Direct Proportion

There is direct proportion between two variables when one variable is a simple multiple of the other

$y \propto x$ means y is proportional to x

We write $y = kx$ for some constant k

Exercise 22A

Ex 1 T is directly proportional to M

$T = 20$ when $M = 4$

Find the relationship between T and M

$$T = kM$$

$\left.\begin{array}{l} T=20 \\ M=4 \end{array}\right\}$

$$20 = 4k$$

$$\frac{20}{4} = k$$

$$5 = k$$

$$\therefore \underline{T = 5M}$$

a) Find T when $M = 3$

$$T = 5 \times 3$$

$$\underline{T = 15}$$

b) Find M when $T = 10$

$$10 = 5M$$

$$\frac{10}{5} = M$$

$$\underline{M = 2}$$

Ex 2 W is directly proportional to F

$W = 45$ when $F = 3$

Find relationship between W and F

$$W = kF$$

$\left.\begin{array}{l} W = 45 \\ F = 3 \end{array}\right\}$

$$45 = 3k$$

$$\frac{45}{3} = k$$

$$15 = k$$

$$\underline{W = 15F}$$

a) Find W when $F = 5$

$$W = 15 \times 5$$

$$\underline{W = 75}$$

b) Find F when $W = 90$

$$90 = 15F$$

$$\frac{90}{15} = F$$

$$\underline{F = 6}$$

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3) $Q = kP$

$$100 = 2k$$

$$\frac{100}{2} = k$$

$$50 = k$$

$\left\{\begin{array}{l} Q = 100 \\ P = 2 \end{array}\right.$

$$\underline{Q = 50P}$$

a) Find Q when $P = 3$

$$Q = 50 \times 3$$

$$\underline{Q = 150}$$

b) Find P when $Q = 300$

$$300 = 50P$$

$$\frac{300}{50} = P$$

$$\underline{P = 6}$$

5) D = Distance T = Time

$$D = kT$$

$$105 = 3k$$

$$\frac{105}{3} = k$$

$$35 = k$$

$$\begin{cases} D = 105 \\ T = 3 \end{cases}$$

$$\underline{D = 35T}$$

Find D when $T = 5$ hrs

$$D = 35 \times 5$$

$$\underline{D = 175 \text{ miles}}$$

Find T when $D = 280$ miles

$$280 = 35T$$

$$\frac{280}{35} = T$$

$$\underline{T = 8 \text{ hrs}}$$

6) $C = kW$

$$\begin{cases} W = 250 \text{ kg} \\ C = £47.50 \end{cases}$$

$$47.5 = 250k$$

$$\frac{47.5}{250} = k$$

$$0.19 = k$$

$$C = 0.19W$$

Find C when $W = 350$ kg

$$C = 0.19 \times 350$$

$$C = £66.50$$

Find W when $C = £33.25$

$$33.25 = 0.19W$$

$$\frac{33.25}{0.19} = W$$

$$\underline{W = 175 \text{ kg}}$$

Exercise 22B

1) T is directly proportional to x^2

$T = 36$ when $x = 3$

Find relationship between T and x.

$$T = kx^2$$

$T = 36$, $x = 3$

$$36 = k \times 3^2$$

$$36 = 9k$$

$$\frac{36}{9} = k$$

$$4 = k$$

$$\underline{T = 4x^2}$$

a) Find T when $x = 5$

$$T = 4 \times 5^2$$

$$T = 100$$

b) Find x when $T = 400$

$$400 = 4x^2$$

$$\frac{400}{4} = x^2$$

$$100 = x^2$$

$$\sqrt{100} = x$$

$$x = \pm 10$$

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3) E varies directly $\sqrt{C}$

$E = 40$ when $C = 25$

Find relationship connecting E to C

$$E = k\sqrt{C}$$

$E = 40$, $C = 25$

$$40 = k\sqrt{25}$$

$$40 = 5k$$

$$\frac{40}{5} = k$$

$$8 = k$$

$$\underline{E = 8\sqrt{c}}$$

a) Find E when C=49

$$E = 8\sqrt{49}$$

$$E = 8 \times 7$$

$$\underline{E = 56}$$

b) Find c when E = 10.4

$$10.4 = 8\sqrt{c}$$

$$\frac{10.4}{8} = \sqrt{c}$$

$$1.3 = \sqrt{c}$$

$$1.3^2 = c$$

$$\underline{c = 1.69}$$