



$$\begin{array}{c} \times 2 \quad \div 7 \quad + 4 \quad \times 3 \\ \boxed{x} \rightarrow \boxed{2x} \rightarrow \boxed{\frac{2x}{7}} \rightarrow \boxed{\frac{2x}{7} + 4} \rightarrow \boxed{3(\frac{2x}{7} + 4)} \end{array}$$

$$\begin{array}{c} \times 6 \quad \div 11 \quad - 3 \quad \times \frac{1}{4} \\ \boxed{x} \rightarrow \boxed{6x} \rightarrow \boxed{\frac{6x}{11}} \rightarrow \boxed{\frac{6x}{11} - 3} \rightarrow \boxed{\frac{1}{4}(\frac{6x}{11} - 3)} \end{array}$$

$$4 \quad a \quad \boxed{F} \xrightarrow{-32} \boxed{F-32} \xrightarrow{\times 5} \boxed{5(F-32)} \xrightarrow{\div 9} \boxed{\frac{5(F-32)}{9}}$$

$$b \quad 10$$

$$c \quad 95$$

$$5 \quad a \quad \boxed{n} \xrightarrow{\times 2} \boxed{2n} \xrightarrow{+10} \boxed{2n+10} \xrightarrow{\div 2} \boxed{\frac{2n+10}{2}}$$

$$b \quad \text{It is 5.}$$

$$c \quad \text{It is always 5.}$$

- 6 a Strategies include 'guess and check'. Backtracking will not work as the pronumeral  $w$  appears more than once in the equation and cannot be simplified.

$$b \quad w = 15 \text{ cm}$$

#### 11.4 Keeping equations balanced

$$1 \quad a \quad x + 5 = 11$$

$$b \quad 7x = 42$$

$$c \quad x - 4 = 2$$

$$d \quad \frac{x}{3} = 2$$

$$e \quad -4x = -24$$

$$f \quad -x = -6$$

$$g \quad -x = -6$$

$$h \quad x - 9 = -3$$

$$i \quad \frac{2x}{3} = 4$$

$$j \quad \frac{3x}{2} = 9$$

$$k \quad x - \frac{2}{3} = 5\frac{1}{3}$$

$$2 \quad a \quad 2x = 4$$

$$b \quad x = 2$$

$$3 \quad a \quad x + 3 = 5$$

$$b \quad x = 2$$

$$4 \quad a \quad 3x + 1 = 7$$

$$b \quad 3x + 4 = 10$$

$$5 \quad a \quad 2x + 1 = 5$$

$$b \quad 4x + 2 = 10$$

$$6 \quad B$$

$$7 \quad E$$

$$8 \quad C$$

$$9 \quad C$$

$$10 \quad a \quad m + 16 = 17$$

$$b \quad n - 5 = 3$$

$$c \quad 2p + 6 = 12$$

$$d \quad 12m = 48$$

$$e \quad 2n = 6$$

$$f \quad 2p = 30$$

$$g \quad 12p + 28 = 8$$

$$h \quad \frac{5m + 3}{3} = \frac{-1}{3}$$

$$i \quad ax + 5a = 7a$$

- 11 a Add 4 to both sides.

- b Add 6 to both sides.

- c Multiply both sides by 3.

- d Multiply both sides by 2.

- e Add 2 to both sides, then multiply both sides by 4.

- f Multiply both sides by 4, then add 2 to both sides.

- 12 a They have subtraction and division in the expressions and these cannot be represented on a pan balance scale.

- b In part e, the pronumeral is divided by 4 and then 2 is subtracted from the result. In part f, 4 is subtracted from the pronumeral and then the result is divided by 2.

$$13 \quad a \quad x = 14 \quad b \quad x = 9 \quad c \quad w = 21$$

$$d \quad e = 18 \quad e \quad q = 48 \quad f \quad q = 42$$

$$14 \quad a \quad 5x = 3$$

$$x = \frac{3}{5}. \text{ One bag of sugar weighs } \frac{3}{5} \text{ kg.}$$

$$b \quad 4x + 2.70 = 9.90$$

$$x = 1.8. \text{ One chocolate bar costs \$1.80.}$$

$$c \quad 3x + 500 = 920$$

$$x = 140. \text{ One apple weighs 140 g.}$$

#### Challenge 11.1

##### Weigh 1:

The least number of weighings is two. Take 6 coins and place 3 coins on each side of the balance. There is a remainder of 2 unweighed coins. If the 6 coins balances, the heavy coin must be one of the 2 unweighed coins.

