



## MATHEMATICS TEST

60 Minutes—60 Questions

**DIRECTIONS:** Solve each problem, choose the correct answer, and then fill in the corresponding oval on your answer document.

Do not linger over problems that take too much time. Solve as many as you can; then return to the others in the time you have left for this test.

You are permitted to use a calculator on this test. You may use your calculator for any problems you choose,

but some of the problems may best be done without using a calculator.

Note: Unless otherwise stated, all of the following should be assumed.

1. Illustrative figures are NOT necessarily drawn to scale.
2. Geometric figures lie in a plane.
3. The word *line* indicates a straight line.
4. The word *average* indicates arithmetic mean.

1. If  $r = 7$ ,  $b = 4$ , and  $g = -8$ , what does  $(r + b - g)(b + g)$  equal?

- A. -76  
B. -12  
C. 12  
D. 15  
E. 76

Evaluating

DO YOUR FIGURING HERE.

Algebraic Phases

plug and chug - No easy way to simplify before  
 $(7 + 4 - (-8))(4 + (-8)) = (19)(-4) = -76$

2. Tasha's regular pay is \$12.00 per hour for a 40-hour workweek. For each hour over 40 hours she works in a week, she is paid  $1\frac{1}{2}$  times her regular hourly pay. How much is Tasha paid for a week in which she works 49 hours?

- F. \$588.00  
G. \$601.50  
H. \$642.00  
J. \$661.50  
K. \$882.00

Real Life problem solving

 $1\frac{1}{2}$  times \$12 = \$1840 hours at regular pay + 9 hours @  $1\frac{1}{2}$ 

$$40 \times 12 = 480$$

$$9 \times 18 = 162$$

$$\underline{642}$$

3. To attend the Press Club Annual Banquet, members pay \$40 per ticket, while nonmembers pay \$50 per ticket. What is the revenue, in dollars, from the tickets when 100 member tickets and  $n$  nonmember tickets are purchased?

- A.  $n + 100$   
B.  $50n + 40(100)$   
C.  $50(n + 100)$   
D.  $50(n + 40)$   
E.  $(50 + 40)n$

Creating Algebraic phrase  
To problem solvePrice per Ticket times Number of  
Tickets sold equals Total revenue

$$\$40(100) + \$50(n) = 50n + 40(100)$$

4. How many integers between 9 and 59 can be divided by 5 with a remainder of zero?

- F. 9  
G. 10  
H. 11  
J. 12  
K. 13

Easiest way is just  
to list those multiples of 5  
between 9 and 59 and then  
count them

10, 15, 20, 25, 30, 35, 40, 45, 50, 55

There are ten of them

5. Of the 200 parking spaces in a parking lot, 4% of the spaces are reserved for handicapped parking, and 12 of the nonhandicapped spaces are suitable for compact cars only. How many spaces that are NOT reserved for handicapped parking are suitable for noncompact cars?

DO YOUR FIGURING HERE.

organizing data

D

- A. 192
- B. 188
- C. 184
- D. 180
- E. 168

$4\% \text{ of } 200 = 0.04 \times 200 = 8$   
 $8 + 12 = 20$        $200 - 20 = 180$

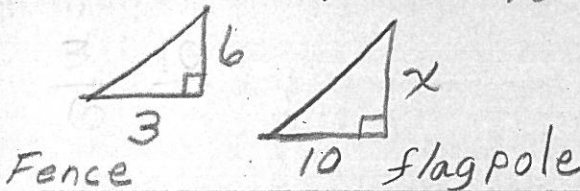
6. The shadows of a fence post and a nearby flagpole (both vertical and on level ground) were measured at the same time. The fence post's shadow was 3 ft long, and the flagpole's shadow was 10 ft long. If the fence post is 6 ft tall, about how many feet tall is the flagpole?

Similar Triangles

Drawing a diagram helps to set up solution

H

- F. 5
- G. 18
- H. 20
- J. 22
- K. 30



Set up Proportion  $\frac{6}{3} = \frac{x}{10}$   
 $x = 10 \times 6 \div 3 = 20$

7.  $-5(|-3 + 8|) = ?$  PEMDAS Combined With Absolute Value

B

- A. -55
- B. -25
- C. 0
- D. 25
- E. 55

$-5(|5|) = -5(5) = -25$

8. A 5-inch-by-6-inch rectangle is cut along its diagonal to form 2 triangles. What is the area of each triangle, in square inches?

Rectangles and rectangles

J

- F. 5.5
- G. 7.5
- H. 11
- J. 15
- K. 30

A diagonal cuts a rectangle into two congruent triangles. Area of  $\square = LW = 5 \times 6$   
 $\Delta's = 30 \div 2 = 15$

9. Franco is riding in a seat on a Ferris wheel. The wheel rotates at a constant rate of 1 revolution every minute. What is the measure of the angle Franco's seat rotates around the center of the Ferris wheel, starting at the bottom, in  $\frac{1}{2}$  minute?

Circles and Rates

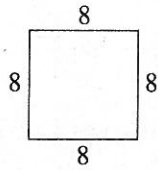
D

- A.  $\frac{1}{2}^\circ$
- B.  $1^\circ$
- C.  $90^\circ$
- D.  $180^\circ$
- E.  $360^\circ$

If it takes ONE minute to make ONE revolution, then he goes half way around in  $\frac{1}{2}$  minute. If a full circle has  $360^\circ$ , then halfway would be  $180^\circ$

10. Which of the following calculations gives the area, in square centimeters, of the square below, with sides 8 centimeters long?

- F.  $8 + 8$
- G.  $8 + 8 + 8 + 8$
- H.  $8 \cdot 8$
- J.  $8 \cdot 8 \cdot 8 \cdot 8$
- K.  $8^8$



DO YOUR FIGURING HERE.

Area of square =  $S^2$   
 $S = 8$   
 $S^2 = 8 \times 8$   
 It is as easy as it is.

11. A recipe for 1 loaf of bread calls for  $3\frac{3}{4}$  cups of flour. What is the maximum number of such loaves that can be made with a bag of flour that contains  $12\frac{3}{8}$  cups of flour?

