**1 a**

$$4(x - 2) = 60$$
$$4x - 8 = 60$$
$$4x = 60 + 8$$
$$= 68$$
$$x = 17$$

**b** The length of the square is $\dfrac{2x + 7}{4}$.

$$\left(\dfrac{2x + 7}{4}\right)^2 = 49$$
$$\dfrac{2x + 7}{4} = 7$$
$$2x + 7 = 7 \times 4 = 28$$
$$2x = 28 - 7 = 21$$
$$x = 10.5$$

**c** The equation is length $=$ twice width.

$$x - 5 = 2(12 - x)$$
$$x - 5 = 24 - 2x$$
$$x + 2x = 24 + 5$$
$$3x = 29$$
$$x = \dfrac{29}{3}$$

**d**

$$y = 2((2x + 1) + (x - 3))$$
$$= 2(2x + 1 + x - 3)$$
$$= 2(3x - 2)$$
$$= 6x - 4$$

**e** $Q = np$

**f** If a 10% service charge is added, the total price will be multiplied by 110%, or 1.1.
$R = 1.1pS$

**g** Using the fact that there are 12 lots of 5 min in an hour ($60 \div 12 = 5$),
$$\dfrac{60n}{5} = 2400$$

**h** $a = \text{circumference} \times \dfrac{60}{360}$
$$= 2\pi(x + 3) \times \dfrac{60}{360}$$
$$= 2\pi(x + 3) \times \dfrac{1}{6}$$
$$= \dfrac{\pi}{3}(x + 3)$$

**2** Let the value of Bronwyn's sales in the first week be $\$s$.

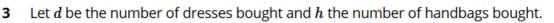$$s + (s + 500) + (s + 1000)$$
$$+ (s + 1500) + (s + 2000)$$
$$= 17500$$
$$5s + 5000 = 17500$$
$$5s = 12500$$
$$s = 2500$$

The value of her first week's sales is $2500.

**3** Let $d$ be the number of dresses bought and $h$ the number of handbags bought.

$$65d + 26h = 598$$
$$d + h = 11$$

Multiply the second equation by 26 (the smaller number).

$$65d + 26h = 598 \quad ①$$
$$26d + 26h = 286 \quad ②$$

① − ②:

$$39d = 312$$
$$d = \frac{312}{39} = 8$$
$$h + 8 = 11$$
$$h = 3$$

Eight dresses and three handbags.

**4** Let the courtyard's width be $w$ metres.

$$3w + w + 3w + w = 67$$
$$8w = 67$$
$$w = 8.375$$

The width is 8.375 m.

The length $= 3 \times 8.375 = 25.125$ m.

**5** Let $p$ be the full price of a case of wine. The merchant will pay 60% (0.6) on the 25 discounted cases.

$$25p + 25 \times 0.6p = 2260$$
$$25p + 15p = 2260$$
$$40p = 2260$$
$$p = 56.5$$

The full price of a case is $56.50.

**6** Let $x$ be the number of houses with an $11 500 commission and $y$ be the number of houses with a $13 000 commission.

We only need to find $x$.

$$x + y = 22$$

$$11\ 500x + 13\ 000y = 272\ 500$$

To simplify the second equation, divide both sides by 500.

$$23x + 26y = 545$$

Using the substitution method:

$$23x + 26y = 545$$
$$y = 22 - x$$
$$23x + 26(22 - x) = 545$$
$$23x + 572 - 26x = 545$$
$$-3x = 545 - 572$$
$$= -27$$
$$x = 9$$

He sells nine houses with an $11 500 commission.

**7** It is easiest to let the third boy have $m$ marbles, in which case the second boy will have $2m$ marbles and the first boy will have $2m - 14$.

$$(2m - 14) + 2m + m = 71$$
$$5m - 14 = 71$$
$$5m = 85$$
$$m = 17$$

The first boy has 20 marbles, the second boy has 34 and the third boy has 17 marbles, for a total of 71.

**8** Let Belinda's score be $b$.

Annie's score will be 110% of Belinda's or $1.1b$.

