

Decimals

6

At a school athletics event, five boys threw the javelin. Aaron threw 22.09 metres, Tyler threw 21.98 metres, David threw 22.1 metres, Anton threw 21.19 metres and Jai threw 21.80 metres. Can you arrange these distances in descending order? Who threw the javelin the furthest?

In this chapter you will learn how to use decimals so that you can compare the distances that each javelin was thrown.



Are you READY?

Try the questions below. If you have difficulty with any of them, extra help can be obtained by completing the matching **SkillsSHEET**. Either click on the **SkillsSHEET** icon next to the question on the *Maths Quest 7* CD-ROM or ask your teacher for a copy.



- 1 Write each of the following as a decimal.
a 3 tenths **b** 5 hundredths **c** 7 thousandths
- 2 Find the largest number in each of the following.
a 1.25, 1.35, 1.32 **b** 0.438, 0.483, 0.484
- 3 Round each of the following to the nearest whole number.
a 4.7 **b** 18.29 **c** 56.51
- 4 Rewrite the following in columns, then add.
a $4.3 + 2.4$ **b** $0.52 + 0.85$ **c** $7.43 + 6.59$
- 5 Rewrite the following in columns, then add.
a $2.76 + 1.2$ **b** $5.2 + 0.376$ **c** $15.37 + 11.4$
- 6 Rewrite the following in columns, then subtract.
a $9.6 - 4.3$ **b** $0.87 - 0.55$ **c** $12.31 - 7.14$
- 7 Rewrite the following in columns, then subtract.
a $8.25 - 2.7$ **b** $1.3 - 0.85$ **c** $26.796 - 19.3$
- 8 Calculate the following.
a 2.5×2 **b** 3.68×3 **c** 12.71×5
- 9 Calculate the following.
a 1.456×10 **b** 0.351×100 **c** 16.039×1000
- 10 Calculate the following.
a $6.9 \div 3$ **b** $8.32 \div 2$ **c** $15.735 \div 5$
- 11 Calculate the following.
a $14.35 \div 10$ **b** $27.1 \div 100$ **c** $38.664 \div 1000$

Place value

Whole numbers

As we saw in chapter 1, the position of a digit within a number indicates the value of the digit. The further the digit is to the left in a number, the larger the place value.

Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Units
100 000	10 000	1000	100	10	1

Each place to the left of another has a value which is 10 times larger. Each place to the right has a value which is $\frac{1}{10}$ of the previous position.

Look at the value of the 3 in each of the following.

Number	Value of 3 in number
132	3 tens or 30
3217	3 thousands or 3000
4103	3 units (ones) or 3

Decimal parts

Whole numbers have units as their smallest place value. It is possible to keep going to smaller values than units. To show values smaller than units, a decimal point, or dot, is placed after the units. The value of the positions to the left and right of the decimal point are shown in the table below.

Thousands	Hundreds	Tens	Units	.	Tenths	Hundredths	Thousandths	Ten thousandths
1000	100	10	1	.	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$	$\frac{1}{10\,000}$

Look at the value of the 3 in these numbers:

14.32 the 3 is 3 tenths or $\frac{3}{10}$
 106.013 the 3 is 3 thousandths or $\frac{3}{1000}$
 0.000 03 the 3 is 3 hundred thousandths or $\frac{3}{100\,000}$

WORKED Example 1

Find the value of the 6 in each of the following.

a 10.64 **b** 0.163 **c** 321.036

THINK

- a** The value of the first place to the right of the decimal point is tenths, so the digit is tenths.
- b** The second place after the decimal point is hundredths, so the digit is hundredths.
- c** The digit is in the thousandths place, so the digit is thousandths.

WRITE

a $\frac{6}{10}$

b $\frac{6}{100}$

c $\frac{6}{1000}$

WORKED Example 2

For the number 76.204 write the value of each digit in words and numbers.

THINK

- 1 7 is in the tens position.
- 2 6 is in the units position.
- 3 2 is in the first position after the decimal point, so it is tenths.
- 4 0 is in the hundredths position.
- 5 4 is in the thousandths position.

WRITE

seventy, 70
 six, 6
 two tenths, $\frac{2}{10}$
 zero hundredths, $\frac{0}{100}$
 four thousandths, $\frac{4}{1000}$

The number 76.204 can be written in expanded notation as:

$$(7 \times 10) + (6 \times 1) + (2 \times \frac{1}{10}) + (4 \times \frac{1}{1000}).$$

WORKED Example 3

Write 3.4501 in expanded notation.

THINK

- 1 Write the question.
- 2 Find the place value of each digit.
 3: 3 ones = 3, 4: 4 tenths = $\frac{4}{10}$,
 5: 5 hundredths = $\frac{5}{100}$, 0: 0 thousandths,
 1: 1 ten thousandth = $\frac{1}{10000}$.
- 3 Write the number in expanded notation.

WRITE

3.4501
 $= (3 \times 1) + (4 \times \frac{1}{10}) + (5 \times \frac{1}{100}) + (1 \times \frac{1}{10000})$

WORKED Example 4

Add one tenth to each of the following numbers.

a 3.4 **b** 0.179 **c** 13

THINK

- a** Tenths is the first place after the decimal point so add 1 to the first digit after the decimal point.
- b** Add 1 to the first place after the decimal point.
- c** There is no tenths place shown (zero tenths), because $13 = 13.0$; so add a decimal point and write 1 after the decimal point.

WRITE

a $3.4 + \text{one tenth} = 3.5$
b $0.179 + \text{one tenth} = 0.279$
c $13 + \text{one tenth} = 13.1$

Decimal places

The number of decimal places is the number of digits after the decimal point.