- A. 3
- B. 4
- C. 9
- D. 15
- E. 16

$\frac{1 \text{ loaf}}{3\frac{3}{4}} = \frac{x \text{ loaves}}{12\frac{3}{8}}$

Ratio and Proportion

$x = 12\frac{3}{8} \div 3\frac{3}{4}$   
 $= 12.375 \div 3.75 = 3.3$

You can estimate by multiplying denominator by 4

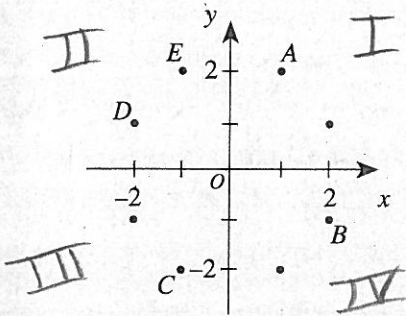
12. The expression  $(3c - 2d)(2c + d)$  is equivalent to:

- F.  $6c^2 - 7cd - 2d^2$
- G.  $6c^2 - 7cd + 2d^2$
- H.  $6c^2 - cd - 2d^2$
- J.  $6c^2 - cd + 2d^2$
- K.  $6c^2 - 2d^2$

Multiplying binomials  
 FOIL Method  
 $(3c - 2d)(2c + d) = (3c)(2c) + (3c)(d) - (2d)(2c) - 2d(d)$   
 $= 6c^2 + 3cd - 4dc - 2d^2 = H$

13. Eight points with integer coordinates are plotted in the standard  $(x, y)$  coordinate plane below. Which of the plotted points has an  $x$ -coordinate less than 1 and a  $y$ -coordinate of at least 2?

- A. A
- B. B
- C. C
- D. D
- E. E



Coordinate Geometry

quadrant I  $\rightarrow (+, +)$   
 II  $\rightarrow (-, +)$   
 III  $\rightarrow (-, -)$   
 IV  $\rightarrow (+, -)$

If  $y \geq 2$ , then it can only be A or E. Since  $x < 0$ , then E

14. When George fell asleep one night, the temperature was  $28^\circ$  Fahrenheit. When George awoke the next morning, the temperature was  $-15^\circ$  Fahrenheit. Which of the following, where + denotes a rise in temperature and - denotes a drop in temperature, best illustrates the temperature change from the time George fell asleep until the time he awoke?

- F.  $-43^\circ\text{F}$
- G.  $-13^\circ\text{F}$
- H.  $-7^\circ\text{F}$
- J.  $+13^\circ\text{F}$
- K.  $+43^\circ\text{F}$

Difference Means subtract

Manipulating positive and negative integers

$28 - (-15) = 28 + 15 = 43$   
 Since there's a drop in temperature then  $-43^\circ$



15. Which of the following is equivalent to  $(a^6)^{24}$ ?

DO YOUR FIGURING HERE.

Rules of Exponents

- A.  $a^{-18}$
- B.  $a^4$
- C.  $a^{18}$
- D.  $a^{30}$
- E.  $a^{144}$

$(x^a)^b = x^{ab}$   
 $(a^6)^{24} = a^{6 \times 24} = a^{144}$

16. Ohm's law for electricity is  $I = \frac{E}{R}$ , where  $I$  is the current flow in amperes,  $E$  is the number of volts, and  $R$  is the number of ohms of resistance. A technician has a circuit with a resistance of 34 ohms and a current flow of 7 amperes. Which of the following expressions gives the number of volts for this circuit?

Plugging Values into given formulas

- F.  $34 + 7$
- G.  $34 - 7$
- H → H.  $34 \cdot 7$
- J.  $\frac{7}{34}$
- K.  $\frac{34}{7}$

$L = 7$   
 $R = 34$

$7 = \frac{E}{34}$

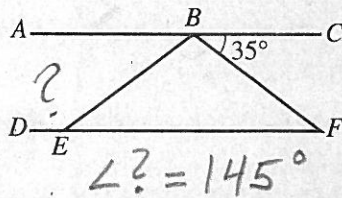
$E = 34 \times 7$

$34 \times 7 = \frac{E}{34} \times 34$

17. In the figure below,  $\overline{AC} \parallel \overline{DF}$ ,  $\triangle EBF$  is isosceles with  $\overline{EB} \cong \overline{FB}$ , and  $\angle CBF$  measures  $35^\circ$ . What is the measure of  $\angle DEB$ ?

Parallel Lines and Isosceles triangles

- E → A.  $107\frac{1}{2}^\circ$
- B.  $110^\circ$
- C.  $125^\circ$
- D.  $135^\circ$
- E.  $145^\circ$



Since  $\triangle EBF$  is isosceles,  $\angle BEF \cong \angle BFE$ .

$\angle ? + \angle BEF = 180^\circ$   
 $\angle ? + 35^\circ = 180^\circ$

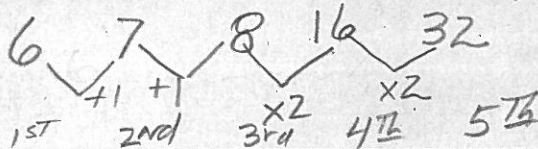
~~$\frac{35 \ 35}{35}$~~

18. A sequence of 5 numbers has 6 as its first term and 32 as its last term. The first 3 numbers are an arithmetic sequence. The last 3 numbers are a geometric sequence with a common ratio of 2. What is the common difference among the first 3 terms?

Arithmetic → Common difference

Geometric → Common Ratio

- F. 0
- G → G. 1
- H. 61
- J. 67
- K. 72



19. Water in Lake Forman is frozen at Celsius temperatures at or below  $0^\circ$ . Which of the following expressions represents all the Celsius temperatures,  $T$ , at which water is frozen in Lake Forman?

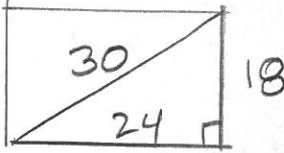
Inequalities

at or below means less than or equal. Use  $\leq$ .

- E → A.  $T = 0$
- B.  $T > 0$
- C.  $T \geq 0$
- D.  $T < 0$
- E.  $T \leq 0$

20. Sarah swims in a rectangular-shaped swimming pool 18 feet wide and 24 feet long. About how many feet long is a diagonal of the surface of the water in the pool?

- G  
 F. 21  
 G. 30  
 H. 42  
 J. 441  
 K. 900



DO YOUR FIGURING HERE.

