10 - 1 Ratio and Its Application

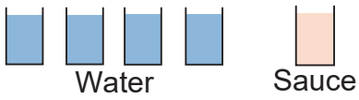
Ratio and Value of Ratio

Instruction

To make soup, the quantity of ingredients needed is as follows;

Soup····· Water (4 cups), Sauce (1 cup)

1. We need 4 times more water than sauce.
2. We can represent the relationship as follow.



When the quantity of water is 4 then the quantity of sauce is 1, the ratio can be represented by using the " : " symbol as '4 : 1'.
4 : 1 is read as "Four is to one". This way of representation is called **ratio**

3. We can also represent the relationship by a fraction.

When a ratio is represented as "a : b", the quotient of "a" divided by "b" is called the **value of ratio**. The value of ratio represents how many times "b" is "a"

Value of ratio a : b is the quotient of a ÷ b

In particular, when "a" and "b" are whole numbers, the value of ratio "a : b" can be represented as $\frac{a}{b}$

Math sentence $4 \div 1 = \frac{4}{1}$

Example 1

To make salad dressing, the quantity of ingredients needed is as follows;

Salad dressing···Salad oil (3 spoons), Vinegar (2 spoons)

1. Fill in the blank. Math sentence $3 \div 2 = 1.5$
we need [1.5] times more salad oil than vinegar.

2. How can the ratio between the quantity of vinegar and the quantity of salad oil be represented using two numbers?

Answer 3 : 2

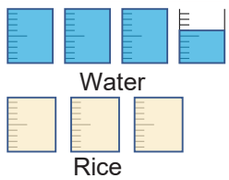
3. How can the ratio between the quantity of salad oil and vinegar be represented by a fraction?

Math sentence $3 \div 2 = \frac{3}{2}$ (3: Compared quantity, 2: Base quantity, $\frac{3}{2}$: Ratio)

To make the rice, the quantity of ingredients needed is as follow;

Rice····· Water (360 mL), Rice (300 mL)

Math sentence



1. Fill in the blank.
we need [ ] times more water than Rice.
2. How can the ratio between the quantity of water and the quantity of rice be represented using two numbers?

Answer

3. How many times the quantity of the water is that of the rice? Let's represent it with a fraction.

Math sentence

10 - 2 Ratio and Its Application

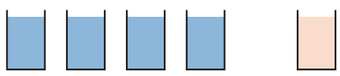
Equal Ratio (1)

Example 1 You made the soup using a small cup as shown below.

Soup····· Water (4 cups) and Sauce (1 cup)

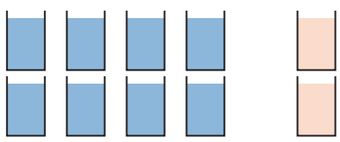
1 What is the ratio of ingridient of the soup represented as "a : b"

The ratio of ingredients = 4 : 1



2 Your friend has made two portions of soup in the same cup as you. What is the ratio of ingridient of the soup represented as "a : b"

The ratio of ingredients = 8 : 2



3 Is the concentration of the soup you and your friend made the same?

The value of the ratio 4 : 1 $4 \div 1 = \frac{4}{1} = 4$ Answer 4

The value of the ratio 8 : 2 $8 \div 2 = \frac{8}{2} = 4$ Answer 4

Answer same

The ratio of the ingredients in your friend's soup is the same as the ratio of yours, 4 : 1.

$4 : 1 = 8 : 2$ (×2 from 4 : 1 to 8 : 2; ×2 from 1 to 2)

When the value of the ratio is equal, such as 4 : 1 and 8 : 2, the two ratios are said to be equal, and are written as follows.

4 : 1 = 8 : 2

What is the concentration (ratio) of coffee to milk?

