

FALL 2013 McNABB GDCTM CONTEST
ALGEBRA ONE

NO Calculators Allowed

1. How many real numbers are equal to their own reciprocal?
2. Two positive integers have a product of 210 and a sum of 29. What is the result when the larger of the two integers is subtracted from the smaller of the two integers?
3. What is the largest prime p satisfying $\left(\frac{16}{p}\right)^2 > 2$?
4. A certain parking lot charges 5 dollars for the first hour or portion of, and 2 dollars per following hour or portion of. If Susan parks her car at 7:41am and drives out at 2:59pm the same day, how much does she owe?
5. In a square pyramid, the sides of the square base are doubled and the height is halved. By what percent is the volume of the original pyramid changed?
6. If one paper clip costs p cents and three erasers costs q cents, how many cents do 21 erasers and 12 paper clips cost? Answer in terms of p and q .
7. Ashley's creature box for her science experiment contains centipedes and spiders. Despite the name 'centipede' each of Ashley's centipedes has 30 legs. She counts a total of 23 insects and 228 legs. How many centipedes does Ashley have? By the way, spiders have 8 legs!
8. A *unit fraction* is a fraction of the form $1/n$ where n is a positive integer. Write $3/17$ as a sum of unit fractions, each with a different denominator.
9. Find the coefficient of x^2 when $(1 + x + x^2)^6$ is expanded and simplified.
10. If x ounces of cleaner clean y square feet of floor, how many square yards of floor can be cleaned by y gallons of this cleaner?
11. Find the value of x if $4^5 + 4^5 + 4^5 = 2^x + 2^x + 2^x$.
12. For which integer m does $\frac{m}{13} < \sqrt{2} < \frac{m+1}{13}$ hold?
13. Simplify

$$a - \left(3b - (a - (2b - a))\right)$$

14. A set S of ordered pairs is said to be *transitive* if whenever (a, b) and (b, c) belong to S then so does (a, c) . Is this set S below transitive?

$$S = \{(6, 13), (4, 8), (5, 7), (6, 10), (3, 5), (10, 13), (3, 7), (1, 5), \\ (3, 10), (1, 4), (1, 7), (9, 6)\}$$

Answer Yes or No.

15. Find the maximum possible product of a set of positive integers whose sum is 27. Answer in standard integer form.