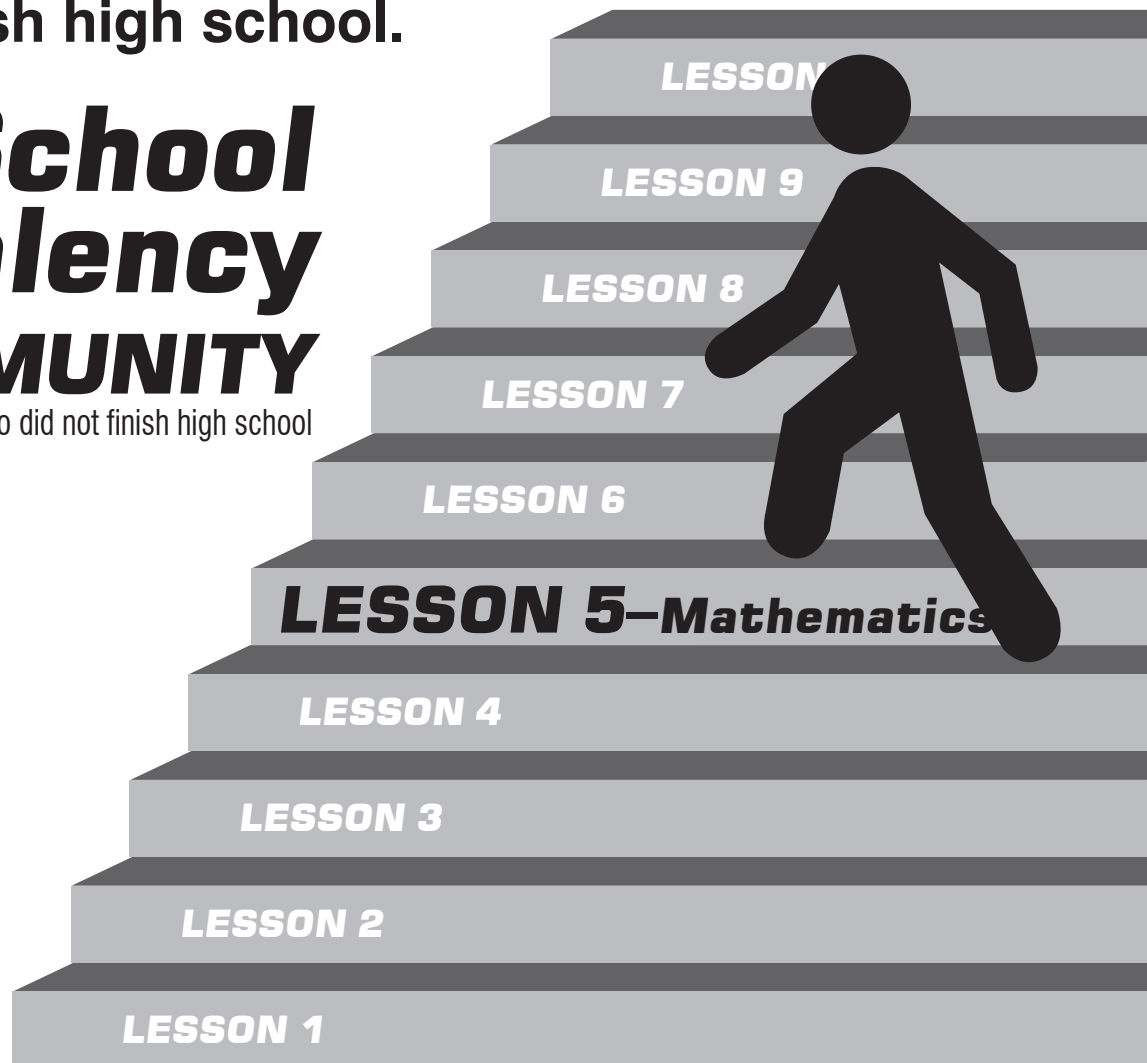


# ***Steps to Success***

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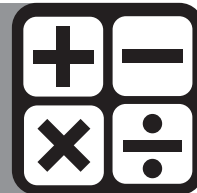


***Fifth Step—  
YOU'RE  
HALFWAY  
THERE!***



# LESSON 5

## Mathematical Reasoning



### Vocabulary to Know

If you don't use these terms in this lesson, you will use them later.

