WALT solve problems involving ratios
Success Criteria I know ratio is an ordered comparison of quantities of the same kind and is expressed the form a:b where a and b are positive integers or 2:3
I can simplify and share ratios.

Example 26

Write as a ratio without simplifying your answer:

a Jenny has $6 and Joan has 25 cents.

b Mix 300 mL of juice with 1 L of water.

a Jenny : Joan $= \$6 : 25$ cents   {write in the correct order}
$= 600$ cents : 25 cents   {write with the same units}
$= 600 : 25$ {omit the units}

b juice : water $= 300$ mL : 1 L   {write in the correct order}
$= 300$ mL : 1000 mL   {write with the same units}
$= 300 : 1000$ {omit the units}

EXERCISE 1H.1

1 Write as a ratio without simplifying your answer:

a 7 kg is to 8 kg	**b** $27 is to $7	**c** 35 m is to 70 m
d 60 cents is to 40 cents	**e** 3 m is to 40 cm	**f** $8 is to 70 cents
g 9 kg is to 300 g	**h** 500 mL is to 3 L	**i** 20 cm is to 10 mm

SIMPLIFYING RATIOS

To simplify a ratio we can multiply or divide each number in it by the same non-zero number. We then obtain an equal ratio.

For example, $8 : 2$ simplifies to $4 : 1$ as $8 : 2 = 8 \div 2 : 2 \div 2 = 4 : 1$

Example 27

Write the following ratios in simplest form:

a $25 : 15$ **b** $0.3 : 1.5$ **c** $\frac{1}{4} : \frac{3}{4}$

a $25 : 15$
$= 25 \div 5 : 15 \div 5$
$= 5 : 3$

b $0.3 : 1.5$
$= 0.3 \times 10 : 1.5 \times 10$
$= 3 : 15$
$= 3 \div 3 : 15 \div 3$
$= 1 : 5$

c $\frac{1}{4} : \frac{3}{4}$
$= \frac{1}{4} \times 4 : \frac{3}{4} \times 4$
$= 1 : 3$

EXERCISE 1H.2

1 Express in simplest form:

    a $4:8$ **b** $6:9$ **c** $0.4:1.2$ **d** $0.9:4.5$

    e $\frac{1}{3}:\frac{2}{3}$ **f** $\frac{2}{5}:1\frac{1}{5}$ **g** $\frac{1}{5}:\frac{1}{6}$ **h** $3\frac{2}{3}:\frac{2}{3}$

2 Express in simplest form:

    a 25 cents : $1.50   **b** 250 mL : 1.75 L   **c** $2\frac{1}{2}$ m : $9\frac{1}{2}$ m

EQUIVALENT RATIOS

Ratios are **equivalent** if they can be written in the same simplest form.

Example 28

Find $\square$ if: **a** $4:7=8:\square$ **b** $18:24=\square:20$

a $4:7=8:\square$ ($\times 2$)

$\therefore \quad \square = 7 \times 2 = 14$

b $18:24=\square:20$

$\therefore \quad \square:20 = 18 \div 6 : 24 \div 6$

i.e., $\square : 20 = 3 : 4$ ($\times 5$)

$\therefore \quad \square = 3 \times 5 = 15$

EXERCISE 1H.3

1 Find $\square$ if:

    a $6:9=\square:18$ **b** $7:21=28:\square$ **c** $2:3=\square:15$

    d $10:12=25:\square$ **e** $18:32=\square:48$ **f** $25:45=10:\square$

Example 29

The ratio of berries to sugar in a jam mix is 7 kg : 3 kg. How many kilograms of berries are needed if 18 kg of sugar are used?

berries : sugar $= \square : 18$ $\therefore$ $7:3=\square:18$ ($\times 6$)   So, $\square = 7 \times 6 = 42$

$\therefore$ we need 42 kg of berries.

EXERCISE 1H.4

Solve the following problems:

1 In a garden the ratio of rose bushes to shrubs is 10 : 3. If there are 70 rose bushes in the garden, how many shrubs are there?

2 A recipe states that the ratio of flour to sugar is to be 5 kg to 2 kg. If I am using 15 kg of flour, how much sugar will I need?

3 The ratio of petrol to oil for my outboard motor is 50 : 1. How much oil is needed to be mixed with 75 litres of petrol?

