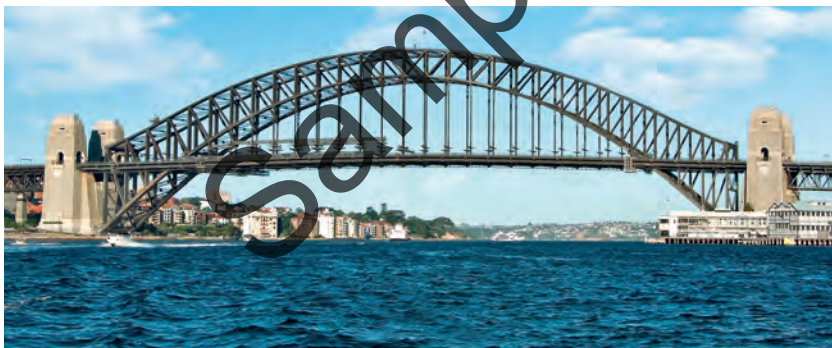


1:01 The language of mathematics

Much of the language met so far is reviewed in the identification cards (ID Cards) found on pages xvii to xxii. These should be referred to throughout the Student Book. Make sure that you can identify every term.

Exercise 1:01

- 1 Write each symbol and its meaning in ID Card 1 (Metric units) on page xvii.
- 2 Write each symbol and its meaning in ID Card 2 (Symbols) on page xvii.
- 3 Write a number sentence, including the answer, for each expression in ID Card 3 (Language) on page xviii. For example, for '6 minus 2' write ' $6 - 2 = 4$ '.
- 4 Write *true* or *false*, without using a calculator.
 - a $344 \times 1.5 \neq 246$
 - b $830 \div 0.9 > 830$
 - c $830 \div 1.1 < 830$
 - d $199 \times 0.9 > 199$
 - e $699 \div 0.99 > 699$
 - f $699 \div 1.01 < 699$
 - g $1.1^2 \neq 1.1^3$
 - h $\pi \div 3.14$
 - i $0.1\% = 0.001$
 - j $\sqrt{1.1} < 1.1$
 - k $\sqrt[3]{1.2} > 1.2$
 - l $0.8^2 < 0.8$
 - m $\sqrt{2} > \sqrt[3]{2}$
 - n $\sqrt{1} > \sqrt[3]{1}$
 - o $\sqrt{0.8} < \sqrt[3]{0.8}$

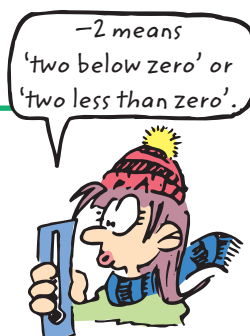


Estimate the width of this bridge, in metres.

1:02 Diagnostic check-ups

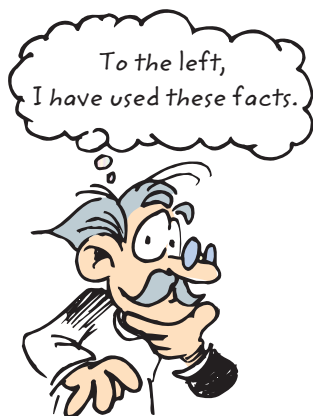
Without obtaining help, complete the following diagnostic tests to determine which areas need attention. Errors made will indicate areas of weakness. If you are having trouble, refer to the stated Appendix, which can be found on the eBook. These include explanations and worked examples relating to these skills.

Do not use a calculator!



Conversion facts you should know

- a $10\% = 0.1 = \frac{1}{10}$
 Multiply each by 6.
 $60\% = 0.6 = \frac{6}{10}$
- b $5\% = 0.05 = \frac{1}{20}$
 Multiply each by 7.
 $35\% = 0.35 = \frac{7}{20}$
- c $20\% = 0.2 = \frac{1}{5}$
 Add 1 or 100% to each.
 $120\% = 1.2 = 1\frac{1}{5}$
- d $12\frac{1}{2}\% = 0.125 = \frac{1}{8}$
 Add 1 or 100% to each.
 $112\frac{1}{2}\% = 1.125 = 1\frac{1}{8}$



Percentage	Decimal	Fraction
1%	0.01	$\frac{1}{100}$
5%	0.05	$\frac{1}{20}$
10%	0.1	$\frac{1}{10}$
$12\frac{1}{2}\%$	0.125	$\frac{1}{8}$
20%	0.2	$\frac{1}{5}$
25%	0.25	$\frac{1}{4}$
$33\frac{1}{3}\%$	0.3	$\frac{1}{3}$
50%	0.5	$\frac{1}{2}$
100%	1	1



CHECK-UP 1:02A

INTEGERS

P Appendix 1:02A
Sets A–D

Give the simplest answer for each of the following.