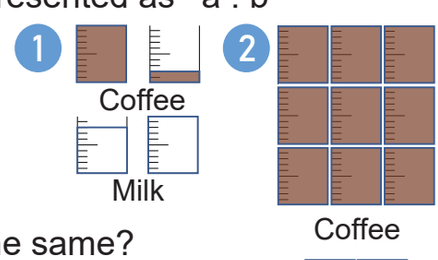
1 What is a ratio of ingredient of the cafe represented as "a : b"

(a) 120 mL of coffee and 80 mL of milk

The value of the ratio ☐ : ☐

(b) 9 cups of coffee and 6 cups of milk

The value of the ratio ☐ : ☐



2 Is the concentration (ratio) of these café the same?

(a) The value of the ratio = ☐ ÷ ☐ = _____

(b) The value of the ratio = ☐ ÷ ☐ = _____

Answer _____

10 - 3 Ratio and Its Application

Equal Ratio (2)

Instruction There are two combinations of rice and water. The relationship between the rice and the water is the same.

(a)··· Rice (60 mL) , water (72 mL) | (b)··· Rice (300mL) , water (360 mL)

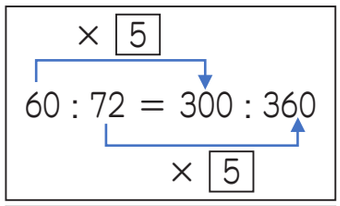
1 Calculate the ratio of (a) to (b) . Write the answers in fractions.

(a) The ratio 60 : 72 Value of ratio = 60 ÷ 72 = $\frac{60}{72} = \frac{5}{6}$

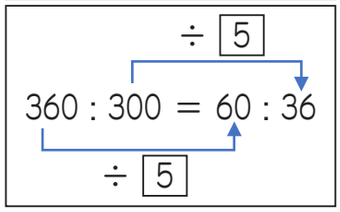
(b) The ratio 300 : 360 Value of ratio = 300 ÷ 360 = $\frac{300}{360} = \frac{5}{6}$

2 Find the relationship of 2 equal ratio above.

60 : 72 = (60 × 5) : (72 × 5) = 300 : 360



300 : 360 = (300 ÷ 5) : (360 ÷ 5) = 60 : 72



The ratio "a : b" is equal to other ratio that is created by multiplying or dividing "a" and "b" by the same number.

Example Among the ratios below, Which are the same?

(a) 2 : 6 = (2 ÷ 2) : (6 ÷ 2) = 1 : 3
(b) 4 : 8 = (4 ÷ 4) : (8 ÷ 4) = 1 : 2
(c) 6 : 18 = (6 ÷ 6) : (18 ÷ 6) = 1 : 3
(d) 16 : 32 = (16 ÷ 16) : (32 ÷ 16) = 1 : 2
(e) 4 : 12 = (4 ÷ 4) : (12 ÷ 4) = 1 : 3

Let's simplify the ratio to find same ratio with smallest whole number!!

Answer (a), (c), (e) and (b), (c)

Among the ratio below, What is the same ratio?

(a) 8 : 10 = (8 ÷ ☐) : (10 ÷ ☐) = ☐ : ☐
(b) 40 : 50 = (40 ÷ ☐) : (50 ÷ ☐) = ☐ : ☐
(c) 6 : 18 = (6 ÷ ☐) : (18 ÷ ☐) = ☐ : ☐
(d) 16 : 32 = (16 ÷ ☐) : (32 ÷ ☐) = ☐ : ☐
(e) 4 : 12 = (4 ÷ ☐) : (12 ÷ ☐) = ☐ : ☐

Answer _____

10 - 4 Ratio and Its Application

Equal Ratio (3)

Example To make juice, we need the ingredients below.

Water (120 mL), Juice base (30 mL)

If there is 60 mL of juice base, how many mL of water should be added to make the same concentraion of juice?

x mL of water is needed to get the same concentration. We can make an equal ratio using x.

Math sentence $120 : 30 = x : 60$

$\times 2$

$120 : 30 = x : 60$

$\times 2$

$x = 120 \times 2$

$= 240$

We can use the diagram on the left to find x!

Answer 240 mL

1 To make pancakes we need the ingredient below.

Pancake mix (200 g), Milk (160 mL)

If there are 100 g of pancake mix, how many mL of milk should be added to the mixture to make?

Make the math sentence and find the answer using x mL of milk.

