4 \cdot \frac{1}{4}x = -8 \cdot 4$   
 $x = -32$
- ⑤ a.  $2(a+b) = 2a + 2b$       b.  $7(2+x) = 14 + 7x$
- ⑥ a.  $(2+2) \times 3 = 12$       b.  $(12-6) \div 2 = 3$   
 c.  $(3 \times 3 + 3) \times 3 = 36$
- ⑦  $0.000000914 = 9.14 \times 10^{-7}$
- ⑧ a.  $x = 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5$   
 $y = -3 \quad -1 \quad 1 \quad 3 \quad 5 \quad 7$   
 b. Use  $(2, 1)$  and  $(3, 3)$        $m = \frac{3-1}{3-2} = 2$   
 c. The y-intercept is  $-3$ , so  $y = 2x - 3$   
 d.  $y = 2(10) - 3$   
 $y = 20 - 3 = 17$
- ⑨  $x = -2$        $(-2)^2 - (-2)$   
 $4 + 2 = 6$

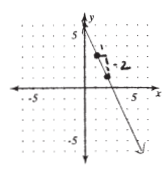
## Lesson 12 continued pg. 26

- ⑩ 2-liter = \$1.29      6-pack = \$1.45  
 (67.2 ounces)      (6 x 12 = 72 ounces)
- a. 2-liter =  $\frac{1.29}{67.2} \approx \$0.019$  per ounce  
 6-pack =  $\frac{1.45}{72} \approx \$0.020$  per ounce
- b. The 2-liter is a better buy, but not by much.
- ⑪ Start with the clue in letter d. Since the number must be greater than 200 and its digits are consecutive even numbers, try 246.  
 $2+4+6 = 12$       246 must be the number.
- $$\begin{array}{r} 246 \\ 2 \overline{) 123} \\ \underline{4} \phantom{6} \\ 3 \phantom{6} \\ \underline{6} \phantom{6} \\ 0 \phantom{6} \end{array}$$
- e. The missing factor is 41.
- ⑫ a.  $A = 5^2$        $A = 3^2 = 9$  units<sup>2</sup>  
 b.  $U = 5^3$        $U = 4^3 = 64$  units<sup>3</sup>  
 c.  $U = 125$  units<sup>3</sup>      What is  $S$ ?       $5^3 = 125$ , so  $S = 5$
- ⑬ 6

## Lesson 13 pg. 27

- ①  $2x - 1 = 5$       ②  $\frac{2}{3}x + 1 = 7$       ③  $-x + 5 = 2$   
 $\begin{array}{r} 2x - 1 = 5 \\ +1 \quad +1 \\ \hline 2x = 6 \\ \div 2 \quad \div 2 \\ \hline x = 3 \end{array}$        $\begin{array}{r} \frac{2}{3}x + 1 = 7 \\ -1 \quad -1 \\ \hline \frac{2}{3}x = 6 \\ \div \frac{2}{3} \quad \div \frac{2}{3} \\ \hline x = 9 \end{array}$        $\begin{array}{r} -x + 5 = 2 \\ -5 \quad -5 \\ \hline -x = -3 \\ \times -1 \quad \times -1 \\ \hline x = 3 \end{array}$
- ④  $\frac{3}{5}x = \frac{9}{10}$       ⑤  $y = 6(5+x)$   
 $\frac{5}{3} \cdot \frac{3}{5}x = \frac{9}{10} \cdot \frac{5}{3}$   
 $x = \frac{3}{2}$
- ⑥ a.  $7a + 9a = 16a$       b.  $8x - 10x = -2x$   
 c.  $6ab + 3ba = 6ab + 3ab = 9ab$
- ⑦ a.  $\begin{array}{c} ** \\ ** \\ ** \\ ** \\ ** \end{array}$       b. 2      c.  $t = 2n$ , if  $n = 10$  then  
 $t = 20$  dots
- ⑧ a.  $x = 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5$   
 $y = 10 \quad 7 \quad 4 \quad 1 \quad -2 \quad -5$   
 b.  $(0, 10)$  &  $(2, 4)$        $m = \frac{4-10}{2-0} = \frac{-6}{2} = -3$   
 c.  $y = -3x + 10$   
 d.  $x = 10$        $y = -3(10) + 10$ ,  $y = -30 + 10$   
 $y = -20$

## Lesson 13 continued pg. 28

- ⑨  $x = -4$ ,  $-2(-4)^4 - (-4) - 4$   
 $-2(16) - (-4) - 4$   
 $-32 - (-4) - 4$   
 $-32 + 4 - 4$   
 $-28 - 4 = -32$
- ⑩ a.  $2x + y = 5$       b.   
 $2(1) + y = 5, y = 3$  (1, 3)  
 $2(2) + y = 5, y = 1$  (2, 1)  
 $2(0) + y = 5, y = 5$  (0, 5)
- c. -2
- ⑪ Examples:  
 $(4-4) + (4-4) = 0$        $(4 \times 4 + 4) \div 4 = 5$   
 $(4 \times 4) \div (4 \times 4) = 1$        $(4 + 4) \div 4 + 4 = 6$   
 $(4 \times 4) \div (4 + 4) = 2$        $4 + (4 - 4 \div 4) = 7$   
 $(4 + 4 + 4) \div 4 = 3$        $4 \times 4 \div 4 + 4 = 8$   
 $(4 - 4) \div 4 + 4 = 4$        $4 + 4 \div 4 + 4 = 9$
- ⑫ -1