

Variations: Direct, Inverse, Joint, and Power Models

Variation Formulas:

Direct Variation

y varies directly as x

$$y = kx$$

Inverse Variation

y varies inversely as x

$$y = k/x \text{ or } xy = k$$

Translate each statement into a formula. Use k as the constant of variation.

1. V varies inversely as B
2. P varies directly as the square of V
3. The volume, V, of gas varies inversely as the pressure, P.
4. The distance, D, a free-falling object falls varies directly as the square of the time, T, that it falls.

Solve each of the following:

5. Find y when $x = -6$, if y varies directly as x and $y = 8$ when $x = 2$.
6. Find y when $x = 3$, if y varies inversely as x and $x = 4$, when $y = 16$.
7. Find y when $x = 1.5$, if y varies directly as x and $y = -16$ when $x = 8$.
8. Find y when $x = 4$, if y varies directly as x and $y = 9$ when $x = 1.5$

Solve the following word problems:

9. The price, P, of a diamond varies directly as the square of the weight, W. If a 1 carat diamond costs \$2000, find the price of a 0.7 carat diamond.
10. The distance, D that a free falling object falls varies directly as the square of the time, T, that it falls. If an object has fallen 36 meters in 3 seconds, find the distance it would have fallen in 5 seconds.
11. The amount of sales tax varies directly to the cost of an item. If the sales tax on an item that costs \$250 is \$12.50, what is the sales tax on an item that costs \$40?
12. The number of calories, C, a person burns and the time, T (in minutes), the person spends performing an activity vary directly. A 150-pound person can burn off 75 calories sitting in class for 30 minutes. How long must a 150-pound person sit in class to burn off 545 calories?

13. The amount of material, needed to cover a ball is directly proportional to the square of the radius, R . If a ball of radius 2 requires 60 square centimeters of materials to cover, how much material would a ball of radius 7 cm require?
14. The price, P , of a pizza varies directly as the square of its radius, R . If a pizza with a diameter of 20 centimeters costs \$6.00, what would pizza with a radius of 12 centimeters cost?
15. When air is pumped into a tire, the pressure required varies inversely as the volume of the air. If the pressure is 30 lb. per square inch when the volume is 140 cubic inches, find the pressure when the volume is 100 cubic inches.
16. A bicycle uses two gears so that a shaft can turn at different speed than the pedals. The speed of the gears varies inversely as the number of teeth in the gear. If one gear has 35 teeth and is moving at 50 revolutions per minutes, how fast is the second gear going if it has 25 teeth?
17. The rate of travel by plane over a given distance is inversely proportional to the time traveled. At 550 mph it takes 4.5 hours to go from Los Angeles to New York City. How fast will the plane fly if it makes the same trip in 5 hours?
18. Boyle's law states that for a constant temperature, the pressure of a gas varies inversely with its volume. A sample of hydrogen gas has a volume of 8.56 liters at a pressure of 1.5 atmospheres. Find the pressure at a volume of 10.5 liters.
19. A company has found that the monthly demand for one of its products varies inversely with the price of the product. When the price is \$12.50, the demand is 12,000 units. Find the demand when the price is \$15.50.
20. Intensity varies inversely with the square of its distance. At a distance of 1 meter, the intensity of jet engine noise is 10 watts per square meter. An airport cargo worker is 15 meters from the jet engine. What is the sound intensity at 15 meters?