Math sentence $200 : 160 = 100 : x$

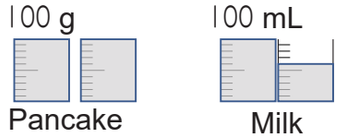
$\div$ ☐

$200 : 160 = 100 : x$

$\div$ ☐

$x = 160 \div$ ☐

$=$ ☐



Answer _____

2 To make café latte we need the ingredient below.

Coffee (120 mL), Milk (360 mL)

If there are 40 mL of coffee, how many mL of milk should be added to make?

Make the math sentence and find the answer using x mL of milk.

Math sentence $120 : 360 = 40 : x$

$\div$ ☐

$120 : 360 = 40 : x$

$\div$ ☐

$x = 160 \div$ ☐

$=$ ☐

Answer _____

10 - 5 Ratio and Its Application

Simple Ratio

Example Use equal ratios to express ratios with the smallest whole number if it is possible. Then find the same ratios.

(a) $1.2 : 2.8 = (1.2 \times \boxed{10}) : (2.8 \times \boxed{10})$

$= \boxed{12} : \boxed{28} = (\boxed{12} \div \boxed{4}) : (\boxed{28} \div \boxed{4}) = \boxed{3} : \boxed{7}$

(b) $1.6 : 3.2 = (1.6 \times \boxed{10}) : (3.2 \times \boxed{10})$

$= \boxed{16} : \boxed{32} = (\boxed{16} \div \boxed{16}) : (\boxed{32} \div \boxed{16}) = \boxed{1} : \boxed{2}$

(c) $1.5 : 3.5 = (1.5 \times \boxed{10}) : (3.5 \times \boxed{10})$

$= \boxed{15} : \boxed{35} = (\boxed{15} \div \boxed{5}) : (\boxed{35} \div \boxed{5}) = \boxed{3} : \boxed{7}$

(d) $2.4 : 4.8 = (2.4 \times \boxed{10}) : (4.8 \times \boxed{10})$

$= \boxed{24} : \boxed{48} = (\boxed{24} \div \boxed{24}) : (\boxed{48} \div \boxed{24}) = \boxed{1} : \boxed{2}$

Answer (a), (c) and (b), (d)

Use equal ratios to express ratios with the smallest whole number if it is possible. Then find the same ratios.

(a) $0.2 : 0.6 = (0.2 \times \square) : (0.6 \times \square)$

$= \square : \square = (\square \div \square) : (\square \div \square) = \square : \square$

(b) $0.9 : 1.2 = (0.9 \times \square) : (1.2 \times \square)$

$= \square : \square = (\square \div \square) : (\square \div \square) = \square : \square$

(c) $4.5 : 6.0 = (4.5 \times \square) : (6.0 \times \square)$

$= \square : \square = (\square \div \square) : (\square \div \square) = \square : \square$

(d) $1.3 : 3.9 = (1.3 \times \square) : (3.9 \times \square)$

$= \square : \square = (\square \div \square) : (\square \div \square) = \square : \square$

Answer _____

Example 2 Use equal ratios to express ratios with the smallest whole number if it is possible. Then find the same ratios

(a) $\frac{3}{4} : \frac{2}{3} = \frac{9}{12} : \frac{8}{12}$

$= \left(\frac{9}{12} \times \boxed{12}\right) : \left(\frac{8}{12} \times \boxed{12}\right)$

$= \boxed{9} : \boxed{8}$

(b) $\frac{4}{9} : \frac{2}{3} = \frac{12}{27} : \frac{18}{27}$

$= \left(\frac{12}{27} \times \boxed{27}\right) : \left(\frac{18}{27} \times \boxed{27}\right)$

$= \boxed{12} : \boxed{14} = \boxed{6} : \boxed{7}$

Fraction make the ratios difficult to understand, so it's better to represent as whole number!

To get whole number, Let's convert to one fraction!