- 10.3014 has 4 decimal places
 0.002 has 3 decimal places
 51 has no decimal places
 51.0 has one decimal place

Zeros at the end of a decimal do not change the size of the number.

remember

- The position of a digit within a number indicates the value of the digit. Each place is 10 times larger than the one immediately to the right. The positions are shown in the table below.

Thousands	Hundreds	Tens	Units	.	Tenths	Hundredths	Thousandths	Ten thousandths
-----------	----------	------	-------	---	--------	------------	-------------	-----------------

- The number of decimal places is the number of digits after the decimal point. Zeros at the end of a decimal do not change the size of the number.

EXERCISE 6A

Place value

WORKED Example 1

- Find the value of the 2 in each of the following.

- | | | | |
|-------------|------------|----------|--------------|
| a 5.2 | b 19.12 | c 0.02 | d 100.29 |
| e 0.982 047 | f 491.7521 | g 6.1342 | h 90.0002 |
| i 27.003 | j 12.14 | k 1.8902 | l 897.014 12 |

- Find the value of the 9 in each of the following.

- | | | | |
|----------|------------|----------|------------|
| a 0.9 | b 14.98 | c 6.1937 | d 18.89 |
| e 12.090 | f 0.009 14 | g 3.4629 | h 1.276 89 |
| i 39.214 | j 9 | k 900.76 | l 90.612 |

WORKED Example 2

- For the following numbers write the value of each digit in *words* and *numbers*.

- | | | | |
|----------|------------|---------|---------|
| a 4.1 | b 1.85 | c 0.271 | d 9.020 |
| e 16.001 | f 3.402 07 | | |

- For each of the following numbers write the value of each digit in *numbers*.

- | | | | |
|----------|------------|----------|--------------|
| a 0.4 | b 2.7 | c 6.80 | d 5.23 |
| e 0.763 | f 2.108 | g 19.910 | h 0.1101 |
| i 7.2964 | j 0.330 24 | k 300.03 | l 12.276 403 |

WORKED Example 3

- Write the following numbers in expanded notation.

- | | | | |
|----------|----------|----------|----------|
| a 2.47 | b 3.69 | c 1.25 | d 56.01 |
| e 39.01 | f 16.07 | g 7.123 | h 5.987 |
| i 13.482 | j 0.3062 | k 0.1305 | l 0.5002 |

WORKED Example 4

- Add one tenth to each of the following numbers.

- | | | | |
|----------|-------------|------------|---------|
| a 5.7 | b 3.6 | c 0.24 | d 0.15 |
| e 10.0 | f 103.568 | g 28.02 | h 0.248 |
| i 65.772 | j 1.729 021 | k 0.899 99 | l 1.9 |



- 7 Add four hundredths to each of the following numbers.

a 2.11	b 7.24	c 512.35	d 0.107
e 41.10	f 100.002	g 13.251 43	h 0.335 12
i 0.9	j 11.4	k 31.69	l 0.08

- 8 Add two thousandths to the following numbers.

a 9.413	b 11.305	c 84.2114	d 17.7751
e 0.6102	f 2.000	g 0.004 3678	h 49.27
i 3.21	j 0.2	k 0.229	l 4.168

- 9 State how many decimal places are in each of the following numbers.

a 3.15	b 10.2	c 100.019	d 4.60
e 8.999	f 14.3021	g 1869.0567	h 7.0
i 9.246 013 90	j 112	k 30	l 1

10 multiple choice

- a** Four tenths, 1 hundredth and 3 thousandths equals:

A 4.13 **B** 3.14 **C** 0.413 **D** 0.314

- b** Five hundredths, 2 thousandths and 7 ten thousandths equals:

A 527 **B** 52.7 **C** 5.27 **D** 0.0527

- 11 For each of the following numbers:

i state the place value of the zero.

ii Would the value of the number change if the zero wasn't there? (Write yes or no.)

a 6.02	b 10.49	c 7.360	d 13.10	e 4.0
f 133.027	g 0.65	h 17.809	i 20	

- 12 Write true (T) or false (F) for each of the following.

a 76.34 has 4 decimal places.

b 109.651 plus two tenths equals 109.851.

c $\frac{6}{10} + \frac{3}{100} + \frac{4}{1000}$ is the same as 0.6304.

d 4.03 has the same value as 4.3.

e 29.60 has the same value as 29.6.

f 1.2804 could be written as $1 + \frac{3}{10} + \frac{8}{100} + \frac{4}{1000}$.

g 1090.264 51 has 5 decimal places.

h If one hundredth is added to 0.627, the answer is 0.727.

- 13 Copy and complete the table by putting only one digit in each box.

		Tens	Units		Tenths	Hundredths	Thousandths
Example	37.684	3	7	.	6	8	4
a	0.205			.			
b	1.06			.			
c	74.108			.			
d	$\frac{108}{1000}$.			
e	$\frac{105}{10}$.			

Comparing decimals

To compare the size of numbers that include decimal digits ('decimal numbers' or just 'decimals'), it is necessary to compare the size of the digits with the same place value. First compare the whole number parts or the digits to the left of the decimal point. If they are the same for each number, move to the first digit after the decimal point, then the second, the third and so on until the digits are different. The larger digit will belong to the larger number.

To work out which is larger, 1.214 or 1.223, look at the digits carefully. In this example the whole number part is 1 for both numbers. There are 2 tenths in each number. The number 1.214 has 1 hundredth, 1.223 has 2 hundredths and so 1.223 is the larger number.