Pythagorean Theorem

Think Pythagorean Triples

$$18 \div 6 = 3$$

$$24 \div 6 = 4$$

$$30 \div 6 = 5$$

This is a multiple of the 3, 4, 5 Triple

21. Let  $a, b, c,$  and  $d$  be positive real numbers such that  $a^{10} < b^{10} < c^{10} < d^{10}$ . Which of the numbers  $a, b, c,$  or  $d$  is the greatest?

- D  
 A.  $a$   
 B.  $b$   
 C.  $c$   
 D.  $d$   
 E. Cannot be determined from the given information

Key word is "positive"  $d$  would not be true if all reals

Axioms - When the exponent is equal, the base that's largest creates the largest #.

22. What value of  $x$  makes the equation  $7x - 3(2x - 4) = 10$  true?

- G  
 F. -12  
 G. -2  
 H.  $-\frac{2}{13}$   
 J.  $\frac{22}{13}$   
 K. 22

Distributive Property esp. with Negative Numbers

$$7x - 6x + 12 = 10$$

$$1x = -2$$

$$x = -2$$

23. Which of the following  $(x,y)$  pairs is the solution for the system of equations  $x + 2y = 5$  and  $-2x + y = 10$ ?

- A  
 A.  $(-3,4)$   
 B.  $(-1,3)$   
 C.  $(1,2)$   
 D.  $(5,0)$   
 E.  $(\frac{35}{3}, -\frac{10}{3})$

All the  $x$  and  $y$  values, so solve for one and you'll have your answer

Systems of Equations

$$\begin{array}{r} 2(x + 2y = 5) \\ + (-2x + y = 10) \\ \hline \end{array}$$

multiply by 2 in your head

$$0 + 5y = 20$$

$$y = 4$$

A is only choice

24. For nonzero numbers  $x$  and  $y$ , which of the following expressions is NOT equivalent to  $\frac{-x}{y}$ ?

- F  
 F.  $\frac{-x}{-y}$   
 G.  $\frac{x}{-y}$   
 H.  $\frac{-x}{y}$   
 J.  $\frac{-\pi x}{\pi y}$   
 K.  $-\frac{1}{\frac{y}{x}}$

Questions require you to test each one

$$-\frac{x}{y} = -\frac{x}{y} = -1\left(\frac{x}{y}\right) = \frac{x}{-y} = \frac{-1(x)}{y} = \frac{x}{-1(y)}$$

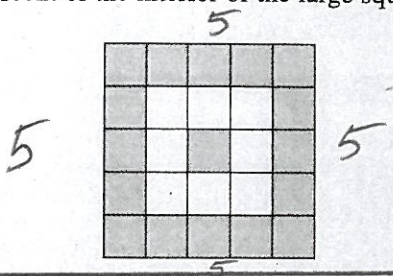
reciprocal



25. In the figure below, the interior of a square with 5-inch sides is partitioned into smaller squares with 1-inch sides. The interior of the small square at the center of the figure and the interiors of all of the small squares that share at least 1 side with the large square are shaded. What percent of the interior of the large square is shaded?

D

- A. 17%
- B. 50%
- C.  $66\frac{2}{3}\%$
- D. 68%
- E. 84%



DO YOUR FIGURING HERE.

Area of Polygons and Percent  
 Whole - unshaded = shaded  
 $25 - 8 = 17$   
 $\frac{17}{25} \times \frac{4}{4} = \frac{68}{100} = 68\%$

26. A researcher observed the growth of a certain colony of bacteria and recorded the data shown below.

| Day                           | 1   | 2   | 3   | 4     | 5     |
|-------------------------------|-----|-----|-----|-------|-------|
| Number of cells in the colony | 100 | 295 | 898 | 2,705 | 8,194 |

For the days observed, which of the following expressions best approximates the number of cells in the colony on the  $n$ th day?

J

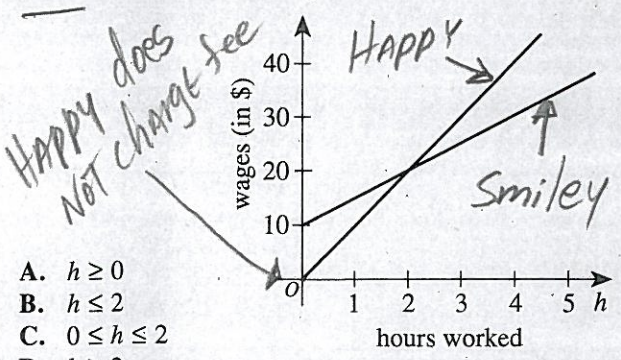
- F.  $100n$  — DOESN'T WORK FOR DAY 2
- G.  $300n$  — DOESN'T WORK FOR DAY 1
- H.  $300 \cdot 3^n$  — DOESN'T WORK FOR DAY 1
- J.  $100 \cdot 3^{n-1}$  — WORKS
- K.  $300 \cdot 3^{n-1}$  — DOESN'T WORK FOR DAY 1

Exponential growth and finding formula for series.

$n$  = Number of days

27. Smiley the Clown charges \$10 for scheduling a party and \$5 per hour after arriving at the party. Happy the Clown charges \$10 per hour for a party but does not have a charge for scheduling a party. The graph below shows the 2 clowns' wages, with  $h$  as the number of hours worked for a party. For what range of hours worked for a party does Happy the Clown make as much or more than Smiley the Clown?

D



- A.  $h \geq 0$
- B.  $h \leq 2$
- C.  $0 \leq h \leq 2$
- D.  $h \geq 2$
- E. There is no range for which Happy the Clown will make as much or more than Smiley the Clown.

graph interpretation given some real life scenario

After 2 hours Happy makes MORE



28. Which of the following is an equation of the line that passes through the points (1,-2) and (4,7) in the standard (x,y) coordinate plane?

DO YOUR FIGURING HERE.

Point Slope

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7 - (-2)}{4 - 1} = \frac{9}{3} = 3$$

G

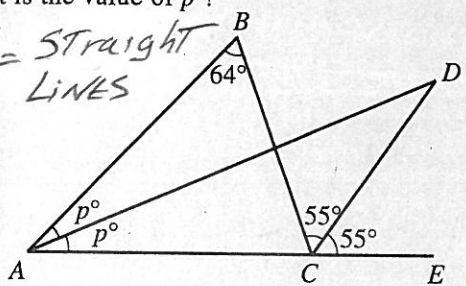
- F.  $y = x - 2$
- G.  $y = 3x - 5$
- H.  $y = 4x + 7$
- J.  $y = \frac{5}{3}x + \frac{1}{3}$
- K.  $y = \frac{1}{3}x + \frac{17}{3}$

All answers in slope/intercept form. All slopes are different so if you find slope, you have answer G has 3

29. In the figure below, A, C, and E are collinear;  $\triangle ABC$  and  $\triangle ADC$  are as shown; and angle measures are marked. What is the value of  $p$ ?