Use equal ratios to express ratios with the smallest whole number if it is possible. Then find the same ratios

(a) $\frac{2}{5} : \frac{3}{8} = \frac{16}{40} : \frac{15}{40}$

$= \left(\frac{16}{40} \times \square\right) : \left(\frac{15}{40} \times \square\right)$

$= \square : \square$

(b) $\frac{4}{5} : \frac{3}{4} = \frac{16}{20} : \frac{15}{20}$

$= \left(\frac{16}{20} \times \square\right) : \left(\frac{15}{20} \times \square\right)$

$= \square : \square$

(c) $\frac{3}{6} : \frac{6}{5} = \frac{15}{30} : \frac{36}{30}$

$= \left(\frac{15}{30} \times \square\right) : \left(\frac{36}{30} \times \square\right)$

$= \square : \square = \square : \square$

10 – 6 Ratio and Its Application

Ratio Application

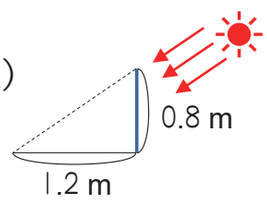
Example Let's find the height of the tree from the length of its shadow. For sticks A and B, compare the ratio of the length of the stick to the length of the shadow.

Stick A··· 0.8 m, its shadow 1.2 m

Stick B··· 2 m, its shadow 3 m

Length of stick : length of shadow = 0.8 : 1.2

(a)



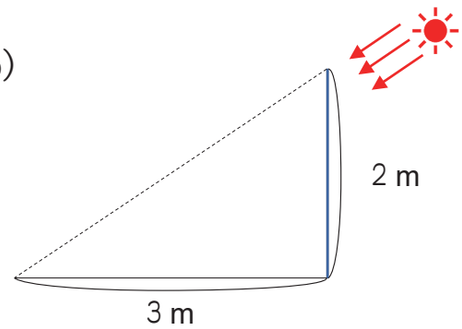
$= (0.8 \times 10) : (1.2 \times 10)$

$= 8 : 12 = 2 : 3$

$= 2 : 3$

Length of stick : length of shadow

(b)



The sun's rays are shining in the same direction, parallel to each other, so the ratio of any sticks and shadow should be same.

1 At this time, the shadow of the trees in the schoolyard were 15 m. What is the height of this tree?

To find the height of tree, let's use ratio and set the height of the tree to x.

Height of tree : Length of shadow $= 2 : 3 = x : 15$

$\times 5$

$2 : 3 = x : 15$

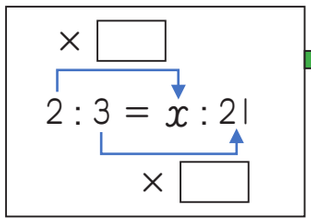
$\times 5$

$x = 2 \times 5 = 10$

Answer 10 m

1 In the same situation as the example, what is the height of the tree when its shadow is 21 m? Fill in the blank.

Height of stick : Length of shadow $= 2 : 3 = x : 21$



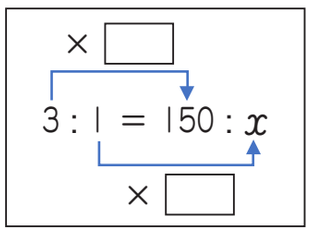
$x =$ ☐ × ☐ = ☐

Answer _____

2 Make cookies with a 3 : 1 weight of flour and sugar.

1 What is the weight of sugar if the weight of flour is 150 g?

Weight of flour : Weight of sugar $= 3 : 1 = 150 : x$

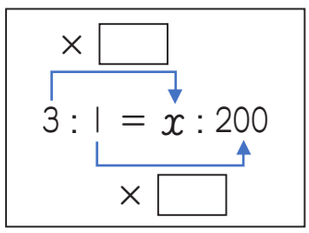


$x =$ ☐ × ☐ = ☐

Answer _____

2 What is the weight of flour if the weight of sugar is 200 g?

Weight of flour : Weight of sugar $= 3 : 1 = x : 200$



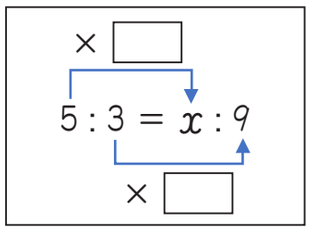
$x =$ ☐ × ☐ = ☐

Answer _____

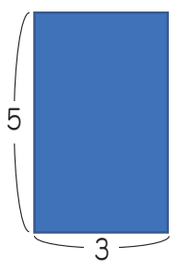
3 Draw a rectangular court in the schoolyard with a length to width ratio of 5 : 3.