WORKED Example 5

Find the largest number in each of the following.

a 0.126, 0.216, 0.122 **b** 2.384, 2.388, 2.138 **c** 0.506, 0.605, 0.612

THINK

- a** As the units digit is 0 in each number, compare the tenths. The number 0.216 has 2 tenths, the others have 1 tenth so 0.216 is the largest number.
- b** ① As the units digits are the same, compare the tenths and eliminate the smallest number.
 ② The hundredths are the same so compare the thousandths and decide which number is bigger.
- c** ① As the unit digit is 0 compare the tenths and eliminate the smallest number.
 ② Compare the hundredths and find the biggest number.

WRITE

- a** 0.216 is bigger than 0.126 and 0.122.
- b** 2.384 and 2.388 are both bigger than 2.138.
 2.388 is bigger than 2.384 and 2.138.
- c** 0.605 and 0.612 are bigger than 0.506.
 0.612 is bigger than 0.605 and 0.506.

When comparing two numbers, it is easier to use symbols instead of words, as shown in chapter 5 on fractions. So '0.825 is less than 0.897' can be written as $0.825 < 0.897$.

Similarly, '0.486 is greater than 0.156' can be written as $0.486 > 0.156$.

WORKED Example 6

Write 'is less than' ($<$) or 'is greater than' ($>$) signs between the following pairs of numbers to make true statements.

a 0.312 0.318 **b** 0.0246 0.0168

THINK

- a** Both numbers have the same number of tenths and the same number of hundredths, so compare thousandths and insert the correct sign.
- b** Both numbers have no tenths, so compare hundredths and insert the correct sign.

WRITE

- a** $0.312 < 0.318$
- b** $0.0246 > 0.0168$

remember

1. To compare the size of decimals, it is necessary to compare the size of the digits with the same place value.
2. The symbol ' $<$ ' means 'is less than'.
3. The symbol ' $>$ ' means 'is greater than'.

EXERCISE 6B

Comparing decimals

WORKED
Example
5

- 1 Find the largest number in each of the following.

- | | | | |
|---|------------------------------|---|------------------------------|
| a | 0.24, 0.32, 0.12 | b | 0.76, 0.68, 0.91 |
| c | 0.57, 0.51, 0.59 | d | 0.92, 0.99, 0.93 |
| e | 0.192, 0.191, 0.901 | f | 0.660, 0.666, 0.662 |
| g | 0.1440, 0.1436, 0.1433 | h | 0.0392, 0.039 90, 0.0039 |
| i | 2.506, 2.305, 2.559 | j | 10.0023, 10.0231, 10.0233 |
| k | 0.110 43, 0.110 49, 0.110 40 | l | 0.102 36, 0.100 23, 0.101 09 |

WORKED
Example
6

- 2 Write $<$ or $>$ signs between each of the following pairs of numbers to make true statements.

- | | | | | | |
|---|----------|--------|---|--------|--------|
| a | 3.2 | 2.9 | b | 8.6 | 8.9 |
| c | 1.27 | 1.28 | d | 0.64 | 0.67 |
| e | 1.37 | 1.41 | f | 0.29 | 0.39 |
| g | 13.103 | 13.112 | h | 0.427 | 0.424 |
| i | 0.580 | 0.508 | j | 0.0101 | 0.0120 |
| k | 0.048 01 | 0.4801 | l | 1.3830 | 1.3824 |

- 3 Write the following in order from smallest to largest (ascending order).

- | | |
|---|---|
| a | 0.21, 0.39, 0.17, 0.45, 0.33 |
| b | 0.16, 0.19, 0.27, 0.12, 0.22 |
| c | 0.314, 0.413, 0.420, 0.391, 0.502 |
| d | 0.613, 0.624, 0.690, 0.710, 0.677 |
| e | 0.821, 0.803, 0.811, 0.807, 0.902 |
| f | 0.1164, 0.1245, 0.1033, 0.1002, 0.1196 |
| g | 0.9864, 0.9812, 0.9943, 0.9087, 0.9189 |
| h | 0.4004, 0.4139, 0.4826, 0.4100, 0.4076 |
| i | 4.6249, 4.5097, 4.802, 4.6031, 4.0292 |
| j | 13.0294, 13.0291, 13.0229, 13.0299, 13.0929 |
| k | 0.004 65, 0.005 02, 0.003, 0.0056, 0.009 |
| l | 0.507, 0.61, 0.595, 0.5079, 0.617 |

- 4 Write the following in order from largest to smallest (descending order).

- | | | | |
|---|--|---|-----------------------------------|
| a | 0.36, 0.31, 0.39, 0.48, 0.19 | b | 0.27, 0.38, 0.16, 0.02, 0.35 |
| c | 0.91, 0.97, 0.90, 0.95, 0.99 | d | 0.02, 0.29, 0.07, 0.13, 0.09 |
| e | 1.264, 1.279, 1.273, 1.291, 1.288 | f | 0.442, 0.437, 0.491, 0.406, 0.433 |
| g | 0.372, 0.318, 0.390, 0.309, 0.317 | h | 0.502, 0.556, 0.573, 0.602, 0.591 |
| i | 0.8207, 0.8889, 0.8823, 0.8217, 0.8448 | | |
| j | 0.7657, 0.6024, 0.0307, 0.1079, 0.7695 | | |
| k | 1.349 54, 1.486 59, 1.702 96, 1.843 21, 1.486 13 | | |
| l | 12.289 50, 12.208 64, 12.392, 12.002 36, 12.9092 | | |

- 5 Year 7 girls competing in their school swimming sports recorded the following times in the 50-metre freestyle, backstroke and breaststroke events.