- 1 a $-7 + 14$ b $2 - 15$ c $-2 - 8$
- 2 a $3 - -6$ b $12 + (-5)$ c $6 - (3 - 8)$
- 3 a -3×2 b -5×-6 c $7 \times (-9)$
- 4 a $(-15) \div (-3)$ b $63 \div -9$ c $\frac{-156}{-3}$
- 5 a $14 - 7 \times 10$ b $(-3 + 6) \div 3$ c $(4 - 18) \div (-8 + 6)$



CHECK-UP 1:02B

FRACTIONS

P Appendix 1:02B
Sets A–L

- 1 Write these improper fractions as mixed numerals.
 a $\frac{7}{4}$ b $\frac{13}{3}$ c $\frac{141}{10}$
- 2 Write these mixed numerals as improper fractions.
 a $2\frac{1}{2}$ b $5\frac{3}{10}$ c $3\frac{1}{7}$
- 3 Simplify these fractions.
 a $\frac{16}{24}$ b $\frac{100}{650}$ c $\frac{240}{3600}$
- 4 Complete the following to make equivalent fractions.
 a $\frac{3}{4} = \frac{\square}{28}$ b $\frac{17}{20} = \frac{\square}{100}$ c $\frac{3}{8} = \frac{\square}{1000}$

Give the simplest answer for each of the following.

- 5 a $\frac{3}{8} + \frac{2}{8}$ b $\frac{9}{10} + \frac{3}{10}$ c $\frac{7}{9} + \frac{2}{9}$

3 of 4 equal parts
 $\frac{3}{4} \rightarrow$ Numerator
 $\frac{3}{4} \rightarrow$ Denominator

6 a $\frac{9}{10} - \frac{7}{10}$

7 a $\frac{3}{4} + \frac{4}{5}$

8 a $\frac{7}{8} - \frac{3}{4}$

9 a $3\frac{1}{2} + 4\frac{3}{5}$

10 a $4\frac{1}{2} - 1\frac{2}{9}$

11 a $7\frac{1}{2} - \frac{7}{8}$

12 a $\frac{4}{5} \times \frac{3}{11}$

13 a $\frac{7}{8} \times \frac{3}{7}$

14 a $3\frac{1}{5} \times \frac{5}{7}$

15 a $4 \times 3\frac{4}{5}$

16 a $\frac{8}{10} \div \frac{2}{10}$

17 a $\frac{3}{5} \div \frac{1}{2}$

18 a $1\frac{7}{8} \div \frac{3}{4}$

19 a $7\frac{1}{2} \div 3$

20 a $5 \div \frac{1}{4}$

b $\frac{13}{14} - \frac{9}{14}$

b $\frac{3}{10} + \frac{2}{5}$

b $\frac{9}{10} - \frac{1}{4}$

b $6\frac{7}{10} + 5\frac{3}{4}$

b $10\frac{3}{4} - 5\frac{1}{10}$

b $6\frac{3}{5} - 2\frac{7}{10}$

b $\frac{3}{10} \times \frac{7}{10}$

b $\frac{15}{38} \times \frac{19}{20}$

b $1\frac{3}{10} \times 1\frac{4}{5}$

b $2\frac{1}{4} \times 3$

b $\frac{9}{20} \div \frac{3}{20}$

b $\frac{8}{9} \div \frac{3}{4}$

b $3\frac{4}{7} \div 2\frac{1}{2}$

b $4\frac{9}{10} \div 7$

b $10 \div \frac{1}{5}$

c $\frac{37}{100} - \frac{11}{100}$

c $\frac{7}{100} + \frac{3}{40}$

c $\frac{5}{6} - \frac{3}{5}$

c $1\frac{5}{6} + \frac{7}{8}$

c $20\frac{3}{8} - \frac{1}{5}$

c $3\frac{1}{2} - 1\frac{5}{6}$

c $\frac{1}{10} \times \frac{3}{5}$

c $\frac{7}{10} \times \frac{5}{6}$

c $5\frac{1}{4} \times 2\frac{2}{5}$

c $5 \times 6\frac{3}{8}$

c $\frac{7}{10} \div \frac{7}{10}$

c $\frac{5}{8} \div \frac{4}{7}$

c $3\frac{5}{8} \div 2\frac{9}{10}$

c $6\frac{7}{8} \div 5$

c $4 \div \frac{1}{10}$

Fractions should always be expressed in lowest terms.