1 What is the length if the width is 9 m?

Length : Width $= 5 : 3 = x : 9$



$x =$ ☐ × ☐ = ☐



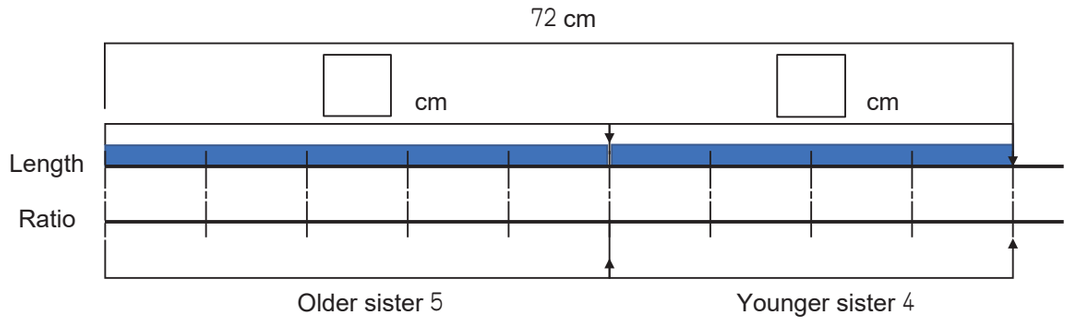
Answer _____

10 - 7 Ratio and Its Application

How to Divide by Ratio

Example A ribbon 72 cm long is divided into two pieces with a length ratio of 5 : 4.

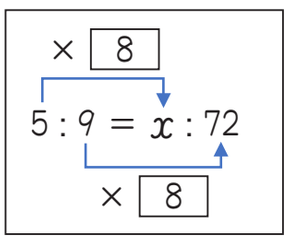
What is the length of each?



1 What is the length of the older sister's ribbon?

The overall ratio is 5 + 4 = 9. So compare the overall ratio and older sister ratio.

Older sister ratio : Overall ratio = 5 : 9 = x : 72

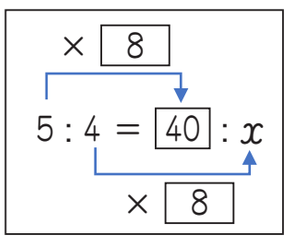


$x = 5 \times 8 = 40$

Answer 40 cm

2 What is the length of the older sister's ribbon? Find the answer using the ratio.

Older sister ratio : Younger sister ratio = 5 : 4 = 40 : x



$x = 4 \times 8 = 32$

Answer 32 cm

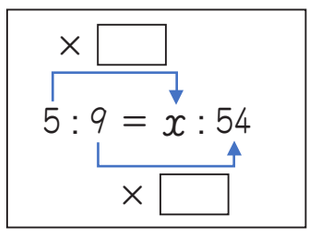
※ You can also use the fraction to find the answer.

Example: The ratio of the ribbon of the older sister is $\frac{5}{9}$ of the total.

$72 \times \frac{5}{9} = (72 \div 9) \times 5 = 40$

1 In the same situation as the example, if the ribbon is 54 cm long, how long are the ribbons for the older sister and younger sister? Find the answer using ratio.