Triangles and Straight lines

Degrees =  $180^\circ =$  Straight Lines in Triangles



Because A, C, + E are collinear  $\angle ACB = 70^\circ$   
 $180 - (55 + 55) = 70^\circ$   
 $2p + 64 + 70 = 180^\circ$   
 $2p = 46$   $p = 23^\circ$

E

- A. 110
- B. 58
- C. 55
- D. 46
- E. 23

30. The diameter of a circle is 10 centimeters. What is its circumference, in centimeters?

Circles

G

- F.  $5\pi$
- G.  $10\pi$
- H.  $20\pi$
- J.  $25\pi$
- K.  $100\pi$

$C = D\pi$  or  $C = 2\pi r$  because  $D = 2r$   
 $C = 10\pi$  because  $D = 10$

31. A day care center has 160 feet of fence that was donated to construct a fence around a play area. The area is to be rectangular with its length 12 feet longer than its width. Assuming all of the fence is used, what will be the approximate dimensions, in feet, of the play area?

Rectangles and perimeters or area

B

- A. 28 by 40
- B. 34 by 46
- C. 36 by 44
- D. 40 by 40
- E. 74 by 86

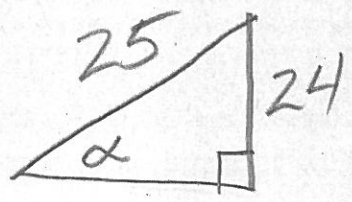
Perimeter of rectangle =  $2L + 2W$   
 $160 = 2(12 + W) + 2W$   
 $160 = 4W + 24$   $W = 34$

32. An angle in a right triangle has measure  $\alpha$ . If  $\sin \alpha = \frac{24}{25}$  and  $\tan \alpha = \frac{24}{7}$ , then  $\cos \alpha = ?$

SOHCAHTOA

F

- F.  $\frac{7}{25}$
- G.  $\frac{7}{24}$
- H.  $\frac{7}{\sqrt{527}}$
- J.  $\frac{7}{\sqrt{1,201}}$
- K.  $\frac{25}{7}$



$$\cos \alpha = \frac{A}{H} = \frac{7}{25}$$

Fill in given info provided



33. What is the distance, in coordinate units, between (6,4) and (8,10) in the standard (x,y) coordinate plane?

DO YOUR FIGURING HERE.

Distance Formula

- A.  $\sqrt{8}$
- B.  $\sqrt{32}$
- C.  $\sqrt{40}$
- D. 4
- E. 8

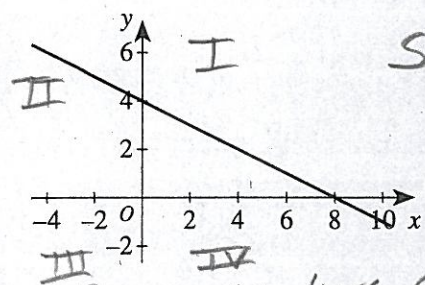
$$D = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$$

$$\sqrt{(10 - 4)^2 + (8 - 6)^2} = \sqrt{36 + 4} = \sqrt{40}$$

34. One of the following is the slope of the line graphed in the standard (x,y) coordinate plane below. Which one is it?

Slope of lines in coordinate plane

- F. -8
- G.  $-\frac{1}{2}$
- H.  $\frac{1}{2}$
- J. 2
- K. 4



$$\text{slope} = \frac{\Delta y}{\Delta x} = \frac{4 - 0}{0 - 8} = \frac{4}{-8} = -\frac{1}{2}$$

Between choices F and G, G is better because slope -8 is very STEEP. Because line goes thru II and IV, slope is (-)

35. A formula for the area of a trapezoid is  $A = \frac{1}{2}(b_1 + b_2)h$ , where A is the area,  $b_1$  and  $b_2$  are the lengths of the bases, and h is the height of the trapezoid. In terms of A,  $b_1$ , and  $b_2$ ,  $h = ?$

Solving for one Variable "in terms of" the others

- A.  $\frac{1}{2}A - b_1 - b_2$
- B.  $2A - b_1 - b_2$
- C.  $\frac{2A - b_1}{b_2}$
- D.  $\frac{\frac{1}{2}A}{b_1 + b_2}$
- E.  $\frac{2A}{b_1 + b_2}$

"In terms of" means solving for one variable and comparing them to the others. This time solve for h

$$\frac{2}{b_1 + b_2} * A = \frac{b_1 + b_2}{2} * h * \frac{2}{b_1 + b_2} \Rightarrow h = \frac{2A}{b_1 + b_2}$$

36. Which of the following equations has the pressure P varying directly as the square of the temperature T and inversely as the volume V?

Variation

- F.  $P = \frac{10V}{T^2}$
- G.  $P = \frac{10T^2}{V}$
- H.  $P = \frac{10}{T^2V}$
- J.  $P = 10T^2V$
- K.  $P = 10\left(\frac{T}{V}\right)^2$

Direct Variation is like slope

$$y = kx$$

Inverse Variation is like rational equation

In this case  $y$  is P and  $10 = k$

$$y = \frac{k}{x}$$

$$P = \frac{10 T^2}{V}$$



37. Which of the following is NOT a factor of  $z^5 - 16z$ ?

DO YOUR FIGURING HERE.

**FACTORS**

- A.  $z^2 - 1$   
 B.  $z^2 - 4$   
 C.  $z + 2$   
 D.  $z$   
 E.  $z - 2$

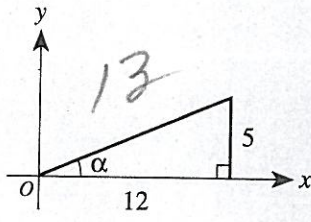
Factoring  $z^5 - 16z$  becomes  $z(z^4 - 16)$   
 Difference of two squares  $\rightarrow z(z^2 - 4)(z^2 + 4) = z(z - 2)(z + 2)(z^2 + 4)$

38. What is the sine of  $\alpha$  in the right triangle shown in the standard (x,y) coordinate plane below?

**SOHCAHTOA and Pythagorean Triples**

5, 12, 13 Triple

$$\sin \theta = \frac{O}{H} = \frac{5}{13}$$



- F.  $\frac{5}{13}$   
 G.  $\frac{5}{12}$   
 H.  $\frac{12}{13}$   
 J.  $\frac{12}{5}$   
 K.  $\frac{13}{5}$

39. In the figure below,  $\overline{AE}$  and  $\overline{BD}$  intersect at  $C$ , and the measure of  $\angle E$  is twice the measure of  $\angle D$ . The measure of  $\angle A$  is  $40^\circ$ , and the measure of  $\angle B$  is  $32^\circ$ . What is the measure of  $\angle E$ ?