**Term**—A single number or a variable, or numbers and variables multiplied together.

**EXAMPLE:** In the equation  $4x - 7 = 5$ ,  $4x$ ,  $7$ , and  $5$  are terms

**Like Terms**—Terms in which the variable and exponents are the same.

**EXAMPLE:**  $2x^2$  and  $3x^2$  are “like terms”. They have the same variable ( $x$ ) and the same exponent.

**Algebraic Expression**—A group of terms where terms are separated by  $+$  or  $-$  signs.

Algebraic Expression	Substitute	Number	Value
$x + 7$	$x = 9$	$9 + 7$	16
$12z$	$z = 4$	$12 \cdot 4$	48
$t + 7x$	$t = 21,$ $x = 2$	$21 + 7 \cdot 2$	35

An expression does not have an  $=$  sign

**EXAMPLE:**  $2x + 3$

**Formula**—Numbers and symbols that show how to work something out; A special type of equation that shows the relationship between different variables.

**EXAMPLE:** The formula for the Volume of a box is: Volume = length  $\times$  width  $\times$  height or  $V = lwh$

**Square Root**—A value that can be multiplied by itself to give the original number.

**EXAMPLE:** The square root of 9 is 3 because  $3 \times 3 = 9$

The Square Root Symbol looks like this:  $\sqrt{\quad}$   
It is also called a radical. If you see  $\sqrt{9}$ —you would read it: The square root of 9 is 3

### Evaluating an expression

If you are asked to **evaluate an expression** using the given values for a variable, simply replace the variable—the letter—with the number that is given.

When a number and a letter are together with no arithmetic sign, it indicates multiplication. For example,  $2y$  means  $2 \times y$

The exponent tells how many times the number (called the base) is multiplies by itself. For example,  $2^3 = 2 \times 2 \times 2 = 8$

**EXAMPLE:** Evaluate the expression for the given values of the variables.

Now you try!

### ASSIGNMENT 1

#### DIRECTIONS

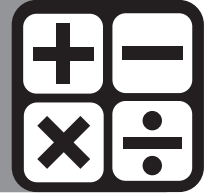
Find the value of each expression.  
Write your answers on a separate sheet of paper.

- $x^2$  when  $x = 7$
- $3y^2 + 3$  when  $y = 4$
- $-3(z + 5)$  when  $z = 4$
- $2a + 6$  when  $a = 4$
- $b - 5$  when  $b = 10$

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# LESSON 5

## Mathematical Reasoning



### DIRECTIONS

Find the value of each expression when  $a = 3$ ,  $b = 9$ , and  $c = 1$

6.  $a + b + c$  \_\_\_\_\_
7.  $abc$  \_\_\_\_\_
8.  $2a^3 + b$  \_\_\_\_\_
9.  $5c - 2a^2$  \_\_\_\_\_

**Evaluate the expression:**

10.  $P = 4s$ ;  $s = 5$

\_\_\_\_\_

11.  $A = \frac{1}{2}bh$ ;  $b = 4$ ,  $h = 5$

\_\_\_\_\_

### DIRECTIONS

Solve the following word problems. Show your work on a separate sheet of paper.

12. Bart drove 60mph for 2 hours.

*Using the formula: Distance = Rate • Time or  $d = r \cdot t$ , find the distance Bart drove.*

\_\_\_\_\_

\_\_\_\_\_

13. Lisa's bowling score for her first game (f) was 110. Her second game (s) was 130, and her third game (t) was 135.

*Using the formula:  $(f + s + t) \div 3 = A$ , what is her average (A) for the three games?*

\_\_\_\_\_

\_\_\_\_\_

14. The cost per disk (r) to ABC Computer Company is \$3. The total cost (c) for the number of disks bought was \$1,500. The number of disks bought (n) was 500. Create the expression and solve. (Remember the word "is" translates to an = sign.)
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

### Vocabulary to Know

*Refer to formula sheet on the last page in the lesson booklet.*

**Formulas** are used for solving many math problems. Use formulas to evaluate and solve math problems just like an expression. Substitute the given numbers for the variables. Then solve like an equation. The formulas we commonly think about are used to find **area**, **perimeter**, **circumference**, and **volume**. Enclosed is a sheet with formulas that you will need to memorize as well as formulas made available to you at the time of the GED test.