Older sister's ratio : Overall ratio $= 5 : 9 = x : 54$

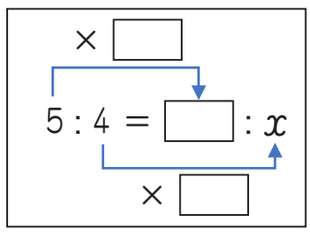


Math sentence

$x =$ ☐ × ☐ = ☐

Answer _____

Older sister's ratio : Younger sister's ratio $= 5 : 4 =$ ☐ $: x$

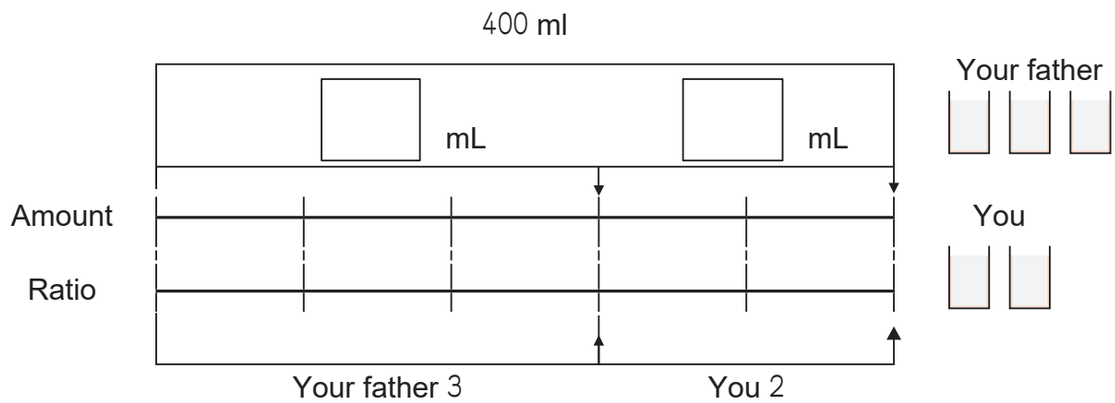


Math sentence

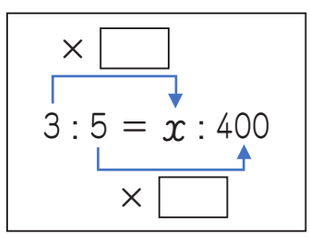
$x =$ ☐ × ☐ = ☐

Answer _____

2 You and your father share 400 mL of milk in a ratio of 3 : 2.



Your father's ratio : Overall ratio $= 3 : 5 = x : 400$

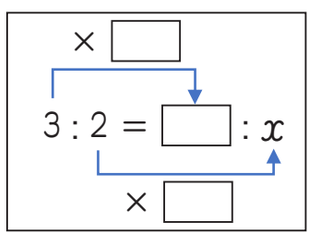


Math sentence

$x =$ ☐ × ☐ = ☐

Answer _____

Your father's ratio : Your ratio $= 3 : 2 =$ ☐ $: x$



Math sentence

$x =$ ☐ × ☐ = ☐

Answer _____

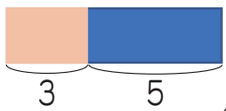
10 - 8 Ratio and Its Application

Problems

Example 1 Divide a 56 m^2 garden into flower bed and fields so that the ratio is 3 : 5. What should be the area of the flower bed?

1 What is the ratio of the area of the flower bed to the area of the whole garden?

The ratio of flower bed : Whole garden = 3 : 8



2 Write an math sentence where the area of the flower bed is x m^2 and the ratios are equal and find the answer

Math sentence $3 : 8 = x : 56$

$x = 3 \times 7 = 21$

Answer 21 m^2

3 Find the area of the flower bed by thinking about how much of the area of the whole garden is covered by the flower bed.

To find the proportion of the flower bed to the total area, divide the flower bed by the total area.

Ratio of flower bed… $3 : 8 = \frac{3}{8}$

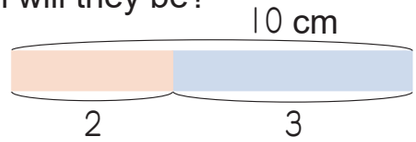
Math sentence $56 \times \frac{3}{8} = 21$

Answer 21 m^2

Cut 10 m of ribbon into 2 : 3 pieces. How many cm will they be?

1 What is the ratio of 2 to the whole ribbon?

The ratio of 2 : Whole ribbon = _____



2 Write a math sentence where The ratio of 2 is x cm and the ratios are equal and find the answer

Math sentence _____

_____

Answer _____

3 Find the length of ribbon in ratio of 2 by thinking about how much of the whole ribbon is covered by the ribbon in ratio of 2 .

To find the ribbon in ratio of 2 to the whole ribbon, divide the length of ribbon in ratio of 2 by the whole ribbon.

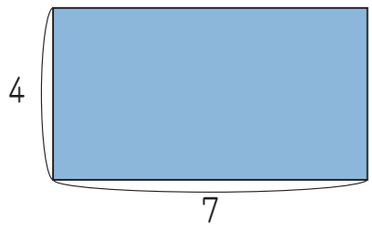
Ratio of ribbon in ratio of 2… _____

Math sentence

Answer _____

Example 2 Draw a rectangle so that the length and width of the rectangle is 7 : 4.