**Triangles and Vertical L's**

Equals  $180 - (40 + 32)$  or  $108$

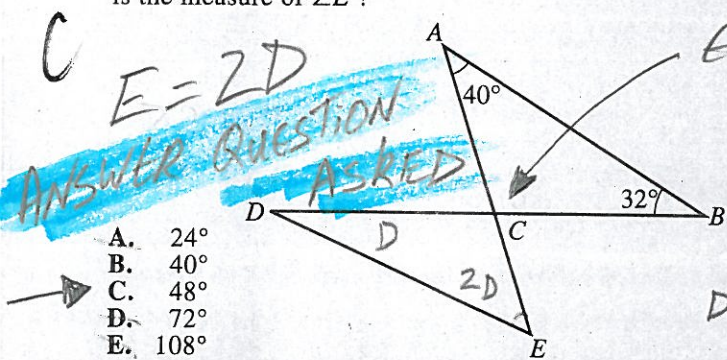
Because of Vertical L's  $\angle DCE$  equals  $108^\circ$

set up equation

$$D + 2D + 108 = 180$$

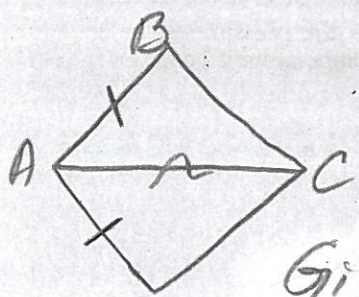
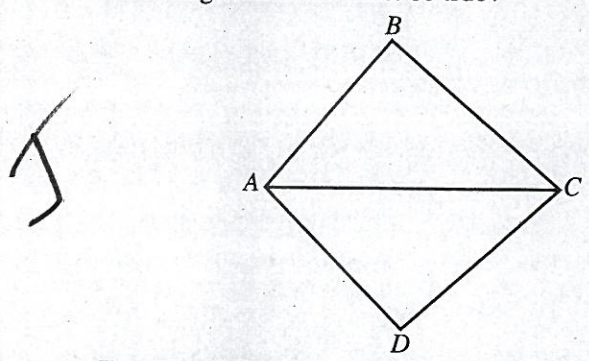
$$3D = 72$$

$$D = 24$$



40. In the figure below, the measure of  $\angle BAC$  is greater than the measure of  $\angle DAC$  and  $AB = AD$ . Which of the following statements must be true?

**Triangles and Axioms of Geometry**



$AC = \text{itself}$   
 $\angle BAC > \angle DAC$

Given this, BC must be greater than DC

IMAGINE AB MOVING

Counter clockwise. What happens to BC?

- F.  $AB > BC$   
 G.  $BC < DC$   
 H.  $BC = DC$   
 J.  $BC > DC$   
 K.  $AB + BC = AC$



41. In a math course, a student scored 100 on one test, 97 on another test, and 88 on each of the other tests. The student's test average for the course, where each test is weighted equally, is exactly 91. What is the total number of math tests that the student has taken in the course?

- A. 3
- B. 5
- C. 7
- D. 15
- E. Cannot be determined from the given information

$n = \text{TOTAL Number of Test Taken}$

DO YOUR FIGURING HERE.

AVERAGES

$$91 = \frac{100 + 97 + 88(n-2)}{n}$$

$$91n = 197 + 88n - 176$$

$$3n = 21 \quad n = 7$$

You can try each choice quickly

42. An equation of a particular circle is  $(x - 3)^2 + y^2 = 10$ . What are the coordinates of this circle's center and what is the length, in coordinate units, of this circle's radius?

- |    | Center | Radius      |
|----|--------|-------------|
| F. | (-3,0) | $\sqrt{10}$ |
| G. | (-3,0) | 5           |
| H. | (3,0)  | $\sqrt{10}$ |
| J. | (3,0)  | 5           |
| K. | (3,0)  | 10          |

H

INTERPRETING EQUATION OF CIRCLE FORMULA

Circle  $= (x-h)^2 + (y-k)^2 = r^2$  (h,k) center  
 $r = \text{radius}$

$(x-3)^2 + y^2 = 10$   
 $(x-3)^2 + (y-0)^2 = (\sqrt{10})^2$  Center (3,0)  
 $r = \sqrt{10}$

43. The point (3,-4) is the midpoint of the line segment in the standard (x,y) coordinate plane joining the point (8,-11) and the point (a,b). Which of the following is (a,b)?

- A. (-2,3)
- B. (-2,-19)
- C. (2,-3)
- D. (2.5,-3.5)
- E. (5.5,-7.5)

A

$$3 = \frac{8+x}{2}$$

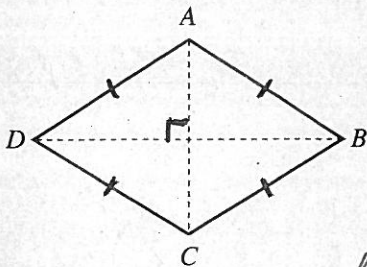
$$-4 = \frac{-11+y}{2}$$

Mid Point Formula

$$\left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

$y = 3$

44. If AC = 10 feet and BD = 12 feet in the rhombus ABCD shown below, what is its area, in square feet?



J

Area of Rhombus

Area ~~is~~  $= \frac{d_1 d_2}{2}$   $d_1 = \text{diagonal}_1$   
 $d_2 = \text{diagonal}_2$

$$A = \frac{(10)(12)}{2} = 5(12) = 60$$

- F. 11
- G. 22
- H. 30
- J. 60
- K. 120

J

45. A right, triangular prism that is 10 feet long, 4 feet wide, and 3 feet tall is shown below. What is its volume, in cubic feet?