**Area**—The size of a flat surface: how much is inside the boundary of a flat (2-dimensional) object such as a square or circle.

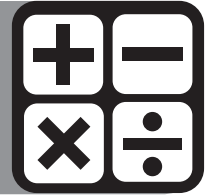
**Perimeter**—the distance around the outside of a 2-dimensional object

**Volume**—The measure of the amount of space inside of a solid figure, like a cube, or cylinder. Its units are always "cubic".

**Circumference**—The distance around the outside of a circle.

# LESSON 5

## Mathematical Reasoning

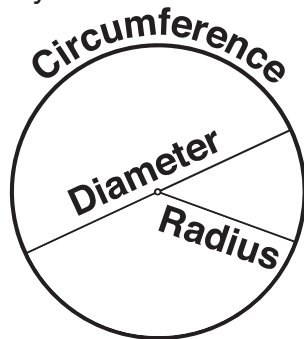


### Steps for using a formula:

- Choose the formula according to the situation in the problem.
- Copy the formula exactly onto your paper.
- Directly under the formula, replace the formula's letters or words with the measurements or values given in the problem. Keep everything else from the formula the same.
- Using arithmetic and the order of operations (see Lesson 2), solve for the measurement that is known.
- Always include the units (miles, pounds, square feet, liters, etc.) in your answer. Is your answer reasonable?

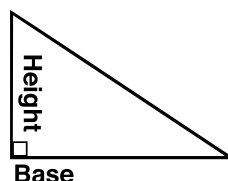
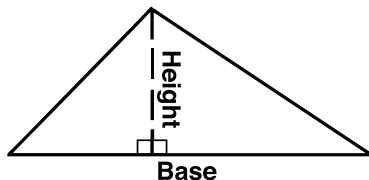
### Tips for working with circles:

Be careful of which measurement is called for when working with circles. The **diameter** is the measurement all the way across the center of a circle. It is twice the length of the **radius** (the distance from the center to the edge). Sometimes you are given one when the other is required, so you must first find the correct measurement.



### Tips for working with triangles:

The **height** of a triangle intersects its **base** at a right angle.



### Tips for working with simple interest formulas:

When using the formula for simple interest, **Interest = Principle x Rate x Time** or  $I = P \cdot R \cdot T$ , you must change the rate, expressed as a percent, to a decimal number by moving the decimal point two places to the left. If the interest rate is given for a year, time is also measured in years. If the problem involves part of a year, divide the number of months by 12. For example, 6 months is  $6/12$ , or  $1/2$ , or 0.5 years.

## ASSIGNMENT 2

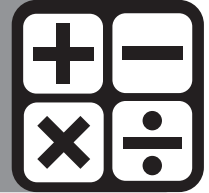
### DIRECTIONS

Using the steps above and the formula page, find the following. Write your answers on a separate sheet of paper. Show your work.

1. The area of a rectangular garden, 100 yards long and 40 yards wide
2. The volume of a cardboard box that is 12 inches long, 4 inches high, and 10 inches wide.
3. The length of edging required to go around a circular fountain that is 6 feet in diameter
4. The amount of lace trim for a circular tablecloth with a radius of 1 meter
5. The length of crown molding needed for a square room, where each wall is 12 feet long
6. The length of fence required to enclose a triangular back yard with sides that are 150 feet, 75 feet, and 95 feet long
7. The area of a triangle with a base of 10 centimeters and a height of 6 centimeters
8. The area of a square that is 1.5 miles on each side

# LESSON 5

## Mathematical Reasoning



9. The value of  $x^2 + 4y$  when  $x = 4$  and  $y = 5$
10. The area of a circle with a radius of 6 inches
11. The area of a circular patio that is 10 feet across
12. The volume of a cube that is 1 centimeter on a side
13. The interest paid by a Treasury Bond of \$2500 at 4% interest for 10 years
14. The total value of the bond and its interest in problem 13 at maturation (after 10 years)