Event	Time (seconds) recorded by contestants						
	Carolyn	Jessica	Mara	Jenika	Robyn	Shelley	Kyah
Freestyle	37.23	39.04	40.90	38.91	37.45	37.02	37.89
Backstroke	40.23	43.87	44.08	42.65	41.98	40.29	41.05
Breaststroke	41.63	42.7	41.10	41.21	42.66	41.33	41.49

- Who won the freestyle event? How much did she win it by?
- Who won the backstroke event? How much did she win it by?
- Who won the breaststroke event? How much did she win it by?

The javelin event

At a school athletics event, five boys threw the javelin. Aaron threw 22.09 metres, Tyler threw 21.98 metres, David threw 22.1 metres, Anton threw 21.19 metres and Jai threw 21.80 metres.

1 Arrange these distances in descending order.

2 Who threw the javelin the furthest?

The student who threw the furthest went on to compete in the Combined Schools Athletics Competition. The results sheet from the boys' javelin event is shown below (each student had three throws).

Student	Distance (metres)		
	Throw 1	Throw 2	Throw 3
David	22.25	22.34	22.17
Brenton	22.46	22.78	22.65
Lloyd	22.09	21.98	22.21
Eli	22.12	22.32	22.32
Daniel	22.67	22.56	22.65
Ari	21.89	21.78	22.05
Aaron	22.23	22.30	22.43

- Write down the longest throw for each boy.
- Who won the competition?
- Who came second?
- Who came third?
- How much further did the winner throw the javelin than the boy who came second?

Converting decimals to fractions

In addition to expressing decimals in expanded notation, decimals can also be written as single fractions. This can be done by following the steps given below.

1. Write every number after the decimal point as the numerator of the fraction.
2. The denominator is the place value of the last digit.

WORKED Example 7

Write the following decimals as fractions without simplifying.

a 0.2 **b** 0.86 **c** 0.6021 **d** 3.041

THINK

- a**
- 1 Write the decimal.
 - 2 The numerator is 2 and the last decimal place is tenths so the denominator is 10.
- b**
- 1 Write the decimal.
 - 2 The numerator is 86. The last decimal place is hundredths so the denominator is 100.
- c**
- 1 Write the decimal.
 - 2 The numerator is 6021. The last place is tens of thousandths so the denominator is 10 000.
- d**
- 1 Write the decimal.
 - 2 Write the whole number part and change the decimal part to a fraction.

WRITE

$$\begin{aligned} \mathbf{a} \quad & 0.2 \\ &= \frac{2}{10} \end{aligned}$$

$$\begin{aligned} \mathbf{b} \quad & 0.86 \\ &= \frac{86}{100} \end{aligned}$$

$$\begin{aligned} \mathbf{c} \quad & 0.6021 \\ &= \frac{6021}{10\,000} \end{aligned}$$

$$\begin{aligned} \mathbf{d} \quad & 3.041 \\ &= 3 \frac{41}{1000} \end{aligned}$$

Once decimals have been written as a fraction or mixed numeral, they can be simplified or cancelled. To simplify a fraction, divide both the numerator and the denominator by the highest common factor.

WORKED Example 8

Write 7.264 as a mixed numeral in simplest form.

THINK

- 1 Write the decimal.
- 2 Write the whole number part and change the decimal part to a fraction.
- 3 Divide the numerator and the denominator by the highest common factor.
- 4 Simplify the fraction.

WRITE

$$\begin{aligned} & 7.264 \\ &= 7 \frac{264}{1000} \\ &= 7 \frac{264 \div 8}{1000 \div 8} \\ &= 7 \frac{33}{125} \end{aligned}$$

remember

To write decimals as single fractions:

1. write the whole number part first
2. write all decimal places as the numerator of the fraction
3. write the denominator as the place value of the last digit
4. simplify the fraction if required.

EXERCISE 6C

Converting decimals to fractions

**WORKED
Example**
7a, b, c

- 1 Write the following decimals as fractions without simplifying.

a 0.3	b 0.5	c 0.9	d 0.21
e 0.49	f 0.63	g 0.502	h 0.617
i 0.882	j 0.9456	k 0.9209	l 0.4621

**WORKED
Example**
7d

- 2 Write the following decimals as mixed numerals without simplifying.

a 1.3	b 1.6	c 2.7	d 9.4
e 2.13	f 6.48	g 5.27	h 19.182
i 12.843	j 16.682	k 2.4917	l 4.3386

- 3 Write the following as fractions, then simplify.

a 0.4	b 0.8	c 0.24	d 0.44
e 0.12	f 0.30	g 0.64	h 0.28
i 0.75	j 0.120	k 0.286	l 0.468

**WORKED
Example**
8

- 4 Write the following as mixed numerals in simplest form.

a 1.2	b 2.8	c 4.2	d 8.5
e 12.42	f 3.15	g 6.25	h 9.140
i 37.205	j 18.645	k 24.345	l 100.0048

- 5 **multiple choice**

- a** 0.13 as a fraction is:

A $\frac{13}{10}$	B $\frac{13}{100}$	C $\frac{13}{1000}$	D $\frac{1.3}{100}$
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- b** 0.207 as a fraction is:

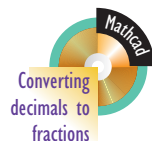
A $\frac{207}{1000}$	B $\frac{207}{100}$	C $2\frac{7}{10}$	D $20\frac{7}{10}$
-----------------------------	----------------------------	--------------------------	---------------------------