##### Weigh 2:

If the 6 coins do not balance, the heavy coin must be one of the 3 coins on the heavy side of the balance (the side that drops lower than the other). Take the 3 coins, place one coin on each side of the empty balance, so that there are 2 coins on the scale at a time. If the balance balances, the heavy coin is the coin not on the balance. If the balance does not balance, the heavy coin is on the heavy side of the balance.

#### 11.5 Using algebra to solve problems

$$1 \quad a \quad x = -1$$

$$b \quad r = -5$$

$$c \quad t = 24$$

$$d \quad w = 2.7$$

$$e \quad m = \frac{1}{2}$$

$$f \quad j = -\frac{19}{7} \text{ or } -2\frac{5}{7}$$

$$g \quad q = 19$$

$$h \quad r = 9$$

$$i \quad t = 32$$

$$j \quad y = 14.5$$

$$k \quad z = -\frac{19}{21}$$

$$l \quad f = \frac{4}{13}$$

$$2 \quad a \quad d = 8$$

$$b \quad p = -14$$

$$c \quad u = \frac{4}{5} \text{ or } 0.8$$

$$d \quad g = 5$$

$$e \quad m = \frac{1}{32}$$

$$f \quad j = -\frac{1}{15}$$

$$g \quad t = 24$$

$$h \quad k = -60$$

$$i \quad l = -21.2$$

$$j \quad v = 4$$

$$k \quad c = -\frac{5}{3} \text{ or } -1\frac{2}{3}$$

$$l \quad h = -\frac{35}{12} \text{ or } -2\frac{11}{12}$$

$$3 \quad a \quad m = 3$$

$$b \quad w = -5$$

$$c \quad k = -4$$

$$d \quad t = -3$$

$$e \quad m = 1$$

$$f \quad n = -18$$

$$g \quad k = -9$$

$$h \quad s = -7$$

$$i \quad m = 3.5$$

$$j \quad p = -14$$

$$k \quad g = -3$$

$$l \quad f = 5$$

$$m \quad q = 9.05$$

$$n \quad r = -3.2$$

$$o \quad t = 3.6$$

$$p \quad k = -0.2$$

$$q \quad g = -\frac{1}{4} \text{ or } -0.25$$

$$r \quad f = \frac{15}{16}$$

$$4 \quad a \quad x = 21$$

$$b \quad x = 9$$

$$c \quad m = -17$$

$$d \quad h = -12$$

$$e \quad m = -20$$

$$f \quad w = -10$$

$$g \quad m = 2\frac{1}{3}$$

$$h \quad c = 1$$

$$i \quad m = -8$$

$$j \quad t = -37$$

$$k \quad c = -19.5$$

$$l \quad x = -20.8$$

$$5 \quad a \quad m = -5$$

$$b \quad x = -20$$

$$c \quad m = 1\frac{1}{5}$$

$$d \quad x = 3$$

$$e \quad x = -7$$

$$f \quad x = 11$$

$$g \quad x = 7$$

$$h \quad b = 10$$

$$i \quad f = -9$$

$$j \quad z = 6$$

$$k \quad m = 5$$

$$l \quad u = -11$$

$$m \quad m = -3$$

$$n \quad w = -1\frac{3}{5}$$

$$o \quad x = 8$$

$$p \quad d = 3$$

$$q \quad n = 9$$

$$r \quad t = -2$$

- 6 a The solution is not correct.