$$\frac{4}{6} = \frac{2}{3}$$

$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{4}$		$\frac{1}{4}$		$\frac{1}{4}$		$\frac{1}{4}$	
$\frac{1}{2}$				$\frac{1}{2}$			
equivalent fractions							
$\frac{4}{8} = \frac{2}{4} = \frac{1}{2}$							



CHECK-UP 1:02C

DECIMALS

P Appendix 1:02C
Sets A–J

1 Place in order from smallest to largest.

a 0.505, 0.5, 0.55

b 8.4, 8.402, 8.41

c 1.01, 1.1, 1.011

Give the simplest answer for each of the following.

2 a $2.6 + 3.14$

b $18.6 + 3$

c $0.145 + 0.12$

3 a $12.83 - 1.2$

b $9 - 1.824$

c $4.02 - 0.005$

4 a 0.7×6

b $(0.3)^2$

c 0.02×1.7

5 a 3.142×100

b 0.04×1000

c 0.065×10

6 a 2.1×10^4

b 8.04×10^6

c 1.25×10^2

7 a $4.08 \div 2$

b $12.1 \div 5$

c $0.19 \div 4$

8 Write answers as repeating decimals.

a $2.5 \div 6$

b $5.32 \div 9$

c $28 \div 3$

Calculate each of the following.

9 a $24.35 \div 10$

b $6.7 \div 100$

c $0.7 \div 1000$

10 a $6.4 \div 0.2$

b $0.824 \div 0.08$

c $6.5 \div 0.05$

11 Convert these decimals to fractions.

a 0.5

b 0.18

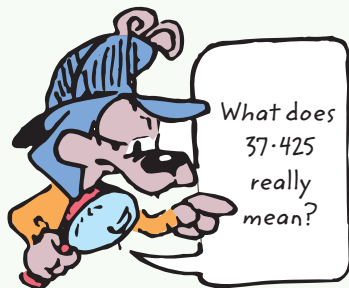
c 9.105

12 Convert these fractions to decimals.

a $\frac{4}{5}$

b $\frac{3}{8}$

c $\frac{5}{6}$



3 tens
7 units
4 tenths
2 hundredths
5 thousandths

3 7 . 4 2 5

10	1	.	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
3	7	.	4	2	5

CHECK-UP 1:02D

PERCENTAGES

P Appendix 1:02D
Sets A–H

1 Convert to fractions.

a 18%

b 7%

c 224%

2 Convert to fractions.

a 9.5%

b $6\frac{1}{4}\%$

c 12.25%

3 Convert to percentages.

a $\frac{11}{20}$

b $\frac{5}{6}$

c $1\frac{1}{4}$

4 Convert to decimals.

a 9%

b 16%

c 110%

5 Convert to decimals.

a 23.8%

b $12\frac{1}{2}\%$

c $4\frac{2}{3}\%$

6 Convert to percentages.

a 0.51

b 0.085

c 1.8

7 Find:

a 35% of 600 m

b 162% of \$8

8 Find:

a 7% of 84.3 m

b $6\frac{1}{4}\%$ of 44 tonnes

9 a 7% of my spending money was spent on a watch band that cost \$4.20. How much spending money did I have?

b 30% of my weight is 18 kg. How much do I weigh?

10 a 5 kg of sugar, 8 kg of salt and 7 kg of flour were mixed accidentally. What is the percentage (by weight) of sugar in the mixture?

b Jarvis scored 24 runs out of the team's total of 60 runs. What percentage of runs did he score?

11 a Increase \$60 by 15%.

b Decrease \$8 by 35%.



Work out the answer to each part and write the letter for that part in the box that is above the correct answer.

Y Write $\frac{15}{4}$ as a mixed numeral.

M Change $1\frac{3}{4}$ to an improper fraction.

H Write $\frac{2}{5}$ as a percentage.

H Write 0.75 as a fraction.

l Increase 50 kg by 10%.

D 40% of my weight is 26 kg. How much do I weigh?

D What fraction is 125 g of 1 kg?

S Write $4 \div 9$ as a repeating (recurring) decimal.

S 10 cows, 26 horses and 4 goats are in a paddock.
What is the percentage of animals that are horses?