- c** 0.52 as a fraction in simplest form is:

A $\frac{52}{100}$	B $\frac{26}{50}$	C $\frac{13}{25}$	D $\frac{26}{100}$
---------------------------	--------------------------	--------------------------	---------------------------

- d** 0.716 as a fraction in simplest form is:

A $\frac{716}{10\,000}$	B $\frac{368}{500}$	C $\frac{716}{1000}$	D $\frac{179}{250}$
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Rounding

Often when a calculator is used to solve a problem, many decimal places are given in the answer. When this happens it is necessary to round the number. For example, when calculating interest on an investment, an answer of \$152.3479 would be meaningless because the first 2 decimal places indicate the number of cents. The answer would be rounded to 2 decimal places and the interest would be \$152.35. An answer in centimetres could be rounded to 1 decimal place because a tenth of a centimetre is 1 millimetre and it would be difficult to measure more accurately than to the nearest millimetre.

Rounding 3.243 1096 to 2 decimal places would give 3.24.

Rounding 4.328 1334 to 2 decimal places gives 4.33.

Rounding decimals

Look at the first digit past the number of decimal places required.

- If this number is *less than 5*, write the number with the required number of decimal places.
- If this number is *5 or more*, add 1 to the last decimal place being kept.

For example if 2.6137 is rounded to 2 decimal places, we would think of the number with the required decimal places (2.61). Then we would look at the next digit, which in this case is 3. As this is less than 5, we leave the number as it is. The answer is approximately 2.61. This can be written as $2.6137 \approx 2.61$. The \approx shows that the 2 parts are approximately equal. In fact, 2.61 is 37 ten thousandths less than 2.6137.

If we were rounding 9.8367 to 2 decimal places, we would think of the number with the required decimal places (9.83). Then we would look at the next digit, which in this case is 6. Whenever the next digit is a 5, 6, 7, 8 or 9, we increase the last digit that we are keeping by 1, so the 3 becomes 4. The answer is $9.8367 \approx 9.84$ when rounded to 2 decimal places.

WORKED Example 9

Round the following to 2 decimal places.

a 3.641 883

b 18.965 4020

THINK

- a** ① Write the number and think of it with the required number of decimal places.
- ② Look at the next digit and, if it is less than 5, write the number with the required number of digits after the decimal point.

WRITE

a 3.641 883

≈ 3.64

- b** ① Write the number and think of it with the required number of decimal places.

- ② Look at the next digit and, if it is greater than or equal to 5, add 1 to the last decimal place that is being kept.

b 18.965 4020

≈ 18.97

If you add 1 to the last decimal place and the number in this position is a 9, the result is 10. The 0 is put in the last required place and the 1 is added to the digit in the next place to the left. So 0.298 rounded to 2 decimal places is 0.30.

WORKED Example 10

Round the following to the number of decimal places shown in the brackets.

- a** 27.462 973 (4) **b** 0.009 94 (3)

THINK

- a** ① Write the number and think of it with the required number of decimal places.
 ② Look at the next digit and, if it is greater than or equal to 5, add 1 to the last decimal place. If 1 is being added to 9, write 0 in the last place and add 1 to the previous digit.
- b** ① Write the number and think of it with the required number of decimal places.
 ② Look at the next digit and, if it is greater than or equal to 5, add 1 to the last decimal place. If 1 is being added to 9, write 0 in the last place and add 1 to the previous digit.

WRITE

- a** 27.462 973
 ≈ 27.4630
- b** 0.009 94
 ≈ 0.010

WORKED Example 11

Round 8.672 to the nearest unit.

THINK

- ① Write the decimal and think of the number with the whole number part only.
 ② Look at the first digit after the decimal point and, if it is greater than or equal to 5, add 1 to the whole number.

WRITE

- 8.672
 ≈ 9

It can be seen that 8.672 is closer to 9 than it is to 8, so this is a way of finding a suitable approximation.

WORKED Example 12

Melinda had \$51.67 in her bank account. She wanted to withdraw all her money so the bank rounded the amount to the nearest 5 cents. How much money did the teller give to Melinda?

THINK

- ① Write the actual amount she had in her account.
 ② The amount will end in 5 if the last digit is closer to 5 and 0 if the last digit is closer to 10, so rewrite the approximate value.
 ③ Write a sentence.

WRITE

- \$51.67
 $\approx \$51.65$

Melinda will receive \$51.65 from the bank.

remember

- To round a decimal.
Look at the first digit past the number of decimal places required.
(a) If this number is *less than 5*, write the number with the number of decimal places required.
(b) If this number is *5 or more*, add 1 to the last decimal place being kept.
If you add 1 to the last decimal place and the number in this position is a 9, the result is 10. The 0 is put in the last required place and the 1 is added to the digit in the next place to the left.
- Rounding an answer gives a useful approximation of the original decimal. Use the symbol \approx instead of $=$ to show that the answer is an approximation.