4 During a season a bowler at cricket has a wicket to run ratio of 3 : 38. If in a game she takes 12 wickets, how many runs would you expect to have been scored from her bowling?

5 On TV the ratio of program time to time for advertisements is 7 : 3. During an evening there were 90 minutes of advertising. How many minutes of program time were there?

SHARING IN A GIVEN RATIO

Quantities can be shared in a given ratio by considering the number of parts the whole can be divided into.

> If a quantity is shared in the ratio $a : b$, the shared fractions are $\dfrac{a}{a+b}$ and $\dfrac{b}{a+b}$.

For example, if profits for a business are Joan : Sally $= 3 : 4$,

then Joan gets $\frac{3}{7}$ of the profit and Sally gets $\frac{4}{7}$ of it.

Example 30

Bill and Linda decide to buy a section of land for \$50 000 and to share the cost in the ratio 3 : 2. How much does each pay?

There are $3 + 2 = 5$ parts.

$\therefore$ Bill pays $\frac{3}{5}$ of \$50 000 and Linda pays $\frac{2}{5}$ of \$50 000

$\qquad\qquad = \frac{3}{5} \times \$50\,000 \qquad\qquad\qquad = \frac{2}{5} \times \$50\,000$

$\qquad\qquad = \$30\,000 \qquad\qquad\qquad\qquad = \$20\,000$

EXERCISE 1H.5

1 Share:

   a 60 kg in the ratio 1 : 4   **b** 80 m in the ratio 3 : 5

   c $2000 in the ratio 7 : 3   **d** 1800 tonnes in the ratio 5 : 1

2 A fortune of $24 000 is to be divided up in the ratio of 7 : 1. What is the larger share?

3 A cake is to be shared amongst three people in the ratio 1 : 3 : 5. If the cake weighs 900 g, what is the weight of the middle share?

4   **a** When a house was painted, the two painters split the work in the ratio 6 : 5. What fraction of the house was painted by each painter?

     b Four members of a household helped move a load of firewood in the ratio 1 : 3 : 4 : 7. What fraction of the total load did the best worker move?

5 The ratio of petrol to oil in one can is 3 : 1, and in another can the ratio is 7 : 2. If equal quantities of each can were poured into a third container, what would be the ratio of petrol to oil in this container?

6 One full container has a water and alcohol mix in the ratio 4 : 1. Another container of twice the capacity has a water and alcohol mix in the ratio 5 : 1. If the contents of both containers are mixed together what will be the ratio of water to alcohol?

Check your Answers

EXERCISE 1H.1

1 a 7 : 8 b 27 : 7 c 35 : 70 d 60 : 40
   e 300 : 40 f 800 : 70 g 9000 : 300
   h 500 : 3000 i 200 : 10

EXERCISE 1H.2

1 a 1 : 2 b 2 : 3 c 1 : 3 d 1 : 5 e 1 : 2
   f 1 : 3 g 6 : 5 h 11 : 2
2 a 1 : 6 b 1 : 7 c 5 : 19

EXERCISE 1H.3

1 a 12 b 84 c 10 d 30 e 27 f 18

EXERCISE 1H.4

1 21 shrubs 2 6 kg 3 1.5 L 4 152 runs
5 210 minutes

EXERCISE 1H.5

1 a 12 kg and 48 kg b 30 m and 50 m
   c $1400 and $600 d 1500 tonnes and 300 tonnes
2 $21 000 3 300 g
4 a $\frac{6}{11}$ by one and $\frac{5}{11}$ by the other b $\frac{7}{15}$
5 55 : 17 6 37 : 8

EXERCISE 1I (OUTLINE)

1 $^-3°C$ 2 $^-800$ m 3 $\frac{5}{12}$ 4 $24.20 5 90
6 120 7 32 700 8 48
9 a $30.40 b $\frac{11}{35}$

   c $\frac{1}{4}$ of $32.50 is $8.12 but the actual reduction
      was $5.50 so, the stated reduction was too big.

10 a $\frac{3}{20}$

    b $150 on the CD player, $90 on CDs, $270 on
       clothing

    c $90

11 a 46 cents b 14 cents per roll c $\frac{7}{23}$

    d 3572. This is probably more than they ex-
       pect to sell (depending on the size of the club).
       Costs probably cannot be reduced so increase
       the selling price.

12 Submit your complete answer to your teacher for
    marking. It should include total costs from band,