S Increase \$5 by 20%.

S 600kg is divided between Misal and Pratik so that Misal gets $\frac{3}{5}$ of the amount.
How much does Pratik get?

Write the basic numeral for.

A $-8 + 10$ **A** $-7 - 3$ **A** -6×4 **A** $6 - (3 - 4)$ **A** $(-5)^2$

Write the simplest answer for:

I $\frac{37}{100} - \frac{12}{100}$	I $\frac{3}{8} + \frac{1}{3}$	T $\frac{4}{5} - \frac{2}{3}$	T $\frac{7}{8} \times \frac{8}{7}$
T $(\frac{1}{3})^2$	T $4\frac{3}{8} + \frac{5}{8}$	N $\frac{1}{2} \div \frac{1}{8}$	N $0.05 + 3$
O $0.3 - 0.02$	O 0.3×5	E $(0.3)^2$	T 3.142×100
E $6.12 \div 6$	E $20.08 \div 10$	C $1.8 \div 0.2$	G $\frac{3}{4}$ of 60 kg
H 5% of 80 kg			

[illegible]

1:03 Rational numbers

Integers, fractions, decimals and percentages (both positive and negative) are **rational numbers**.

e.g. $\frac{3}{4}$, 8, 52%, 0.186, $0.\dot{3}$, -1.5, -10

Exercise 1:03 (Calculators are needed)

- 1 From the list on the right, choose two equivalent numbers for:

a $2\frac{1}{2}$ b 130%
c 2.8 d $1\frac{1}{4}$

125%	114%	$2\frac{4}{5}$	28%	280%
$2\frac{1}{8}$	1.4	2.5	208%	13
1.25	1.3	$1\frac{3}{10}$	250%	25%

- 2 Write each list in ascending order (from smallest to largest).

a 0.85, 0.805, 0.9, 1 b 87.5%, 100%, 104%, $12\frac{1}{4}\%$
c $\frac{5}{8}$, $\frac{2}{7}$, $\frac{2}{3}$, $\frac{6}{100}$ d $1\frac{3}{4}$, 150%, 1.65, 2
e 1.42 , $\sqrt{2}$, 1.41, 140% f π , $3\frac{1}{4}$, 3.1, $\sqrt{12}$

- 3 Find the number half-way between:

a 6.8 and 6.9 b 12% and 20%
c 1 and $\frac{1}{5}$ d 6.3 and 6.4.

- 4 Two unit fractions have a difference of $\frac{3}{8}$. What are they? ($\frac{1}{2}$ is one of the fractions).

- 5 Write the next three numbers in these sequences.

a 0.2, 0.4, 0.8, 1.6, ... b 2.4, 1.2, 0.6, 0.3, ...

- 6 The average (i.e. mean) of five numbers is 5.8.

a What is the sum of these numbers?
b If four of the numbers are 5s, what is the other number?

- 7 What is meant by an interest rate of 8% p.a.?

- 8 An advertisement reads: '67% of flats in Tertiary Place already rented. Only one flat remaining for rent.' How many flats would you expect there to be in Tertiary Place?

- 9 Using a diameter growth rate of 4.3 mm per year, find the number of years it will take for a tree with a diameter of 20 mm to reach a diameter of 50 mm.

- 10 At the South Pole, the temperature dropped 15°C in 2 hours from -18°C . What was the temperature after that 2 hours?

- 11 Julius Caesar invaded Britain in 55 BCE and again a year later. What was the date of the second invasion?

A unit fraction has a numerator of 1.



- 12** Chub was playing 'Five Hundred'.
- a** His score was -150 points. He then gained 520 points. What was his new score?
 - b** His score was 60 points. He then lost 180 points. What was his new score?
 - c** His score was -120 points. He then lost 320 points. What was his new score?

- 13** What fraction would be displayed on a calculator as:

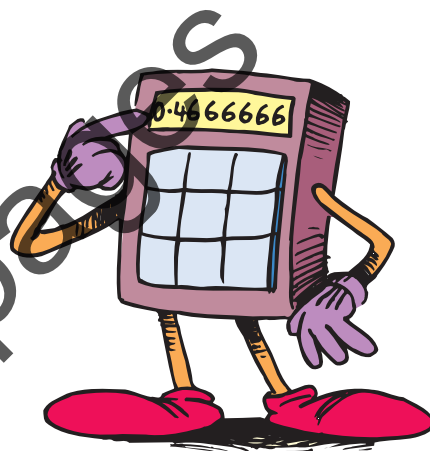
- a** 0.3333333 **b** 0.6666666
- c** 0.1111111 **d** 0.5555555

- 14** To change $\frac{7}{15}$ to a decimal approximation, press $7 \div 15 =$ on a calculator. Use this method to write the following as decimals, correct to five decimal places.