Cassie's will be 60% of their combined scores:

$$0.6(1.1b + b) = 0.6 \times 2.1b$$
$$= 1.26b$$
$$1.1b + b + 1.26b = 504$$
$$3.36b = 504$$
$$b = \frac{5.04}{3.36}$$
$$= 150$$

Belinda scores 150

Annie scores $1.1 \times 150 = 165$

Cassie scores $0.6 \times (150 + 165) = 189$

**9** Let $r$ km/h be the speed Kim can run. Her cycling speed will be $(r + 30)$ km/h. Her time cycling will be $48 + 48 \div 3 = 64$ min. Converting the times to hours ($\div 60$) and using **distance = speed × time** gives the following equation:

$$r \times \frac{48}{60} + (r + 30) \times \frac{64}{60} = 60$$
$$48r + 64(r + 30) = 60 \times 60$$
$$48r + 64r + 1920 = 3600$$
$$112r + 1920 = 3600$$
$$112r = 1680$$
$$r = \frac{1680}{112} = 15$$

She can run at **15 km/h**

**10** Let $c$ g be the mass of a carbon atom and $x$ g be the mass of an oxygen atom.

( $o$ is too confusing a symbol to use)

$$2c + 6x = 2.45 \times 10^{-22}$$
$$x = \frac{c}{3}$$

Use substitution.

$$2c + 6 \times \frac{c}{3} = 2.45 \times 10^{-22}$$
$$2c + 2c = 2.45 \times 10^{-22}$$
$$4c = 2.45 \times 10^{-22}$$
$$c = \frac{2.45 \times 10^{-22}}{4}$$
$$= 6.125 \times 10^{-23}$$
$$x = \frac{c}{3}$$
$$= \frac{6.125 \times 10^{-23}}{3}$$
$$\approx 2.04 \times 10^{-23}$$

The mass of an oxygen atom is $2.04 \times 10^{-23}$ g.

**11** Let $x$ be the number of pearls.

$$\frac{x}{6} + \frac{x}{3} + \frac{x}{5} + 9 = x$$

$$\frac{5x + 10x + 6x}{30} + 9 = x$$

$$21x + 270 = 30x$$

$$7x + 90 = 10x$$

$$3x = 90$$

$$x = 30$$

There are 30 pearls.

**12** Let the oldest receive $\$x$.

The middle child receives $\$(x - 12)$.

The youngest child receives $\$\left(\dfrac{x - 12}{3}\right)$

$$x + x - 12 + \frac{x - 12}{3} = 96$$

$$2x - 12 + \frac{x - 12}{3} = 96$$

$$2x - 12 + \frac{x}{3} = 100$$

$$6x - 36 + x = 300$$

$$7x = 336$$

$$x = 48$$

Oldest $48, Middle $35, Youngest $12

**13** Let $S$ be the sum of her marks on the first four tests.

Then $\dfrac{S}{4} = 88$

$\therefore S = 352$

Let $x$ be her mark on the fifth test.

$\dfrac{S + x}{5} = 90$

$352 + x = 450$

$x = 98$

Her mark on the fifth test has to be 98%

**14** Let $N$ be the number of students in the class.

$0.72N$ students have black hair

After 5 leave the class there are $0.72N - 5$ students with black hair.

There are now $N - 5$ students in the class.

Hence

$$\frac{0.72N - 5}{N - 5} = 0.65$$

$$\therefore 0.72N - 5 = 0.65(N - 5)$$

$$\therefore 0.72N = 0.65N + 1.75$$

$$\therefore 0.07N = 1.75$$

$$7N = 175$$

$$N = 25$$

There were originally 25 students

**15** Amount of water in tank A at time $t$ minutes $= 100 - 2t$

Amount of water in tank B at time $t$ minutes $= 120 - 3t$

$$100 - 2t = 120 - 3t$$

$$t = 20$$

After 20 minutes the amount of water in the tanks will be the same.

**16**  Height of candle A at $t$ minutes $= 10 - 5t$
Height of candle B at $t$ minutes $= 8 - 2t$

**a**   $10 - 5t = 8 - 2t$
$$3t = 2$$
$$t = \frac{2}{3}$$
∴ equal after 40 minutes.

**b**   $10 - 5t = \frac{1}{2}(8 - 2t)$
$$10 - 5t = 4 - t$$
$$4t = 6$$
$$t = \frac{3}{2}$$
∴ half the height after 90 minutes.

**c**   $10 - 5t = 8 - 2t + 1$
$$10 - 5t = 9 - 2t$$
$$3t = 1$$
$$t = \frac{1}{3}$$
∴ one centimetre more after 20 minutes.

**17**  Let $t$ be the time the motorist drove at $100 \mathrm{km/h}$
$$100t + 90(\frac{10}{3} - t) = 320$$
$$100t + 300 - 90t = 320$$
$$10t = 20$$
$$t = 2$$
Therefore the motorist travelled **200 km** at **100 km/h**

**18**  Let v km/h be Jarmila's usual speed
Therefore distance travelled $= \dfrac{14v}{3}$ km

$v + 3$ is the new speed and it takes $\dfrac{13}{3}$ hours.
$$\therefore \frac{13}{3}(v + 3) = \frac{14v}{3}$$
$$13(v + 3) = 14v$$
$$v = 39$$
Her usual speed is **39 km/h**