DO YOUR FIGURING HERE.

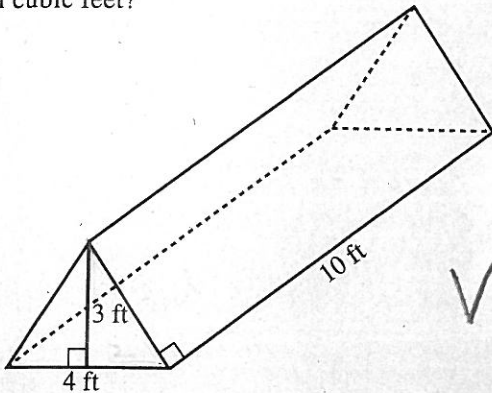
Volume of prism

Similar to volume of cylinder  
area of triangle times depth

$$V = \frac{bh}{2} * d = \frac{4 * 3}{2} * 10 = 60$$

B

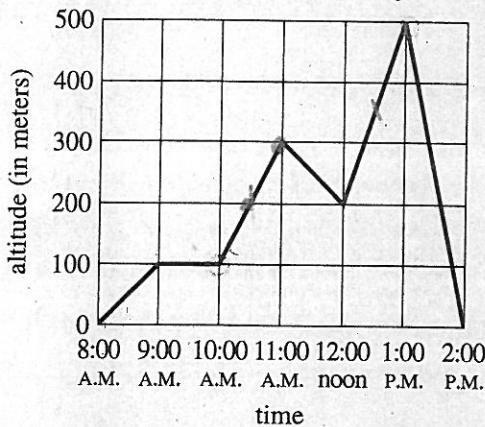
- A. 50
- B. 60
- C. 84
- D. 114
- E. 120



Use the following information to answer questions 46-49.

A balloonist collecting data on pollutants at various levels above the ground takes off at 8:00 A.M. When the balloon is in motion, it moves only straight up or straight down and at a constant speed within each hour-long interval. The balloon is at an altitude that is a multiple of 100 meters at the beginning of each hour. The balloon lands at 2:00 P.M. at the same spot from which it took off. The altitude of the balloon, in meters above the ground, is shown in the figure below.

Graphs and real life scenario



| Time Interval   | Distance Travel |
|-----------------|-----------------|
| 10am → 11:00    | 200 ft up       |
| 11:00am → 12:00 | 100 ft down     |
| 12:00 → 1:00    | 300 ft up       |

46. Which of the following is closest to the total distance, in meters, that the balloonist traveled from 10:00 A.M. to 1:00 P.M. ?

TOTAL 600 feet

H

- F. 400
- G. 500
- H. 600
- J. 680
- K. 700

47. What was the total time, in hours and minutes, that the balloon was at least 200 meters above the ground?

$$\frac{1}{2} + 1 + 1 + \frac{5}{8} = 3 \text{ hrs } 6 \text{ min}$$

D

- A. 1 hour 30 minutes
- B. 1 hour 36 minutes
- C. 3 hours 0 minutes
- D. 3 hours 6 minutes
- E. 3 hours 48 minutes

Confusing because its tough to determine between 10 and 11 and 1 and 2

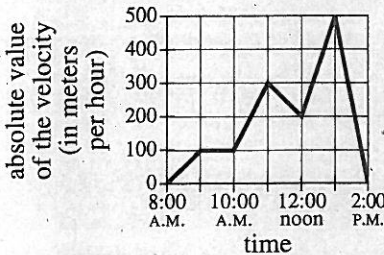
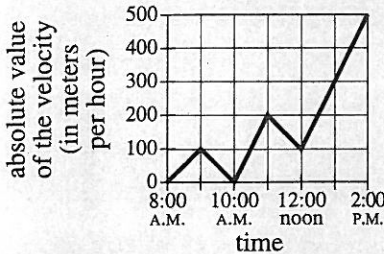
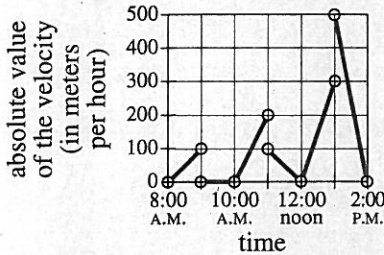
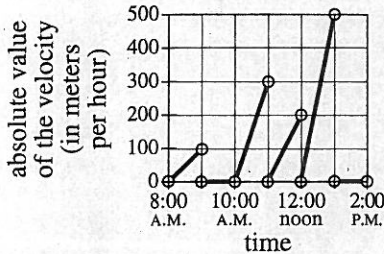
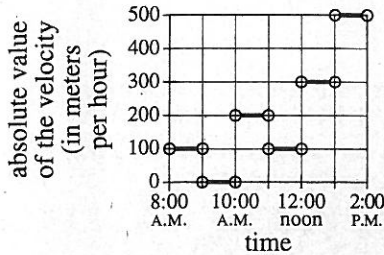


48. Which of the following graphs best represents the absolute value of the balloon's velocity, in meters per hour, between 8:00 A.M. and 2:00 P.M. ?

DO YOUR FIGURING HERE.

(Note: Ignore acceleration and deceleration.)

F



→ same graph as altitude graph

Velocity is speed or rate

$$\text{Velocity} = \frac{\text{Distance}}{\text{Time}}$$

"Which of the following"

Test and see what makes sense with original graph on previous page EVERY ONE EXCEPT F

doesn't reflect the correct  $\frac{\text{Distance}}{\text{Time}}$  in the altitude graph

49. Which of the following phrases best describes the balloon's motion between 10:30 A.M. and 12:00 noon?

E

- A. Descended, and then ascended more quickly
- B. Descended, and then ascended more slowly
- C. Stayed at the same altitude
- D. Ascended, and then descended more quickly
- E. Ascended, and then descended more slowly

"Which of the following" Review each one and determine which one makes the most sense



50. In the standard  $(x,y)$  coordinate plane shown below,  $\triangle ABC$  has vertices at  $A(-2,3)$ ,  $B(-2,1)$ , and  $C(-1,1)$ . A translation is performed on  $\triangle ABC$ , and the image of each point  $P$  with coordinates  $(x,y)$  is the point  $P'$  with coordinates  $(x',y')$  where  $x' = x + 3$  and  $y' = y - 2$ . The vertices of  $\triangle A'B'C'$  are in which quadrant(s)?