### ASSIGNMENT 3

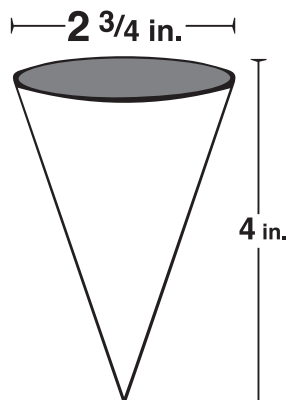
#### DIRECTIONS

Using what you have learned about formulas and the formula sheet that you have been provided, solve the following. You may use a calculator if you have one available. An online TI XS30 calculator will be provided on the High School Equivalency test.

1. An office uses paper drinking cups in the shape of a cone, with dimensions as shown.

To the nearest tenth of a cubic inch, what is the volume of each drinking cup?

- A. 2.5
- B. 7.9
- C. 23.7
- D. 31.7



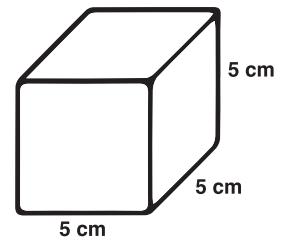
### Surface Area

The **surface area** is the total area of the outside **faces** of three-dimensional figures. This is different from the **volume**, which is the capacity of what a figure can hold. Surface area is expressed in square units.

### Surface Area of a Square Prism

The **surface area of a square prism** (cube) is the sum of the areas of the six squares that form the prism. The area of one square is  $s^2$ . Since these sides are the same, find the area of one side and multiply by 6.

**Example 1:** Find the surface area of a cube with sides of 5 centimeters (cm) each.



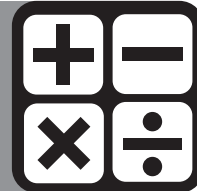
$$SA = 6s^2$$

$$SA = 6(5 \text{ cm})^2 = 6(25 \text{ cm}^2) = 150 \text{ cm}^2$$

Memorize the process for finding the surface area of a cube. The formulas for surface areas of prisms, pyramids, cylinders, cones and spheres are listed on the online Formula Sheet.

# LESSON 5

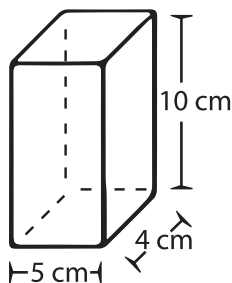
## Mathematical Reasoning



### Surface Area of a Rectangular Prism

A rectangular prism has six sides. The **surface area** of a rectangular prism is the sum of the areas of the six rectangles that form the prism. You simply find the area for each of the three sides, multiply by two, and add them together. If you look closely at the formula listed below, you will see that is what the formula does. Replace the 'l' with the given length, the 'w' with the given width, and the 'h' with the given height. Multiply as indicated, then add the products. This will give you the surface area for a rectangular prism.

**Example 2:** Find the surface area of this box.



$$SA = 2lw + 2lh + 2wh$$

$$SA = (2 \times 5\text{cm} \times 4\text{cm}) + (2 \times 5\text{cm} \times 10\text{cm}) + (2 \times 4\text{cm} \times 10\text{cm})$$

$$SA = 40\text{cm}^2 + 100\text{cm}^2 + 80\text{cm}^2$$

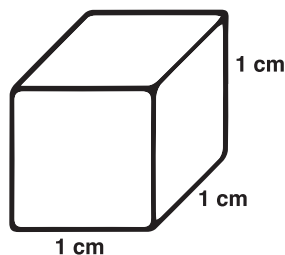
$$SA = 220\text{cm}^2$$

### ASSIGNMENT 4

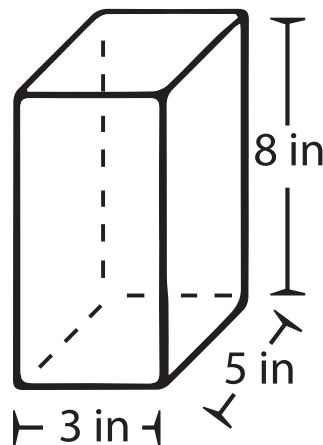
#### DIRECTIONS

Find the surface area of each object in square units. Use the formula sheet. Show your work on a separate sheet of paper.