EXERCISE 6D

Rounding



WORKED Example 9

- 1 Round the following to 2 decimal places.

a 0.3241	b 0.863	c 1.246 10	d 13.049 92
e 7.128 63	f 100.813 82	g 71.260 39	h 0.0092
i 0.185 00	j 19.6979	k 0.3957	l 0.999



- 2 Round the following to 1 decimal place.

a 0.410	b 0.87	c 9.27	d 25.25
e 300.06	f 12.82	g 99.91	h 8.88
i 17.610 27	j 0.8989	k 93.994	l 0.959 027

WORKED Example 10

- 3 Round the following to the number of decimal places shown in the brackets.

a 2.386 214 (2)	b 14.034 59 (1)	c 0.027 135 (2)
d 0.876 4903 (4)	e 64.295 18 (4)	f 0.382 04 (3)
g 96.28 049 (1)	h 3.0409 (2)	i 8.902 (2)
j 47.879 69 (3)	k 0.099 498 632 (2)	l 0.486 2590 (2)

- 4 **multiple choice**

- a 13.179 rounded to 2 decimal places is equal to:
 A 13.17 B 13.20 C 13.18 D 13.27
- b 0.2465 rounded to 1 decimal place is equal to:
 A 0.3 B 0.25 C 1.2 D 0.2
- c 1.7688 rounded to 3 decimal places is equal to:
 A 1.768 B 1.770 C 1.778 D 1.769
- d 2.998 rounded to 1 decimal place is equal to:
 A 3.0 B 2.9 C 2.8 D 3.1



WORKED Example 11

- 5 Round the following to the nearest unit.

a 10.7	b 8.2	c 3.6	d 92.7
e 112.1	f 21.76	g 42.0379	h 2137.50
i 0.12	j 0.513	k 0.99	l 40.987

- 6 Round the following to the nearest ten.

a	13	b	76	c	47	d	138
e	262	f	175	g	306.2	h	1484
i	10 024	j	209 718.5	k	18.6	l	5.92

- 7 Round the following to the nearest hundred.

a	320	b	190	c	894	d	138
e	125	f	6751	g	875.2	h	9750.051
i	1724	j	1 462 836.5	k	71	l	47

- 8 Round the following to the nearest thousand.

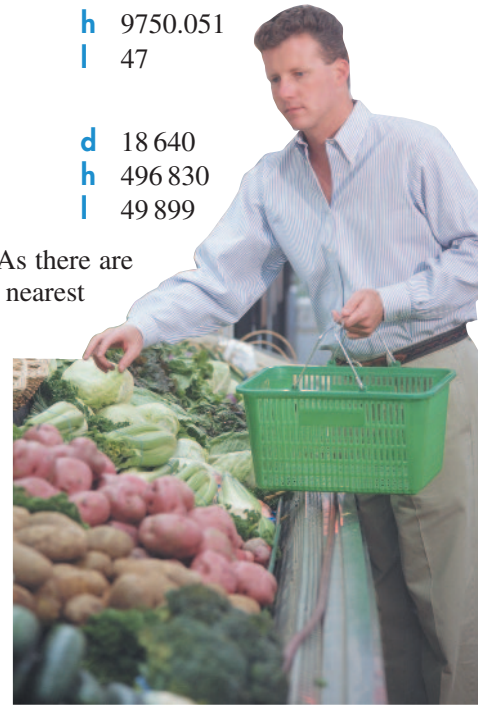
a	3426	b	5890	c	12 300	d	18 640
e	28 000	f	9462	g	1098	h	496 830
i	12 780	j	862	k	129 980	l	49 899

**WORKED
Example**
12

- 9 In the supermarket Chris's shopping bill came to \$27.68. As there are no 1 or 2 cent pieces, this amount must be rounded to the nearest 5 cents. How much will Chris pay for his shopping?

- 10 The maximum temperature was recorded as 24.7°C . In the news broadcast, the presenter quoted this to the nearest degree. What temperature was quoted?

- 11 Using a calculator, Hymie worked out that the piece of timber required to finish making a support for a gate should be 3.567 82 metres. Realistically, the timber can be measured only to the nearest millimetre (nearest thousandth of a metre). What measurement should be used for the length of the timber? Explain why 3.567 82 m is unreasonable as a measurement for timber.



10 QUICK QUESTIONS 1

- What is the value of 5 in 12.654?
- For the number 1.9632, write the value of each digit in words.
- Add two hundredths to 4.308.
- Use $<$ or $>$ between 4.098 and 4.908 to make a true statement.
- Write the following in order from smallest to largest.
7.03, 4.15, 24.5, 6.08, 0.0709, 0.8, 324.8, 1.61
- Write 0.67 as a fraction.
- Write 0.4 as a fraction in simplest form.
- Write 7.082 as a mixed numeral.
- Round 13.628 to 2 decimal places.
- Round 13.628 to 1 decimal place.



Adding decimals

When adding numbers with decimals:

1. Line up the decimal points so that digits of the same place value are underneath each other.
2. Add numbers with decimals as though adding whole numbers, working from right to left.
3. Make sure that the decimal point in the answer is directly underneath the decimal points in the question.

WORKED Example 13

Calculate:

a 0.3	b 12.14
$+ 0.5$	$+ 2.33$
<u> </u>	<u> </u>

THINK

- a Copy the question exactly and add the digits as for whole numbers. Write the decimal point directly below the decimal points in the question.
- b Copy the question exactly and add the digits as for whole numbers. Write the decimal point directly below the decimal points in the question.

WRITE

a 0.3
$+ 0.5$
<u>0.8</u>
b 12.14
$+ 2.33$
<u>14.47</u>

It is useful to check answers by rounding them to the nearest first digit which is not zero and adding them in your head.

WORKED Example 14

Calculate the following, after filling the blank spaces with zeros.

a 0.048	b 1.25
$+ 1.3$	3.146
<u> </u>	$+ 7.0$
<u> </u>	<u> </u>

THINK

- a ① Write the question, replacing the spaces with zeros.
- ② Add the digits as for whole numbers. Write the decimal point directly below the decimal points in the question.
- ③ Check the answer by rounding the numbers and then adding them. (The checked answer will be less than the actual answer because the first answer is rounded up a little and the second number is rounded down a larger amount; so we would obtain $0.05 + 1 = 1.05$ which is close to 1.348.)

