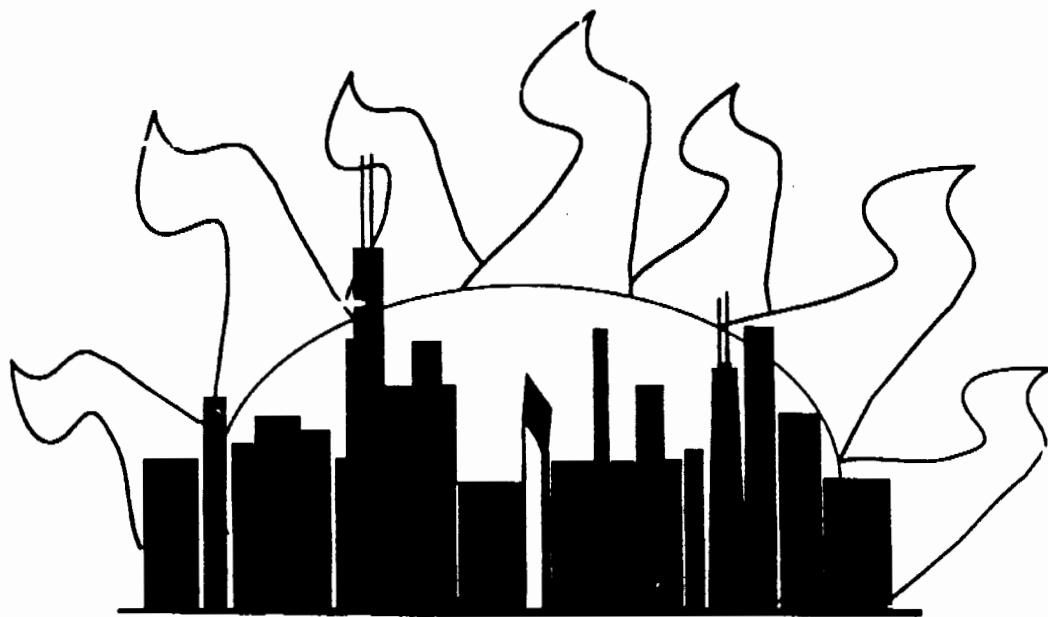# Ratio, Proportion & Variation


Mu Alpha Theta National Convention
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General Instructions:

1. Unless otherwise stated all answers should be written as decimals.

2. If you are asked to give your answer as a fraction, please give your answer in $\frac{a}{b}$ form where a and b are relatively prime.

Questions

1. Suppose x varies inversely as the square of y. If $x = 15$ when $y = \frac{1}{3}$, find x when $y = \frac{4}{5}$. Give your answer as a decimal rounded to the nearest thousandth.

2. The I. Q. of a Martian varies directly with the square of the number of tentacles it has. If a Martian with 5 tentacles has an I. Q. of 75, find the I. Q. of a Martian with 8 tentacles.

3. Given that y^2 varies inversely as x^3. If $y = 3$ when $x = 2$, for $y > 0$, find y when $x = 9$.

4. Find the measure, in degrees, of the largest exterior angle of a convex pentagon whose exterior angles are in the ratio $1 : 2 : 3 : 4 : 5$.

5. Suppose z varies jointly as x and y^3 and inversely as w^2. If $z = 12$ when $x = 3$, $y = 2$, $w = 5$, find z when $x = 4$, $y = 3$, $w = 6$. Give your answer as a simplified fraction in lowest terms.

6. An elephant weighing 2.64 tons and a rabbit weighing one pound are balanced on a very long, perfectly rigid seesaw. If the elephant starts sliding toward the fulcrum (balancing point of the seesaw) at the uniform rate of 1 foot per minute, how many miles per hour must the rabbit run in order to maintain the balance? (1 ton = 2000 pounds, 1 mile = 5280 feet)

7. The measure of the angles of a triangle are in the ratio $189 : 286 : 425$. Find the measure, in degrees, of the largest angle.

8. Sally, Dick and Jane earn S, D and J dollars, respectively, from their dog walking businesses. These monetary quantities satisfy the following ratios $S : D = 7 : 12$ and $D : J = 3 : 7$. If the total earnings were $141, find the value of D. Do not include $ in your answer.

9. The sides of a right triangle are in the ratio of $7 : 24 : 25$. The area of the triangle is 3024 square centimeters. What is the length, in cm., of the hypotenuse of the triangle?

10. The electrical resistance of a wire is directly proportional to its length and inversely proportional to the square of its diameter. A wire 400 meters long, with diameter 0.6 mm, has a resistance of 2.5 ohms. Find the resistance, in ohms, of a wire, made of the same metal, that is 80 meters long with diameter 0.3 mm.

11. The height of a certain tree is proportional to the square root of its age. The tree was cut down April 27, 1998. If the tree had lived $4\frac{1}{4}$ years longer, it would have increased its height by 12.5% of its height when planted. In what year was the tree planted?

12. The pitch of a roof is defined as the rise per unit of horizontal distance. What is the pitch of a roof if one end of a 17 foot rafter is 8 feet above the other end? Give your answer as a simplified fraction in lowest terms.

13. If there were 12 more boys on the Jack Benny Math Team, the ratio of boys to girls on the team would be 2 : 1. If there were 6 more girls on the team, the ratio of girls to boys would be 2 : 1. How many girls are on the team?

14. The gravitational force between two bodies varies jointly with the weight of the bodies and inversely with the square of the distance between them. The centers of two rocks, A and B, are placed one meter apart. Rock A weighs four times as much as rock B. How far, in meters, from rock A should a third rock, C, be placed so that the force between A and C is the same as the gravitational force between B and C ? Assume that C is between A and B. Give your answer as a simplified fraction in lowest terms.

15. Quadrilateral ABCD is a rectangle. What is the ratio of the shaded area of the rectangle to the unshaded area of the rectangle? Write your answer as a simplified fraction in lowest terms.
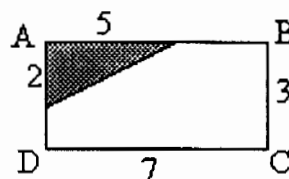
16. The amount of ping when you hit a softball is directly proportional to the amount of oomph in your swing and inversely proportional to the amount of klunk in the hit. On your first hit the ping has a measure of 7. On your second hit you triple the amount of oomph and have only half the amount of klunk in the hit. What is the measure of ping in your second hit?

17. If eggs had cost x cents less per dozen, it would have cost 3 cents less for $x + 3$ eggs than if they had cost x cents more per dozen. Find the value of x.

18. The costs to a concessionaire at a ball game are partly fixed and partly vary directly as the number of people in attendance. If 4000 people attend the game, the concessionaire's costs will be $1300. If 2800 people attend, his costs will be $970. Find his costs, in dollars, if only 1000 people attend.

19. On a plane, two men together had 135 kilograms of luggage. The first paid $1.35 for his excess luggage and the second man paid $2.70 for his excess luggage. Had all of the luggage belonged to one person, the excess luggage charge would have been $8.10. At most how many kilograms of luggage is each person permitted to bring on the plane free of additional charge?

20. In $\triangle ABC$, DP = 1, AP = 7, EP = 3 and CP = 5. What is the ratio of the area of $\triangle APC$ to the area of $\triangle ABC$?