Joint Variation

1. P varies jointly with Q and R. When P = 98, Q = 2 and R = 7.
   Find an equation connecting P, Q and R. hence find P when Q = 15 and R = 8.

2. A varies as the square of B and inversely as C. When A is 6, B is 5 and C = 100.
   Calculate A when B is 12 and C = 72.

3. H varies directly as the square of L and inversely as the square root of M. When H is 10, L is 4 and m is 64.

   (a) Find an equation connecting H, L and M.
   (b) Find H when L is 12 and M is 256.

4. M varies as N and as the square root of P. When M = 9, N = 3 and P = 36.
   Calculate N when M = 20 and P = 100.

5. The safe load W of a beam supported at each end varies as the breadth of the beam b and the square of its depth d. It also varies inversely as the distance x between the beams.
   It is known that W = 8400 when b = 7.5, d = 5 and x = 5.

   (a) Find a formula for W in terms of b, d and x.
   (b) Find W given b = 6, d = 12 and x = 4.

6. The volume, V cubic centimetres, of a certain gas varies directly as the temperature, t^o, and inversely as the pressure, P mmHg.
   At a temperature of 250^0 and a pressure of 750 mmHg, the volume is 200 cm^3.

   (a) Find a formula connecting V, t and P.
   (b) Calculate the volume of the gas at a temperature of 350^0 and a pressure of 1000mmHg.

7. The time, t seconds, taken by a child to slide down a chute varies directly as the length, L metres, of the chute and the inversely as the square root of the height, H metres, of the chute above the ground.
   It takes 10 seconds to slide down a chute 3.75 metres long and 2.25 metres high.

   How long does it take to slide down a chute 5 metres long which is 2.56 metres high?

8. The weight, W kilograms, of a cylindrical metal pole varies as its length, L centimetres, and as the square of its diameter, D centimetres.
A pole 120 cm long and with diameter 8 cm weighs 14.4 kg.

Calculate the length of a pole with diameter 12 cm and weighing 67.5 kilograms.

9. The number of litres of petrol, L, used by a car on a journey varies directly as the distance, d km, travelled and as the square root of the average speed , s kmph.
The car uses 30 litres of petrol for a journey of 550 km at an average speed of 81 kmph.

(a) Find a formula connecting L, d and s.
(b) How many litres of petrol would be used on a journey of 693 km at an average speed of 100kmph?

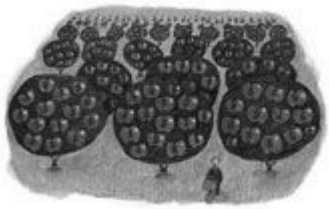
10. The time, T minutes, taken for a stadium to empty varies directly as the number of spectators, S, and inversely as the number of open exits, E.
It takes 12 minutes for a stadium to empty when there are 20 000 spectators and 20 open exits.

(a) Find a formula connecting T, s and E.
(b) How long does it take to empty the stadium when there are 36 000 spectators and 24 open exits?

11. The force, F newtons, needed to stop a train varies as the square of the speed, S kmph, of the train and inversely as the stopping distance, D metres.
It is known a force of 300 newtons is required to stop a train travelling at a speed of 60 kmph in a distance of 1200 metres.

(a) Calculate the force needed to stop a train travelling at a speed of 50 kmph in a distance of 800 metres.
(b) Calculate the distance it would take a train to stop if it was travelling at 40 kmph and a force of 256 newtons was applied.

12. The time, T hours, taken to harvest an orchard varies directly as The area, A m^2, of the orchard and inversely as the number of workers used, N.
An orchard with an area of 1200 m^2 can be harvested by 8 workers in a time of 6 hours.



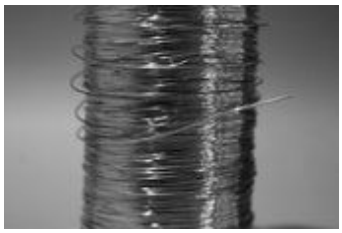
How much time could have been saved if 10 workers had been used to harvest the orchard?

13. As the drum of a washing machine spins it exerts a force on the clothes inside it, forcing them against the side of the drum.
The force, F newtons, varies directly as the square of the speed of the drum, S metres per second, and the mass, M kilograms, of the clothes in the drum and also inversely as the radius of the drum, R centimetres.

A drum of radius 20 cm spinning at 20 mps and containing 2 kg of clothes exerts a force of 33.75 newtons.

Calculate the force exerted if this machine spins at the same speed but the weight of clothes is doubled.

14. The electrical resistance, R, of copper wire varies directly as its length, L metres, and inversely as the square of its diameter D millimetres.
A piece of copper wire 8 metres long with diameter 4 millimetres has resistance 7.5.



Calculate the resistance of a piece of copper wire 10 metres long with diameter 2.5 millimetres.