WRITE

a 0.048
$+ 1.300$
<u>1.348</u>

THINK

- b** ① Write the question, replacing the spaces with zeros.
- ② Add the digits as for whole numbers. Write the decimal point directly below the decimal points in the question.
- ③ Check the answer by rounding and then adding $1 + 3 + 7 = 11$ which is close to 11.396. (This step can be done in your head.)

WRITE

$$\begin{array}{r}
 1.250 \\
 3.146 \\
 + 7.000 \\
 \hline
 11.396
 \end{array}$$

If the question is not written in columns, it is necessary to rewrite it with the decimal points one under the other.

WORKED Example 15

Rewrite in columns, then add $0.26 + 1.8 + 12.214$.

THINK

- ① Write the question in columns with the decimal points directly beneath each other with the zeros included.
- ② Add the digits as for whole numbers. Write the decimal point directly below the decimal points in the question.
- ③ Check the answer by rounding and then adding $0.3 + 2 + 12 = 14.3$ which is close to 14.274.

WRITE

$$\begin{array}{r}
 0.260 \\
 1.800 \\
 + 12.214 \\
 \hline
 14.274
 \end{array}$$

You may like to check your answers by using one of the technology files on the *Maths Quest 7* CD-ROM (see the icons on page 234).

remember

1. To add numbers containing decimals, write the numbers in columns, making sure that the decimal points are directly underneath each other. If there are blank places, replace them with zeros.
2. Add numbers with decimal points as for whole numbers and insert the decimal point directly below the decimal points in the question.

EXERCISE 6E

Adding decimals


**WORKED
Example**
13

1 Calculate the following.

$$\begin{array}{r} \text{a} \quad 0.4 \\ + 0.1 \\ \hline \end{array}$$

$$\begin{array}{r} \text{d} \quad 4.6 \\ + 0.3 \\ \hline \end{array}$$

$$\begin{array}{r} \text{g} \quad 5.2 \\ + 3.7 \\ \hline \end{array}$$

$$\begin{array}{r} \text{j} \quad 2.35 \\ + 1.04 \\ \hline \end{array}$$

$$\begin{array}{r} \text{m} \quad 15.19 \\ + 18.23 \\ \hline \end{array}$$

$$\begin{array}{r} \text{p} \quad 20.024 \\ + 18.118 \\ \hline \end{array}$$

$$\begin{array}{r} \text{b} \quad 0.5 \\ + 0.2 \\ \hline \end{array}$$

$$\begin{array}{r} \text{e} \quad 8.9 \\ + 5.4 \\ \hline \end{array}$$

$$\begin{array}{r} \text{h} \quad 0.12 \\ + 0.33 \\ \hline \end{array}$$

$$\begin{array}{r} \text{k} \quad 0.18 \\ + 0.73 \\ \hline \end{array}$$

$$\begin{array}{r} \text{n} \quad 0.421 \\ + 0.392 \\ \hline \end{array}$$

$$\begin{array}{r} \text{q} \quad 0.764 \\ + 0.8210 \\ \hline \end{array}$$

$$\begin{array}{r} \text{c} \quad 1.2 \\ + 2.3 \\ \hline \end{array}$$

$$\begin{array}{r} \text{f} \quad 2.6 \\ + 1.3 \\ \hline \end{array}$$

$$\begin{array}{r} \text{i} \quad 1.67 \\ + 1.02 \\ \hline \end{array}$$

$$\begin{array}{r} \text{l} \quad 1.04 \\ + 8.89 \\ \hline \end{array}$$

$$\begin{array}{r} \text{o} \quad 8.062 \\ + 5.177 \\ \hline \end{array}$$

$$\begin{array}{r} \text{r} \quad 10.0364 \\ + 92.1494 \\ \hline \end{array}$$

Adding
decimalsAdding
decimalsAdding
decimals
(DIY)
**WORKED
Example**
14a

2 Calculate the following, after filling the blank spaces with zeros.

$$\begin{array}{r} \text{a} \quad 3.12 \\ + 4.321 \\ \hline \end{array}$$

$$\begin{array}{r} \text{d} \quad 0.904 \\ + 0.32 \\ \hline \end{array}$$

$$\begin{array}{r} \text{g} \quad 1.5 \\ + 13.291 \\ \hline \end{array}$$

$$\begin{array}{r} \text{j} \quad 100.049 \\ + 3.01 \\ \hline \end{array}$$

$$\begin{array}{r} \text{m} \quad 12.26 \\ + 1089.094 \\ \hline \end{array}$$

$$\begin{array}{r} \text{b} \quad 8.69 \\ + 3.1 \\ \hline \end{array}$$

$$\begin{array}{r} \text{e} \quad 18.943 \\ + 3.87 \\ \hline \end{array}$$

$$\begin{array}{r} \text{h} \quad 12.31 \\ + 7 \\ \hline \end{array}$$

$$\begin{array}{r} \text{k} \quad 0.1 \\ + 37.992 \\ \hline \end{array}$$

$$\begin{array}{r} \text{n} \quad 8.1559 \\ + 0.21 \\ \hline \end{array}$$

$$\begin{array}{r} \text{c} \quad 6.27 \\ + 0.5 \\ \hline \end{array}$$

$$\begin{array}{r} \text{f} \quad 1.641 \\ + 0.4 \\ \hline \end{array}$$

$$\begin{array}{r} \text{i} \quad 3.26 \\ + 18.6460 \\ \hline \end{array}$$

$$\begin{array}{r} \text{l} \quad 3.2286 \\ + 0.85 \\ \hline \end{array}$$

$$\begin{array}{r} \text{o} \quad 4.3 \\ + 3.6082 \\ \hline \end{array}$$

**WORKED
Example****14b**

- 3** Calculate the following, after filling in the blank spaces with zeros.

