CHAPTER 4 Equations
4.4 Modelling With Formulas
Rearranging Formulas to Isolate Variables

Example:

a) Businesses calculate profit P in terms of revenue R and costs C using the formula $P = R - C$. Rearrange this formula to express R in terms of P and C. Then, find the revenue required to make a profit of $500 when costs are $1800.

b) The cost of storing a boat at the Municipal Marina is calculated using the formula $C = 50m + 10l$, where m is the storage time in months, and l is the length of the boat in metres. Rearrange this formula to express the time in months in terms of the cost and the length of the boat. Rudy has a 12-m boat, and has budgeted $420 for storage costs. How long can he store the boat for?

Solution:

a)

$$\begin{aligned} P &= R - C \\ P + C &= R - C + C \\ P + C &= R \\ R &= P + C \\ R &= 500 + 1800 \\ &= 2300 \end{aligned}$$

A revenue of $2300 is required to make a profit of $500 when costs are $1800.

b)

$$\begin{aligned} C &= 50m + 10l \\ C - 10l &= 50m + 10l - 10l \\ C - 10l &= 50m \\ \frac{C - 10l}{50} &= \frac{50m}{50} \\ \frac{C - 10l}{50} &= m \\ m &= \frac{C - 10l}{50} \\ &= \frac{420 - 10 \times 12}{50} \\ &= \frac{420 - 120}{50} \\ &= 6 \end{aligned}$$

Rudi can store his boat for 6 months for $420.

Practice:

1. On a trip to the USA, Belinda calculated the relation between litres and US gallons using the formula $L = 3.79G$. Rearrange this formula to express gallons in terms of litres. The fuel tank of Belinda's car holds 60 L. Find the capacity of the fuel tank in gallons.

2. The pilot of a commercial aircraft approaching an airport calculates the time to landing t, in minutes, from the formula $t = \frac{h}{d}$, where h is the altitude, in metres, and d is the rate of descent, in metres per minute. Rearrange the formula to express d in terms of t and h. Then, find the rate of descent required to land in 10 min from an altitude of 800 m.

Answers:

1. $G = \frac{L}{3.79}$, 15.8 gal **2.** $d = \frac{h}{t}$, 80 m/min