Let's consider the answer as x.



1 If the length is 28 cm, what is the width?

$\times$ 4

$7 : 4 = 28 : x$

$\times$ 4

Math sentence

$x = 4 \times 4 = 16$

Answer 16 cm

2 If the width is 36 cm, what is the length?

$\times$ 9

$7 : 4 = x : 36$

$\times$ 9

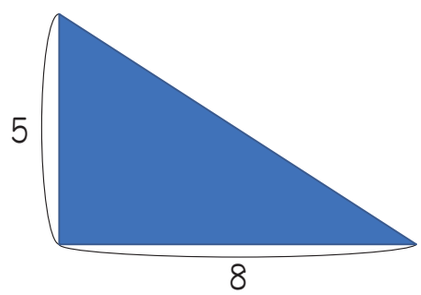
Math sentence

$x = 4 \times 9 = 36$

Answer 36 cm

Draw a triangle so that the base and height of the rectangle is 8 : 5.

1 If the base is 64 cm, what is the height.



$\times$ ☐

$8 : 5 = 64 : x$

$\times$ ☐

$x = \square \times \square = \square$

Answer _____

2 If the height is 65 cm, what is the base.

$\times$ ☐

$8 : 5 = x : 65$

$\times$ ☐

$x = \square \times \square = \square$

Answer _____

10 – 9 Ratio and Its Application

Review

1 Express the following proportions as simple ratios.

(a) Ratio of 20 ml vinegar to 30 ml salad oil. Answer _____

(b) The ratio of the length of a rectangle 18 cm to its width 14 cm.

Answer _____

2 Find the number that applies to x.

(a) $2 : 5 = 12 : x$ Answer _____

(b) $63 : 49 = x : 7$ Answer _____

3 Simplify the following ratios.

(a) 16 : 24 Answer _____

(b) 52 : 13 Answer _____

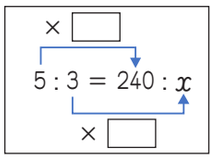
(c) 1.5 : 4.5 Answer _____

(d) 0.6 : 3.8 Answer _____

(e) $\frac{3}{2} : \frac{3}{7}$ Answer _____

(f) $\frac{12}{7} : \frac{9}{4}$ Answer _____

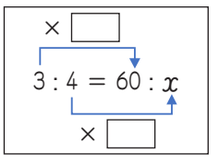
4 There is a 5 : 3 ratio of story books to science books in the school library and there are 240 story books. How many science books are there?



Math sentence _____

_____ Answer _____

5 Make a flag in the shape of a rectangle so that the ratio of length to width is 3 : 4. If the length is 60 cm, how long should the width be? Find the length of the rectangle.



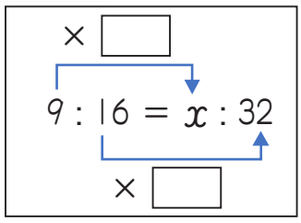
Length : Width = 3 : 4 = _____ x = _____

Answer _____

6 In one school, grade 5th and 6th students are in the football club. The ratio of 5th and 6th grade students in the football club is 9 : 7 and there are 32 members in the football club. How many 5th grade students are there in the football club?

1 Find the ratio of the whole number _____

2 Find the number of 5th grade students.



Ratio of 5th grade : Ratio of whole number = _____ = _____

x = _____

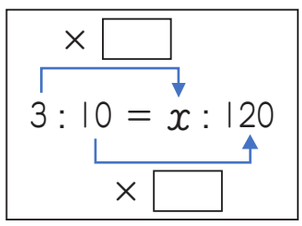
Answer _____

7 Make a lottery so that the ratio of the number of winning lots to the number of losing lots is 3 : 7. If the total number of lots is 120, how many winning lots should there be? Write two different math sentences.

(a) Find the ratio of the total number of lots. _____

(b) Math sentence...

Ratio of winning lots : Ratio of total lots = _____ = _____



x = _____

Answer _____

(c) What is the ratio of winning lots to the total lots? Express it in fraction.

Math sentence

_____

(d) What is the ratio of wining lots? Calculate with fraction above.

Math sentence

Answer _____

_____