- b Alex should have subtracted 3 from both sides first before dividing both sides by 2. The solution should be  $x = 5\frac{1}{2}$ . The error made was that he didn't divide all parts of the equation by 2.

$$7 \quad a \quad x = 2$$

$$b \quad v = -2$$

$$c \quad m = -1$$

$$d \quad y = 4$$

$$e \quad y = -6$$

$$f \quad t = -5$$

$$g \quad w = 2\frac{2}{9}$$

$$h \quad w = \frac{2}{3}$$

$$i \quad u = -4$$

$$j \quad c = 6$$

$$8 \quad a \quad 2\frac{1}{2} \text{ hours}$$

- b 40 could be the charge per hour; 55 could be the flat fee covering travel and other expenses.

$$9 \quad l + 286 = 517, l = \$231$$

$$10 \quad a \quad 10x + 54 = 184, x = 13 \text{ cm} \quad b \quad 11x + 12 = 287, x = 25 \text{ cm}$$

- 11 2  
 12 Yes, when Tom is 45 and his dad is 90.  
 13 \$80 per month

11.6 Equations with the unknown on both sides

- 1 a  $x = 3$       b  $y = 4$       c  $n = 4$   
 d  $t = 4$       e  $w = 5$       f  $y = 3\frac{2}{3}$   
 g  $z = 4$       h  $a = -4$       i  $s = 2$   
 j  $k = 4$       k  $w = -3$       l  $v = -4$   
 2 a  $w = 2$       b  $b = 2$       c  $n = 2$   
 d  $s = 3$       e  $a = -3$       f  $m = 2$   
 g  $p = 4$       h  $d = 3$       i  $m = 0$   
 j  $s = 1$       k  $t = -2$       l  $x = 4$   
 3 a  $x = 3$       b  $m = 10$       c  $n = 12$   
 d  $t = 5$       e  $d = 2\frac{5}{6}$       f  $w = 1\frac{2}{9}$   
 g  $k = 10$       h  $s = -3$       i  $z = -17$   
 j  $v = 1\frac{1}{2}$       k  $m = 11\frac{2}{3}$       l  $d = 3\frac{7}{10}$   
 m  $d = -19$       n  $k = -10$       o  $v = 2$   
 p  $l = 18$   
 4  $x = -\frac{13}{33}$   
 5  $x = \frac{13}{5}$  or  $2\frac{3}{5}$   
 6 6.25 cm  
 7 a  $6(x + 3) = \frac{1}{2} \times 6 \times (x + 5 + 2)$   
 b  $x = 1$  cm  
 c Parallelogram: base 4 cm, height 6 cm, Trapezium: base 6 cm, top 2 cm, height 6 cm.  
 8 24  
 9 3  
 10 Mick is 14, his father is 42.  
 11 16  
 12 12  
 13 a i  $3x + 12$       ii  $4x + 5$   
 b  $3x + 12 = 4x + 5$   
 c  $x = 7$

- 14  $2(3w - 7) + 2w = 3w + 7$   
 $6w - 14 + 2w = 3w + 7$   
 $5w = 21$   
 $w = 4.2$   
 Rectangle lengths are 4.2 cm and 5.6 cm; triangle lengths are 4.2 cm, 5.2 cm and 10.2 cm.  
 15 a  $2.5x + 10 = 3.5x + 5$   
 $x = 5$   
 Both options cost the same for 5 rides.  
 b Option 1:  $2.5 \times 2 + 10 = \$15$ ; option 2:  $3.5 \times 2 + 5 = \$12$ .  
 Option 2 is cheaper for 2 rides.  
 16 a Let daughter's age =  $x$ . Mother's age =  $3(x + 8)$  and  $= 4(13 - x)$ .  
 b  $3(x + 8) = 4(13 - x)$   
 $3x + 24 = 52 - 4x$   
 $x = 4$   
 c The daughter is 4 and the mother is 36.  
 d The number of their house is 36.

Challenge 11.2

13 Smarties

Investigation — Rich task

- 1 1972  
 2  $t = 59.0$  s; difference of 0.4 s  
 3  $x = 56$ ,  $t = 51.6$  s  
 4 Teacher to check.  
 5  $x = 32$ ; year is 1988  
 6  $t = 50.2$  s; difference of 0.4 s  
 7  $t = 46.4$  s  
 8–12 Teacher to check.

Code puzzle

Filter 200 litres of fluid daily and make 2 litres of urine.