

- 1 (a) Given that y is directly proportional to the cube root of x , and that $y = 18$ when $x = 27$,
 (i) Express y in terms of x .
 (ii) Calculate the value of y when $x = 125$.
 (b) The number of days, y , taken to dig a canal is inversely proportional to the square of x , the number of machines used. It takes 100 days to dig the canal if 4 machines are used. Find the number of days it will take if 8 machines are used.
- 2 Given that y varies as $(x^2 + 1)$ and $y = 15$ when $x = 2$,
 (a) express y in terms of x ,
 (b) find the value of y when $x = 1$.
- 3 Given that y is directly proportional to $x^2 - 1$, and that $y = 1$ when $x = 2$.
 (a) Express y in terms of x ,
 (b) Calculate the value(s) of x when $y = 8$.
- 4 Given that p is inversely proportional to $(1 - 2q)^2$, and that $p = 5$ when $q = 3$.
 (a) Express p in terms of q .
 (b) Calculate the value(s) of q when $p = 20$.
- 5 Given that p is inversely proportional to the square root of $(2q + 1)$ and that $p = 6$ when $q = 4$, find q when $p = 4\frac{1}{2}$.
- 6 The variables x and y are connected by the equation $y = k(x + 1)^2$, where k is a constant. Pairs of corresponding values are given in the table below.

x	3	-2	n
y	32	m	8

Calculate

- (a) k , (b) m , (c) the possible values of n .
- 7 Given that y is inversely proportional to $\sqrt{x} - 1$, and that $y = 2$ when $x = 9$.
 (a) Express y in terms of x .
 (b) Calculate the value of x when $y = 5$.
- 8 (a) y is inversely proportional to the square root of $(x + 2)$. It is given that $y = 4$ when $x = 2$. Find y when $x = 7$.
 (b) If y varies directly as the cube root of $x + 1$ and that $y = 12$ when $x = 26$, find the value of x when $y = 8$.
- 9 It is given that y is directly proportional to $(x + 1)^2$,
 (a) Write down an expression for y in terms of x and a constant k .
 (b) If $y = \frac{1}{3}$ when $x = 2$, find the value of y when $x = 6$.

- 10 (a) The kinetic energy E , of a toy car is directly proportional to the square of its velocity v . The difference in the kinetic energy of the car when it is travelling at 15 cm/s and 20 cm/s is 10 J. Find the kinetic energy of the toy car when it is travelling at 12 cm/s.
- (b) The commission, $\$C$, charged at a rate of 11%, varies directly as the amount of sales, $\$S$. Find the formula relating C and S . Calculate S when $C = 115$, giving your answer to the nearest dollar.
- 11 The Goods and Services Tax (GST), $\$T$, on a purchase of $\$m$, is at a rate of 5%, varies directly as the purchase amount.
Find the formula relating T and m . Calculate m when $T = 0.72$. (10.40)
- 12 The interest, $\$I$, on a loan of $\$P$ for a year at a rate of 8% per annum, is directly proportional to the loan.
- (a) Write down the formula relating I and P .
- (b) Calculate P when $I = 120$.
- 13 If y varies directly as $\sqrt{2x+1}$ and if the difference in the values of y when $x = 4$ and $x = 12$ is 6, find the value of x when $y = 21$.
- 14 The resistance R of a copper wire of constant length varies inversely as the square of its diameter, d . If the difference in resistance of two wires of diameter 1 mm and 3 mm is 10 ohms, find the resistance of a wire with diameter 5 mm.
- 15 A lighthouse is being built in order to guide ships into a new harbour. When viewed from a certain distance (D km), the illumination factor (I) of the light is given as 30 and when the same light is viewed 2km closer, the illumination factor is 4 times bigger. (12)
Given that the illumination factor is inversely proportional to the square of its viewing distance, find the illumination factor when the same light is viewed 3.5km closer.
- 16 The air resistance, R newtons, to the motion of a vehicle is directly proportional to the square root of its speed, v km/h. Sherrie cycled to school at an average speed of 0.25 km/h, and cycled home at an average speed of 0.49 km/h. There was an increase in air resistance of 18 newtons on her trip home. She cycled to the library later in the day and the air resistance is 50 newtons.
Calculate her average speed for her trip to the library.
- 17 (a) During the preparation of a Project Fair, it was estimated that it would take 40 helpers to design and set up the exhibits in 7 days. Later, it was realised that the job must be completed in 4 days.
Assuming that each helper works at the same speed, how many more helpers would be needed instead?
- (b) Given that p varies directly as q and $\sqrt{q}$ varies inversely as t^2 , show how p varies with t .

- 18 (a) The amount that a man donates to charity is directly proportional to his earnings. Given that his current monthly salary is \$1800 and he donates \$200 a month to charity, calculate how much he would have to earn if he would like to donate \$300 a month to charity.
- (b) 10 students volunteer to help fold paper stars for a charity project. If an additional 5 students help out, they will be able to finish the job 3 days earlier. The number of days required to finish the job is inversely proportional to the number of students who help out. Find the additional number of students needed to help out in order to finish the job 4 days earlier.
- 19 The force of attraction, F , between two electrically charged particles is inversely proportional to the square of the distance, d , between them. Two charged particles are placed 5 cm apart. If they are placed an additional 1 cm apart, the force is reduced by 0.02 N.
How far apart should the two particles be placed such that the force is 1 N?