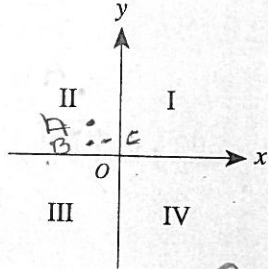
DO YOUR FIGURING HERE.

Translations in  $xy$  Coordinate Plane

If the  $x$ 's slide to the right  $(+3)$ , then the figure would be in quad I. If they move down  $(-2)$ , they would move to quad IV.

J

quadrants of the standard  $(x,y)$  coordinate plane



- F. Quadrant I only
- G. Quadrant II only
- H. Quadrant III only
- J. Quadrants I and IV only
- K. Quadrants II and III only

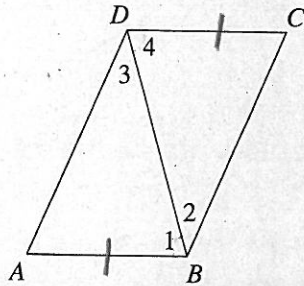
51. In the figure below,  $AB \cong CD$ . Fred wants to apply the Side-Angle-Side (SAS) congruence theorem to prove that  $\triangle ABD \cong \triangle CDB$ . Which of the following congruences, if established, is sufficient?

Geometry Proof (rare)

DB equals itself  
For SAS, the sides are  $AB \leftrightarrow DC$  and  $DB \leftrightarrow DB$ .  
Need included angles 1 and 4

E

- A.  $\angle A \cong \angle C$
- B.  $\angle 3 \cong \angle 4$
- C.  $\angle 2 \cong \angle 4$
- D.  $\angle 2 \cong \angle 3$
- E.  $\angle 1 \cong \angle 4$



52. A camper at Site C sends a distress signal. The signal is received by both Ranger Station A and Ranger Station B. As shown below, Ranger Station A is 6 miles directly west of Ranger Station B. Ranger Station A is directly south of Site C. The entire region is flat and level. On a map, the angle formed at Ranger Station B by drawing straight lines from Ranger Station B to Site C and to Ranger Station A measures  $57^\circ$ . About how many miles away from Site C is the closer of the 2 ranger stations?

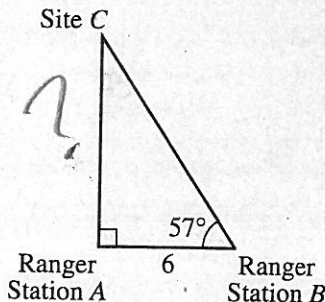
Trigonometry  
The closer of the two from Site C is station A

$$\tan 57^\circ = \frac{?}{6}$$

$$6 \tan 57^\circ = ?$$

K

- F.  $\frac{6}{\sin 57^\circ}$
- G.  $\frac{6}{\cos 57^\circ}$
- H.  $6 \sin 57^\circ$
- J.  $6 \cos 57^\circ$
- K.  $6 \tan 57^\circ$



53. If the diameter of a circle is tripled, the area of the resulting circle is how many times the area of the original circle?

- A. 1.5
- B. 2.25
- C. 3
- D. 6
- E. 9

E

ORIGINAL circle

$A = \pi \left(\frac{D}{2}\right)^2$  because  
 $r = D/2$   $A = \pi \frac{D^2}{4}$

$A = \pi r^2$

DO YOUR FIGURING HERE.

Circles and area

Triple Diameter

$\pi \left(\frac{3D}{2}\right)^2 = \frac{\pi \cdot 9D^2}{4}$

9 times as large 4

### Ratio and Probability

54. Only tenth-, eleventh-, and twelfth-grade students attend Washington High School. The ratio of tenth graders to the school's total student population is 86:255, and the ratio of eleventh graders to the school's total student population is 18:51. If 1 student is chosen at random from the entire school, which grade is that student most likely to be in?

- F. Tenth
- G. Eleventh
- H. Twelfth
- J. All grades are equally likely.
- K. Cannot be determined from the given information

G

SINCE  $51 \times 5 = 255$ , there

are  $18 \times 5 = 90$  in 11<sup>th</sup> grade

$86 + 90 + x = 255$

$x = 79$  or 12<sup>th</sup>

|                  |                  |                  |
|------------------|------------------|------------------|
| $\frac{86}{255}$ | $\frac{90}{255}$ | $\frac{79}{255}$ |
| 10 <sup>th</sup> | 11 <sup>th</sup> | 12 <sup>th</sup> |

the greatest chance is 11<sup>th</sup> because they have most

### Absolute Value

55. When  $x$  and  $y$  are nonzero real numbers such that  $|x| = -x$  and  $|y| = y$ , which of the following must be positive?

- A.  $x^y$
- B.  $xy$
- C.  $x - y$
- D.  $x + y$
- E.  $y - x$

E

If  $|x| = -x$ , then  $x < 0$

If  $|y| = y$ , then  $y > 0$

When you subtract a negative number from a positive, its the same as adding another positive

### Proportions and solving for Variables

56. If  $\frac{2x-y}{x+y} = \frac{2}{3}$ , then  $\frac{x}{y} = ?$

- F.  $\frac{1}{2}$
- G.  $\frac{2}{3}$
- H.  $\frac{5}{4}$
- J.  $\frac{5}{3}$
- K. 5

H

$3(2x - y) = 2(x + y)$

Cross products equal

$6x - 3y = 2x + 2y$   
 $-(6x - 2y - 6x - 2y)$

$-y = -4x + 4y$

$-5y = -4x$

$\frac{-5}{-4} = \frac{x}{y} = \frac{5}{4}$

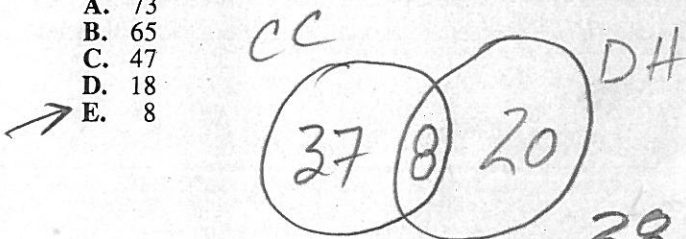


57. Kelly asked 120 students questions about skiing. The results of the poll are shown in the table below.

| Question   | Yes | No |
|--|-----|----|
| 1. Have you skied either cross-country or downhill?              | 65  | 55 |
| 2. If you answered Yes to Question 1, did you ski downhill?      | 28  | 37 |
| 3. If you answered Yes to Question 1, did you ski cross-country? | 45  | 20 |

After completing the poll, Kelly wondered how many of the students polled had skied both cross-country and downhill. How many of the students polled indicated that they had skied both cross-country and downhill?