- a** $\frac{8}{9}$ **b** $\frac{2}{7}$ **c** $\frac{7}{13}$
- d** $\frac{20}{21}$ **e** $\frac{4}{11}$ **f** $\frac{5}{18}$

- 15** My income was \$21 500 when I started work. If my income has increased by 200%, how much do I earn now?

- 16** What information is needed to complete the following questions?
- a** If Mary scored 40 marks in a test, what was her percentage?
 - b** In a test out of 120, Nandor made only 3 mistakes. What was his percentage score?
 - c** If 53% of cases of cancer occur after the age of 65, what is the chance per 10 000 of developing cancer after the age of 65?



1:04 Recurring decimals

PREP QUIZ 1:04

Write these fractions as decimals.

1 $\frac{1}{4}$

2 $\frac{2}{5}$

3 $\frac{1}{3}$

4 $\frac{5}{6}$

0.63974974974 ... is written as 0.63 $\dot{9}$ 74.

Rewrite these recurring decimals using the 'dot' notation.

5 0.4444...

6 0.631631631...

7 0.166666...

8 0.72696969...

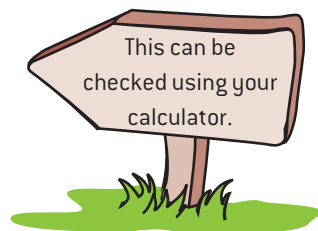
Rewrite these decimals in simplest fraction form.

9 0.75

10 0.875

To write fractions in decimal form we simply divide the numerator (top) by the denominator (bottom). This may result in either a 'terminating' or 'recurring' decimal.

$$\text{For } \frac{3}{8}: \begin{array}{r} 0.375 \\ 8 \overline{) 3.000} \end{array} \quad \text{For } \frac{1}{6}: \begin{array}{r} 0.1666... \\ 6 \overline{) 1.0000} \end{array}$$



To rewrite a terminating decimal as a fraction, simply place the numbers in the decimal over the correct power of 10 (e.g. 10, 100, 1000) and then simplify.

$$\begin{aligned} \text{For example: } 0.375 &= \frac{375}{1000} \div \frac{125}{125} \\ &= \frac{3}{8} \end{aligned}$$

Recurring decimals are sometimes called repeating decimals.

Rewriting a recurring decimal as a fraction is a more difficult process. Carefully examine the two examples below and use the method shown in the following exercise.

WORKED EXAMPLE 1

When each number in the decimal part is repeated.

Write $0.\dot{6}\dot{3}$ as a fraction

Let $x = 0.6363...$

Multiply by 100 because two digits are repeated.

$$100x = 63.6363...$$

Subtract the two lines.

$$100x - x = 63.6363... - 0.6363...$$

$$99x = 63$$

$$x = \frac{63}{99} \div 9$$

Simplify this fraction.

$$\therefore x = \frac{7}{11}$$

$$0.\dot{6}\dot{3} = \frac{7}{11}$$

WORKED EXAMPLE 2

When only some digits are repeated.

Write $0.61\dot{7}$ as a fraction

Let $x = 0.61777...$

Multiply by 100 to move the non-repeating digits to the left of the decimal point.

$$100x = 61.777...$$

Multiply by 1000 to move one set of the repeating digits to the left of the decimal point.

$$1000x = 617.777$$

Subtract the previous two lines.

$$1000x - 100x = 617.777 - 61.777$$

$$900x = 556$$

$$x = \frac{556}{900} \div 4$$

Simplifying this fraction using your calculator.

$$\therefore x = \frac{139}{225}$$

This answer can be checked by finding $139 \div 225$ using your calculator.

$$0.61\dot{7} = \frac{139}{225}$$

Exercise 1:04

P Foundation worksheet 1:04
Decimals and fractions
ProductLink resources

1 Write these fractions as terminating decimals.

- a $\frac{3}{4}$ b $\frac{4}{5}$ c $\frac{5}{8}$ d $\frac{7}{10}$ e $\frac{7}{100}$
f $\frac{35}{20}$ g $\frac{4}{25}$ h $\frac{17}{50}$ i $\frac{19}{40}$ j $\frac{117}{125}$