1.

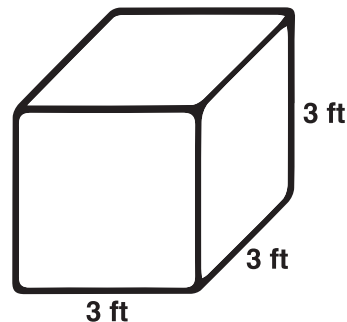


2.



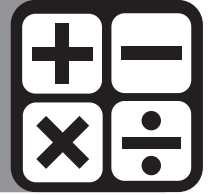
3. If the dimensions of the box below are doubled, by how many square centimeters does the surface area increase?

- A. 8
- B. 54
- C. 162
- D. 216



# LESSON 5

## Mathematical Reasoning



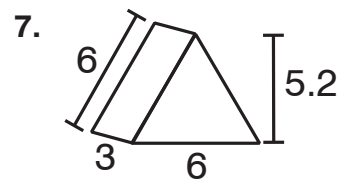
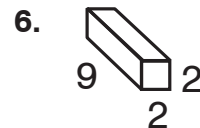
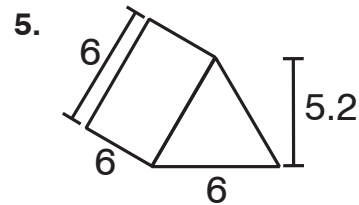
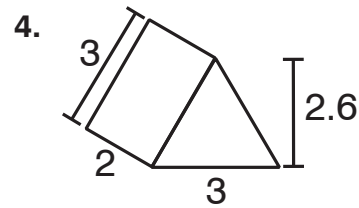
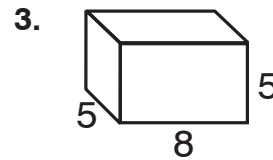
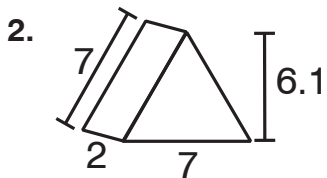
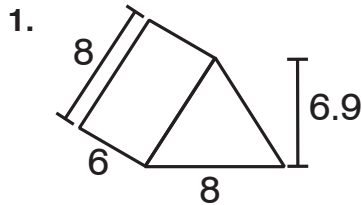
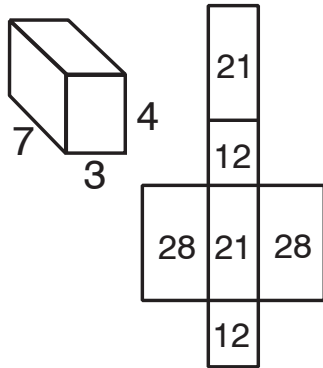
### ASSIGNMENT 5

#### DIRECTIONS

Find the surface area of each figure by drawing the net. Refer to Example.

**Net**—a pattern of shapes that you can fold to make a solid shape.

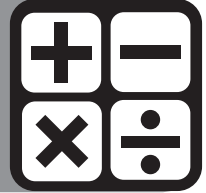
**EXAMPLE:**





# LESSON 5

## Mathematical Reasoning



9. Mrs. Amrhein made a cylindrical pencil holder. It has a height of 5 in. and a diameter of 3 in. How much material does she need to make her pencil holder?
- 

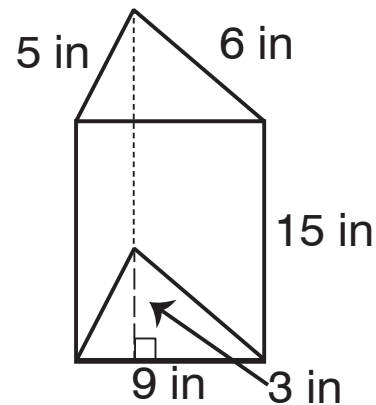
10. Grete opens and lays a shoe box out flat. She sees that the top and the bottom of the box both measure 10 inches by 6 inches; the sides of the box both measure 10 inches by 2 inches; and the front and back of the box both measure 6 inches by 2 inches. What is the surface area of the shoe box?
- 

