# 2009 Rocket City Junior Math Mania
Algebra Test – 8th Grade

1. Express the number 987 in scientific notation.

2. Evaluate: $137^2 - 123^2$

3. Express in simplest radical form: $\sqrt{63}$

4. When six liters of a 66% acid solution are mixed with nine liters of a 21% acid solution, what percent of the resulting solution is acid?

5. What values of m satisfy $3m^2 - 11m - 4 = 0$?

6. What value of p satisfies $2(p+3) - 9 = 5(p-1) - 22$?

7. What is the equation of the axis of symmetry of the parabola $y = 2x^2 - 24x + 3$?

8. What is the solution, as an ordered pair (m, n), of the equations $3m - n = 17$ and $m + n = 15$?

9. List the roots of the polynomial $6g^3 + 23g^2 - 5g - 4 = 0$.

10. What are the coordinates, in the form (x, y), of the point of intersection of the lines $y = 3x - 2$ and $2x - y = -8$.
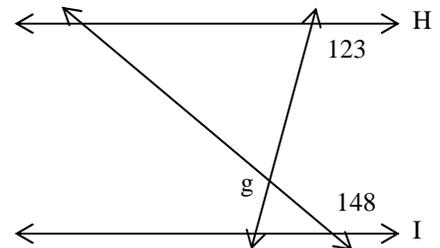
2009 Rocket City Junior Math Mania
Geometry Test – 8th Grade

1. How many diagonals can be drawn in a convex 11-gon?

2. A cow is tied to an outside corner of a rectangular barn with sides measuring 30 by 50 m. If the cow's tether is 40 meters long, what is the area, in square meters, of the region the cow can graze?

3. What is the volume, in cubic centimeters, of a right circular cylinder with a base radius of 4 cm and a height of 5 cm?

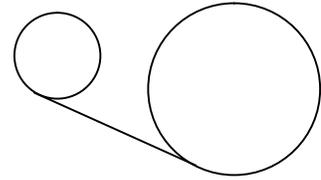4. In the figure shown, what is the value of f?
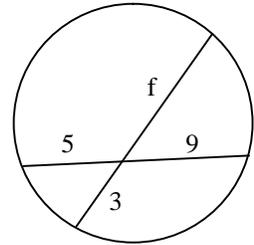
5. What is the perimeter, in centimeters, of a square that is inscribed in a circle with a diameter of 16 cm?

6. In a right triangle with sides measuring 5, 12, and 13 cm, what is the radius, in centimeters, of its inscribed circle?

7. What is the measure, in degrees, of an interior angle in a regular nonagon (9-gon)?

8. When four lines are drawn in a plane, what is the largest number of regions into which they can divide the plane?

9. The area between two concentric circles is $36f$ cm^2. What is the length, in centimeters, of a chord of the larger circle that is tangent to the smaller circle?

10. In the figure shown with angle measures provided in degrees, if lines H and I are parallel, what is the value of g?

2009 Rocket City Junior Math Mania
Potpourri Test – 8th Grade

1. Two circles with radii of 4 and 14 cm have their centers 26 cm apart. What is the length, in centimeters, of their common external tangent?

2. My piggy bank contains fifteen coins and is worth $1.21. If each coin is either a penny, nickel, or dime, how many nickels are in the piggy bank?

3. In the figure shown, where lines E and F are parallel and angle measures are given in degrees, what is the value of g?

    2g+13   E

    g

    3g-37   F
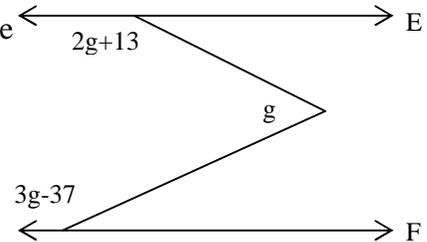
4. In the cryptarithm below, each instance of a letter represents the same digit (0-9) and different letters represent different digits (e.g. if one A is an 8, all A's are 8 and B cannot be 8). What is the largest possible value of the four-digit integer ABCD?

    $$\begin{array}{r} AB \\ -BC \\ \hline CD \end{array}$$

5. If a sequence is defined recursively as $k_1 = 3$ and $k_n = 2k_{n-1} - 1$, what is the value of k_5?

6. Using the numbers 3, 4, 6, and 9 exactly once each and the operators +, -, ×, and ÷ (as well as parentheses) as many times as you like, write an expression which evaluates to 49.

7. What is the sum of the number of faces on a right square pyramid, the number of positive one-digit prime numbers, and the number of positive perfect squares less than 100?

8. How many positive three-digit numbers have three different digits, one of which is a three? Note: a number cannot start with the digit 0.

9. What are the coordinates, in the form (x, y), of the lower focus of the ellipse

    $$\frac{(x-2)^2}{9} + \frac{(y+1)^2}{25} = 1 ?$$

10. Evaluate: $\cfrac{42}{11 + \cfrac{42}{11 + \cfrac{42}{\cdots}}}$

2009 Rocket City Junior Math Mania
Probability Test – 8th Grade

1. The probability that I eat breakfast in the morning is $\frac{5}{6}$ and the probability that I take a nap in the afternoon is $\frac{2}{9}$. If these events are independent, what is the probability that I do neither?

2. A trusted friend draws two marbles from a bag containing five blue and three white marbles, examines them, and tells you that they are not both blue. What is the probability that they are both white?

3. What is the mean of the data set 3, 7, 19, 31?

4. In the game of Domjot, a player pays $4 to roll a fair six-sided die. If the player rolls a 3 or less, they receive $3 back. If they roll a 4 or 5 they receive $2 back. If they roll a 6, they receive $8 back. What is the expected value of the player's gain in dollars (perhaps negative) in this game?

5. When six fair coins are flipped, what is the probability that exactly four of them show tails?

6. When two fair six-sided dice are rolled, what is the probability that the product of their numbers is a multiple of six?

7. What is the median of the data set 5, 6, 6, 8, 10, 11, 12, 14, 16, 17, 18, 19, 20, 21, 22?

8. Two people play a game in which they take turns removing marbles from a bag containing three red and four white marbles. If the first person to remove a white marble is declared the winner, what is the probability that the second player wins the game?

9. In how many ways can seven people sit relative to one another at a round table?

10. In a seven-element data set of integer test scores from 0 to 100 inclusive, the unique mode is 63, the median is 54, and the range is 38. What is the largest possible value of the mean?