Name: _____ Date: _____ Score: _____

MATHEMATICS TEST
8 Minutes—8 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.

Pre-Algebra 23% ~ about 14 out of 60

1. For all positive integers *x*, what is the greatest common factor of the 2 numbers 216*x* and 180*x* ?
F. 6
G. 72
H. *x*
J. 12*x*
K. 36*x*
Solution: You can break up each expression into divisors,
216x = (2)(2)(2)(3)(3)(3)(x)
180x = (2)(2)(3)(3)(5)(x)
The symbols that they share together make up the greatest common factor, which would be (2)(2)(3)(3)(x) which is the same as 36x. **So K is the correct response.**

2. The table below shows the price of different quantities of standard-sized lemons at Joe's Fruit Stand. What is the least amount of money needed to purchase exactly 20 standard-sized lemons if the bags must be sold intact and there is no tax charged for lemons?

# of lemons:	1	Bag of 6	Bag of 12
Total price:	\$0.30	\$1.20	\$2.10

A. \$3.60
B. \$3.90
C. \$4.20
D. \$4.50
E. \$6.00
Solution: Start with the largest amount (bag of 12) and see how many you can use. Then go down to the bag of 6, etc. 20 is the same as one 12 + one 6 + two 1's. so the price is (1)(\$2.10) + (1)(\$1.20) + (2)(\$0.30) = \$2.10 + \$1.20 + \$0.60 = \$3.90. **The answer is B.**

3. A bag contains 6 red marbles, 5 yellow marbles, and 7 green marbles. How many additional red marbles must be added to the 18 marbles already in the bag so that the probability of randomly drawing a red marble is $\frac{3}{5}$?

F. 12
G. 16
H. 18
J. 24
K. 36
Solution: Let r represent the total number of red marbles that must be added to the bag. If the probability of choosing a red is 3/5, then the fraction (6+r)/(18+r) must equal 3/5. This is a proportion,. 3/5 = (6+r)/(18+r), so you can cross multiply to get
3(18+r) = 5(6+r).
54 + 3r = 30 + 5r
-3r = - 3r
54 = 30 + 2r
-30 = - 30
24 = 2r Divide by 2 to get r = 12. So 12 red marbles must be added. **The answer is F.**

4. The sum of the real numbers *x* and *y* is 11. Their difference is 5. What is the value of *xy* ?

F. 3
G. 5
H. 8
J. 24
K. 55

Solution: x + y = 11
x – y = 5 Add these two equations together (notice that the y's cancel each other)
2x = 16 Divide by 2 to get x = 8. Now if x + y = 11, and if x = 8, then y must be 11 – 8, or y = 3.
But we want xy. So that (8)(3) = 24. **The answer is J.**

5. The diameter, *d* centimeters, of the metal poles Goodpole Manufacturing produces must satisfy the inequality $|d-3| \le 0.001$. What is the maximum diameter, in centimeters, such a metal pole may have?

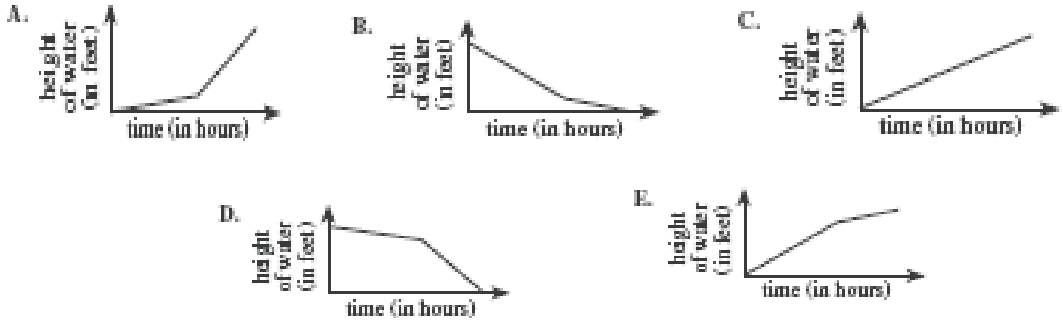
F. 1.4995
G. 1.5005
H. 2.999
J. 3.000
K. 3.001

Solution: If $|d-3| \le 0.001$, this inequality can be re-written as $-0.001 \le d-3 \le 0.001$

Add 3 to all sides: +3 +3 +3
You get: $-2.999 \le d \le 3.001$
So the maximum diameter is 3.001, or **letter K.**

Coordinate Geometry 15% ~ about 9 out of 60

6. Two hoses are used to fill the pool. Twice as many gallons of water per minute flow through one of the hoses as through the other. Both hoses had been on for 12 hours and had filled the pool to the 4-foot mark when the hose with the faster flow stopped working. The hose with the slower flow then finished filling the pool to the 5-foot mark. Which of the following graphs shows the relationship between the time spent filling the pool and the height of the water in the pool?

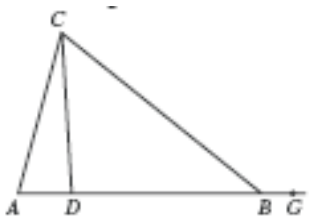


Solution: Since the graph is measuring the height, and the water in the pool is getting deeper, the graph must show an increase in height. So B and D are out! When the hose stops working, the rate at which the height is going up must slow down, because only 1 hose is now working. That means the 2nd part of the graph must be less steep than the first part when both hoses are working. Graph A shows the rate speeding up, graph C shows the rate staying the same, so only graph E could be the possible graph. **Your answer must be E.**

Plane Geometry 23% ~ about 14 out of 60

7. In the figure below, *A*, *D*, *B*, and *G* are collinear. If $\angle CAD$ measures 76°, $\angle BCD$ measures 47°, and $\angle CBG$ measures 140°, what is the degree measure of $\angle ACD$?

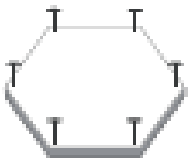
F. 12°
G. 14°
H. 17°
J. 36°
K. 43°



Solution: The angles of a triangle must add up to 180 degrees. So $\angle A + \angle ABC + \angle BCA = 180$.
Now, $\angle A$ is another name for $\angle CAD$, so it must be 76.
Also, $\angle CBG + \angle CBD = 180$, because the 2 angles form a straight line (that's what collinear means). Since $\angle CBG = 140$, that leave 40 for $\angle CBD$. Substitute numbers into the equation from line 2 of the solution.
That gives us $76 + 40 + \angle BCA = 180$, which gives $\angle BCA = 64$. But $\angle BCA = \angle ACD + \angle BCD$.
Substitute again to get $64 = \angle ACD + 47$. Subtract 47 to find $\angle ACD = 17$. **Your choice is H.**

8. Minh cuts a board in the shape of a regular hexagon and pounds in a nail at an equal distance from each vertex, as shown in the figure below. How many rubber bands will she need in order to stretch a different rubber band across every possible pair of nails?

A. 15
B. 14
C. 12
D. 9
E. 6



Solution: Give each nail a letter, say, A, B, C, D, E, and F. Let's make a table of which nail is connected to which other nails:

A	connect to B, C, D, E, and F. (5 rubber bands)
B	connect to C, D, E, and F (4 rubber bands)*
C	connect to D, E, and F (3 rubber bands)**
D	connect to E and F (2 rubber bands)
E	connect to F (1 rubber band)

The total is 5 + 4 + 3 + 2 + 1 = 15 rubber bands. **The correct answer is A.**

*B was already connected to A so it's not counted again
**C was already connected to A and B, so those aren't counted again.
Similary for D and E..