11. You are painting a room that is 18 ft. long, 14 ft. wide and 8 ft. high. Find the area of the four walls that you are going to paint.
- 

12. If the paint costs \$6.50 a gallon and each gallon covers 128 ft<sup>2</sup> of wall, how much will it cost to paint the room?
- 

13. Kaitlyn bakes two rectangular cakes to put on top of each other. Each cake is 6 inches wide, 12 inches long and 3 inches high. She removes the cake from the pan to frost it. How many square inches of frosting does she need for both cakes?
- 

14. Solve:



### References

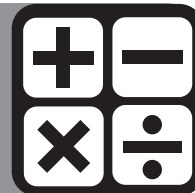
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# LESSON 5

## Mathematical Reasoning



### Æ Symbol Tool Explanation

The 2014 GED® test on computer contains a tool known as the “Æ Symbol Tool.” Use this guide to learn about entering special mathematical symbols into fill-in-the-blank item types.

SYMBOL	EXPLANATION	SYMBOL	EXPLANATION
$\pi$	Pi	$\pm$	positive or negative
$f$	function	$\infty$	infinity
$\geq$	greater than or equal to	$\sqrt{\phantom{x}}$	square root
$\leq$	less than or equal to	$+$	plus or positive
$\neq$	not equal to	$-$	minus or negative
$^2$	2 exponent (“squared”)	$($	open or left parenthesis
$^3$	3 exponent (“cubed”)	$)$	close or right parenthesis
$ $	absolute value	$>$	greater than
$\times$	multiplication	$<$	less than
$\div$	division	$=$	equals

## Mathematics Formula Sheet & Explanation

The 2014 GED® Mathematical Reasoning test contains a formula sheet, which displays formulas relating to geometric measurement and certain algebra concepts. Formulas are provided to test-takers so that they may focus on *application*, rather than the *memorization*, of formulas.

### Area of a:

square	$A = s^2$
rectangle	$A = lw$
parallelogram	$A = bh$
triangle	$A = \frac{1}{2}bh$
trapezoid	$A = \frac{1}{2}h(b_1 + b_2)$
circle	$A = \pi r^2$

### Perimeter of a:

square	$P = 4s$
rectangle	$P = 2l + 2w$
triangle	$P = s_1 + s_2 + s_3$
Circumference of a circle	$C = 2\pi r$ OR $C = \pi d$ ; $\pi \approx 3.14$

### Surface area and volume of a:

rectangular prism	$SA = 2lw + 2lh + 2wh$	$V = lwh$
right prism	$SA = ph + 2B$	$V = Bh$
cylinder	$SA = 2\pi rh + 2\pi r^2$	$V = \pi r^2 h$
pyramid	$SA = \frac{1}{2}ps + B$	$V = \frac{1}{3}Bh$
cone	$SA = \pi rs + \pi r^2$	$V = \frac{1}{3}\pi r^2 h$
sphere	$SA = 4\pi r^2$	$V = \frac{4}{3}\pi r^3$

( $p$  = perimeter of base with area  $B$ ;  $\pi \approx 3.14$ )

### Data

mean	mean is equal to the total of the values of a data set, divided by the number of elements in the data set
median	median is the middle value in an odd number of ordered values of a data set, or the mean of the two middle values in an even number of ordered values in a data set

### Algebra

slope of a line	$m = \frac{y_2 - y_1}{x_2 - x_1}$
slope-intercept form of the equation of a line	$y = mx + b$
point-slope form of the equation of a line	$y - y_1 = m(x - x_1)$
standard form of a quadratic equation	$y = ax^2 + bx + c$
quadratic formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Pythagorean theorem	$a^2 + b^2 = c^2$
simple interest	$I = Prt$ ( $I$ = interest, $P$ = principal, $r$ = rate, $t$ = time)
distance formula	$d = rt$
total cost	total cost = (number of units) $\times$ (price per unit)