- A. 73
- B. 65
- C. 47
- D. 18
- E. 8



DO YOUR FIGURING HERE.

SET Theory / Venn Diagrams

Group<sub>1</sub> + Group<sub>2</sub> + Neither  
 — Both = TOTAL

Group<sub>1</sub> = Downhill skiers  
 Group<sub>2</sub> = Cross Country skiers

Neither = 55  
 Both = ? TOTAL = 120

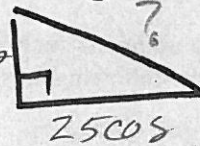
$$28 + 45 + 55 - ? = 120$$

$$128 - 120 = ? = 8 \quad x = 8$$

58. A right triangle has legs of length  $25 \sin \theta$  feet and  $25 \cos \theta$  feet for some angle  $\theta$  that satisfies  $0^\circ < \theta < 90^\circ$ . What is the length, in feet, of the longest side of the triangle?

- F.  $\theta$
  - G. 1
  - H. 5
  - J. 25
  - K. Cannot be determined from the given information
- Longest side of right triangle is the hypotenuse

TRIGONOMETRY



$$(25 \sin \theta)^2 + (25 \cos \theta)^2 = (?)^2$$

$$625(\sin^2 \theta) + 625(\cos^2 \theta) = ?^2$$

$$625(\sin^2 \theta + \cos^2 \theta) = (?)^2$$

$$625(1) = (?)^2$$

$$\sqrt{625} = \sqrt{?^2}$$

$$25 = ?$$

59. For all nonzero  $x$ ,  $y$ , and  $z$  such that  $x = yz$ , which of the following *must* be equivalent to  $xy$ ?

- A.  $\frac{z}{x}$
- B.  $yz^2$
- C.  $yz$
- D.  $\frac{x^2}{z}$
- E.  $\frac{x}{y}$

Solving for variables using substitution

$$x = x$$

$$y = \frac{x}{z}$$

$$xy = x \left( \frac{x}{z} \right) = \frac{x^2}{z}$$



## INEQUALITIES

60. When  $-3 \leq x \leq 4$  and  $-1 \leq y \leq 2$ , what is the least possible value for  $x - y$ ?

DO YOUR FIGURING HERE.

- F. -5  
 G. -3  
 H. -2  
 J. 3  
 K. 5

You can start with the smallest value and work backward

END OF TEST 2

STOP! DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.

DO NOT RETURN TO THE PREVIOUS TEST.

-5 would work with  
 $x - y$

-3 - 2 and yes  $-3 - 2 = -5$

The least  $x$  is -3  
 and the greatest  $y$  is 2

$$-3 - 2 = -5$$



0861B

**Test 2: Mathematics—Scoring Key**

|     | Key | Subscore Area* |       |       |
|-----|-----|----------------|-------|-------|
|     |     | EA             | AG    | GT    |
| 1.  | A   | _____          |       |       |
| 2.  | H   | _____          |       |       |
| 3.  | B   | _____          |       |       |
| 4.  | G   | _____          |       |       |
| 5.  | D   | _____          |       |       |
| 6.  | H   | _____          |       |       |
| 7.  | B   | _____          |       |       |
| 8.  | J   |                |       | _____ |
| 9.  | D   |                |       | _____ |
| 10. | H   |                |       | _____ |
| 11. | A   | _____          |       |       |
| 12. | H   | _____          |       |       |
| 13. | E   |                | _____ |       |
| 14. | F   | _____          |       |       |
| 15. | E   |                | _____ |       |
| 16. | H   | _____          |       |       |
| 17. | E   |                |       | _____ |
| 18. | G   |                | _____ |       |
| 19. | E   | _____          |       |       |
| 20. | G   |                |       | _____ |
| 21. | D   |                |       | _____ |
| 22. | G   | _____          |       |       |
| 23. | A   |                | _____ |       |
| 24. | F   | _____          |       |       |
| 25. | D   | _____          |       |       |
| 26. | J   |                | _____ |       |
| 27. | D   |                | _____ |       |
| 28. | G   |                | _____ |       |
| 29. | E   |                |       | _____ |
| 30. | G   |                |       | _____ |

|     | Key | Subscore Area* |       |       |
|-----|-----|----------------|-------|-------|
|     |     | EA             | AG    | GT    |
| 31. | B   |                |       | _____ |
| 32. | F   |                |       | _____ |
| 33. | C   |                |       | _____ |
| 34. | G   |                | _____ |       |
| 35. | E   |                | _____ |       |
| 36. | G   | _____          |       |       |
| 37. | A   | _____          |       |       |
| 38. | F   |                |       | _____ |
| 39. | C   |                |       | _____ |
| 40. | J   |                |       | _____ |
| 41. | C   | _____          |       |       |
| 42. | H   |                | _____ |       |
| 43. | A   |                | _____ |       |
| 44. | J   |                |       | _____ |
| 45. | B   |                |       | _____ |
| 46. | H   | _____          |       |       |
| 47. | D   | _____          |       |       |
| 48. | F   |                |       | _____ |
| 49. | E   | _____          |       |       |
| 50. | J   |                | _____ |       |
| 51. | E   |                |       | _____ |
| 52. | K   |                |       | _____ |
| 53. | E   |                |       | _____ |
| 54. | G   | _____          |       |       |
| 55. | E   |                | _____ |       |
| 56. | H   |                | _____ |       |
| 57. | E   |                | _____ |       |
| 58. | J   |                |       | _____ |
| 59. | D   | _____          |       |       |
| 60. | F   | _____          |       |       |

| Number Correct (Raw Score) for:                   |            |
|---|------------|
| Pre-Alg./Elem. Alg. (EA) Subscore Area            | _____ (24) |
| Inter. Alg./Coord. Geo. (AG) Subscore Area        | _____ (18) |
| Plane Geo./Trig. (GT) Subscore Area               | _____ (18) |
| Total Number Correct for Math Test (EA + AG + GT) | _____ (60) |

\* EA = Pre-Algebra/Elementary Algebra  
 AG = Intermediate Algebra/Coordinate Geometry  
 GT = Plane Geometry/Trigonometry