

2010 Rocket City Junior Math Mania
Algebra Test – 8th Grade

1. Evaluate: $7 + 8 \times 9 - (4 \times 5 - 36 \div 2)^6$
2. What are the coordinates, in the form (x, y) , of the point of intersection of the lines $y = 2x - 7$ and $x + 3y = 0$?
3. An 8 cm by 12 cm picture has a rectangular matting that extends 3 cm beyond the picture on all sides. What is the area, in square centimeters, of just the matting? Note: matting does not go behind the picture itself, just around the picture.
4. Mathium has a half-life of ten seconds. If a sample contains 20 kg of Mathium, how many kilograms of Mathium will remain after a minute?
5. What is the slope of the line: $3x + 7y = 18$?
6. Two numbers have a sum of 71 and a difference of 43. What is the larger of the two numbers?
7. What is the measure, in degrees, of the smaller angle between the hands of a standard 12-hour analog clock at 3:30 PM?
8. Currently, Danny is three times as old as Ellie. In seven years, Danny will be three years older than twice Ellie's age. How old is Danny now?
9. Bill has 10 liters of an 80% acid solution that he will dilute to a 70% acid solution by adding 2 liters of a second solution. What percent of the second solution is acid?
10. What value(s) of b satisfy $5(4 - 3b) + 2 = 2(3b + 4) - 5$?

Tiebreakers:

1. Express in simplest rational form: $\sqrt{54}$
2. If $f(g) = 3(2 + g) - 4$, then evaluate $f(5)$.

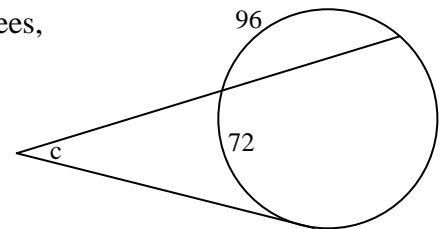
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Geometry Test – 8th Grade

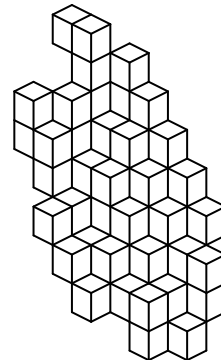
Please **do not include units** in your answers.

If a problem uses π , please leave your answer in terms of π instead of using an approximation. (Example: the area of a circle with radius 5 is 25π .)

1. What is the volume, in cubic meters, of a right rectangular pyramid with base edges measuring 4 m and 8 m and a height of 6 m?
2. A right triangle has a hypotenuse of 26 cm and a leg of 10 cm. What is the length, in centimeters, of the other leg?
3. What is the area, in square centimeters, of an equilateral triangle with sides measuring 6 cm?
4. How many diagonals can be drawn in a regular hexagon?
5. In the diagram to the right, with all measures given in degrees, what is the value of c ?

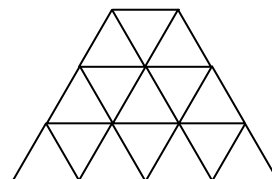


6. The vertices of a regular polygon are named in alphabetical order: A, B, C, ..., etc. If \overline{DM} passes through the center of the figure, how many sides does the polygon have?
7. What is the minimum number of unit cubes necessary to create the following structure, if unit cubes must be glued together face-to-face? (You must count hidden squares if they are necessary for holding the structure together.)



8. Two circles with radii of 12 m and 16 m have centers 40 m apart. What is the length, in meters, of one of their common internal tangents?
9. A triangle has two sides measuring 8 cm and 13 cm. What is the smallest possible integer length, in centimeters, of the third side?
10. What is the surface area, in square meters, of a right circular cylinder with a base radius of 8 m and a height of 12 m?

Tiebreaker: 1. How many equilateral triangles of any size are shown in the given figure?



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Potpourri Test – 8th Grade

1. On the first day of her road trip, Cherie drove 800 km at 100 km per hour. On the second day, she drove at an average speed of 90 km per hour for 9 hours. On the third day, she drove 700 km in 10 hours. How many total kilometers did Cherie drive in those three days?
2. What is the missing term of the sequence 3, 1, 5, 2, 7, 4, 9, 8, __, 16, 13, ...?
3. In a line, Oliver is somewhere ahead of Percy, Quincy is immediately behind Rachel, and Shelley is somewhere behind Terrance. If Oliver is immediately ahead of Terrance, and Quincy and Percy are somewhere behind Shelley, how many arrangements of these six are possible?
4. If g is directly proportional to h , and $g = 3$ when $h = 4$. What is the value of h when $g = 12$?
5. Evaluate: $8^3 - 6^3$
6. When six fair coins are flipped, what is the probability that there are more heads than tails?
7. Convert the base 3 number 2012_3 to base 10.
8. What is the smallest possible area, in square meters, of an isosceles triangle with sides measuring 10 m and 12 m?
9. In the cryptarithm below where each instance of a letter represents the same digit (0-9) and no two letters represent the same digit, what is the largest possible value of the four-digit number ABCD?
$$\begin{array}{r} AA \\ \times B \\ \hline CDA \end{array}$$
10. When $(2j+3)^3$ is completely expanded and like terms are combined, what is the coefficient of the j^2 term?

Tiebreakers:

1. A five-element data set of integer test scores between 0 and 100 inclusive has a mode of 92 a mean of 74 and a median of 68. What is the smallest possible value of one of the test scores?
2. In a survey of 382 math club members, 114 enjoyed arithmetic, 203 enjoyed algebra, and 258 enjoyed geometry. If 86 enjoyed both arithmetic and algebra, 92 enjoyed both arithmetic and geometry, 135 enjoyed both algebra and geometry, and 73 enjoyed all three, how many of the surveyed math club members enjoyed none of these subjects?

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Probability Test – 8th Grade

1. When two fair six-sided dice are rolled, what is the probability that the sum of the numbers on their upper faces is five?
2. When two cards are drawn without replacement from a standard 52-card deck, what is the probability that they are the same suit?
3. Of the 35 students in Mr. Smith’s class, eight are in math club and eleven are in game club. If 20 students are in neither club, how many students are in both clubs?
4. Bag B contains three red marbles and two green marbles. Bag C contains two red marbles and one green marble. If a marble is drawn from each bag, what is the probability the two marbles are the same color?
5. A bag contains three white marbles and three black marbles. When two marbles are drawn, what is the probability they are both white?
6. In how many ways can the letters in the word “DIVISION” be arranged?
7. Bag J contains two blue and three white marbles. Bag K contains one blue and four white marbles. If a single marble is drawn from Bag J and placed in Bag K, and then a marble is drawn from Bag K, what is the probability that this final marble is white?
8. When four fair coins are flipped, what is the probability that exactly two of them show heads?
9. My bookshelf has three shelves, each of which can hold up to five books. My book collection is four J.R.R. Tolkein books, three E.B. White books and two Lewis Carroll books. If books by the same author must be touching one another, in how many ways can I arrange my books on the bookshelf?
10. Four pieces of candy are to be distributed among six people. In how many ways can this be done, if at least two people must receive candy?

Tiebreaker:

1. In the array of unit squares to the right, how many paths are there from the upper left corner to the lower right corner going only right or down along the gridlines?
2. In a certain game, you roll a single die on your turn and receive points based on what you roll. If you roll less than four, you receive only one point. Otherwise, you receive a number of points equal to the square of the number you roll. On average, what is the expected number of points you will receive on a single turn?