2 Write these fractions as recurring decimals.

- a $\frac{2}{3}$ b $\frac{5}{9}$ c $\frac{8}{9}$ d $\frac{2}{11}$ e $\frac{1}{7}$
f $\frac{1}{6}$ g $\frac{1}{15}$ h $\frac{7}{15}$ i $\frac{1}{24}$ j $\frac{17}{30}$

3 Write these terminating decimals as fractions.

- a 0.47 b 0.16 c 0.125 d 0.85 e 0.035

4 Rewrite these recurring decimals as fractions, following Worked Example 1.

- a 0.4444... b 0.575757... c 0.173173173...
d $0.\dot{7}$ e $0.\dot{3}\dot{6}$ f $0.\dot{1}23\dot{4}$

5 Determine the value of $0.\dot{3}$.

6 Rewrite these recurring decimals as fractions, following Worked Example 2.

- a 0.83333... b 0.6353535... c 0.197777...
d 0.64 e 0.736 f 0.8249
g $0.5\dot{1}2\dot{3}$ h 0.5278 i $0.\dot{6}47\dot{3}4$



CHALLENGE 1:04

TRY THIS WITH REPEATING DECIMALS

Here is a clever shortcut method for writing a repeating decimal as a fraction. Follow the steps carefully.

Step 1 (Numerator)

Subtract the digits in front of the repeating digits from all the digits

Example 1

$$0.\dot{2}\dot{6}$$
$$26 - 0$$

Example 2

$$0.32\dot{7}$$
$$327 - 32$$

Step 2 (Denominator)

Write a 9 for each repeating digit and then a zero for each non-repeating digit in the decimal.

$$99$$

$$900$$

Step 3

Simplify the fraction if possible.

$$0.\dot{2}\dot{6} = \frac{26 - 0}{99}$$
$$= \frac{26}{99}$$

$$0.32\dot{7} = \frac{327 - 32}{900}$$
$$= \frac{295}{900}$$
$$= \frac{59}{180}$$



Try converting these repeating decimals to fractions using this method.

- 1 $0.\dot{7}$ 2 $0.6\dot{7}$ 3 $0.\dot{3}1\dot{2}$ 4 $0.1\dot{6}$ 5 $0.321\dot{7}$

Rachel discovered an interesting trick.

- 1 She asked her father to write a five-digit number.
- 2 Rachel then wrote a five-digit number below her father's. She chose each digit of her number so that when she added it to the digit above, she got 9.
- 3 She then asked her father to write another five-digit number.
- 4 She then repeated Step 2.
- 5 She then asked her father to write one more five-digit number.
- 6 She now challenged her father to a race in adding these five numbers.



4 1 8 4 9
 5 8 1 5 0
 3 8 1 4 6
 6 1 8 5 3
 2 1 4 1 1
 2 2 1 4 0 9

Put a 2 at the front. These three digits are the same as in the last number. Make this 2-digit number two less than the one above it.

1:05 Ratios and rates



PREP QUIZ 1:05

Simplify these fractions.

- 1 $\frac{50}{60}$ 2 $\frac{16}{20}$ 3 $\frac{72}{84}$ 4 $\frac{125}{625}$

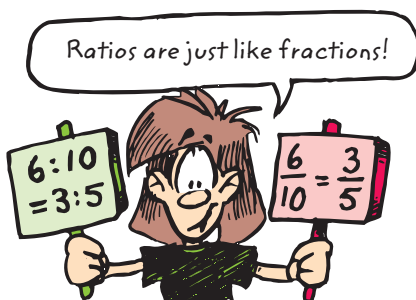
What fraction is:

- 5 50c of \$1 6 40c of 160c 7 8kg of 10kg
 8 100 cm of 150 cm 9 1 m of 150 cm 10 \$2 of \$2.50?

A ratio is a comparison of like quantities.

e.g. Comparing 3 km to 5 km we write:

3 to 5 or 3:5 or $\frac{3}{5}$



A rate is a comparison of unlike quantities.

e.g. If 150 kg of flour is used every 10 minutes, the rate of use would be:

$$\frac{150 \text{ kg}}{10 \text{ min}} \text{ or } \frac{15 \text{ kg}}{1 \text{ min}} \text{ or } 15 \text{ kg/min.}$$

Usually, we write how many of the first quantity correspond to one of the second quantity.

e.g. 46 km in 2 hours is 23 km/h.