$$\begin{array}{r} \text{a} \quad 4.2 \\ 3.6 \\ + 0.1 \\ \hline \end{array}$$

$$\begin{array}{r} \text{b} \quad 7.28 \\ 9.5 \\ + 3.6 \\ \hline \end{array}$$

$$\begin{array}{r} \text{c} \quad 2.64 \\ 0.17 \\ + 3.22 \\ \hline \end{array}$$

$$\begin{array}{r} \text{d} \quad 1.83 \\ 4.27 \\ + 12.68 \\ \hline \end{array}$$

$$\begin{array}{r} \text{e} \quad 3.02 \\ 4.1 \\ + 9.27 \\ \hline \end{array}$$

$$\begin{array}{r} \text{f} \quad 13.017 \\ 8.6 \\ + 34.13 \\ \hline \end{array}$$

$$\begin{array}{r} \text{g} \quad 0.2791 \\ 0.34 \\ + 0.1 \\ \hline \end{array}$$

$$\begin{array}{r} \text{h} \quad 13.942 \\ 6.38 \\ + 2 \\ \hline \end{array}$$

$$\begin{array}{r} \text{i} \quad 4.2 \\ 62.013 \\ + 1946.12 \\ \hline \end{array}$$

$$\begin{array}{r} \text{j} \quad 0.38 \\ 2.640\ 29 \\ + 19.02 \\ \hline \end{array}$$

$$\begin{array}{r} \text{k} \quad 153.27 \\ 0.8321 \\ + 21.7 \\ \hline \end{array}$$

$$\begin{array}{r} \text{l} \quad 48.129\ 06 \\ 9 \\ + 204.32 \\ \hline \end{array}$$

**WORKED
Example****15**

- 4** Rewrite the following in columns, then add.

$$\text{a} \quad 1.4 + 3.2$$

$$\text{b} \quad 6.5 + 0.4$$

$$\text{c} \quad 0.22 + 1.37$$

$$\text{d} \quad 12.12 + 28.15$$

$$\text{e} \quad 0.213 + 12.495$$

$$\text{f} \quad 0.362 + 7.078$$

$$\text{g} \quad 4.39 + 0.5$$

$$\text{h} \quad 8.21 + 100.039$$

$$\text{i} \quad 0.264 + 9.17$$

$$\text{j} \quad 3.261 + 0.21$$

$$\text{k} \quad 15.987 + 1.293$$

$$\text{l} \quad 8.027 + 0.9415$$

$$\text{m} \quad 10.8271 + 6.5$$

$$\text{n} \quad 1.8 + 18.6329$$

$$\text{o} \quad 26.29 + 1030.4963$$

- 5** Rewrite the following sums, then add.

$$\text{a} \quad 0.24 + 3.16 + 8.29$$

$$\text{b} \quad 14.23 + 1.06 + 86.29 + 3.64$$

$$\text{c} \quad 40.271 + 0.36 + 1.4$$

$$\text{d} \quad 5.27 + 1.381 + 12.3$$

$$\text{e} \quad 9.2 + 5 + 26.482$$

$$\text{f} \quad 0.31 + 4.26 + 5.039 + 0.19$$

$$\text{g} \quad 0.82 + 4.1 + 29.264 + 8.33$$

$$\text{h} \quad 4.27 + 8.996 + 0.8$$

$$\text{i} \quad 100 + 4.3 + 0.298 + 1.36$$

$$\text{j} \quad 82.3 + 100.6 + 0.9949 + 9$$

$$\text{k} \quad 3.026 + 5.9938 + 8.7718 + 3.2$$

$$\text{l} \quad 126 + 372.8 + 100.0264 + 2020.13$$

6 multiple choice

$$\text{a} \quad 1.6 + 4.8 \text{ equals:}$$

$$\text{A} \quad 5.4$$

$$\text{B} \quad 6.4$$

$$\text{C} \quad 0.54$$

$$\text{D} \quad 0.64$$

$$\text{b} \quad 3.26 + 0.458 \text{ equals:}$$

$$\text{A} \quad 3.718$$

$$\text{B} \quad 0.784$$

$$\text{C} \quad 0.037\ 18$$

$$\text{D} \quad 3.484$$

$$\text{c} \quad 1.84 + 0.61 + 4.07 \text{ equals:}$$

$$\text{A} \quad 6.52$$

$$\text{B} \quad 6.42$$

$$\text{C} \quad 5.42$$

$$\text{D} \quad 5.52$$

$$\text{d} \quad 216 + 1.38 + 0.002\ 64 \text{ equals:}$$

$$\text{A} \quad 217.4064$$

$$\text{B} \quad 0.618$$

$$\text{C} \quad 217.644$$

$$\text{D} \quad 217.382\ 64$$

- 7** Josh deposited \$27.60 into his bank account. If his balance before the deposit was \$139.40, what is Josh's new bank balance?
- 8** Jessica bought the following items at the school canteen: 1 can of Coke for \$1.60, 1 sausage roll for \$1.20, 1 packet of chips for \$1.50 and 2 Redskins for \$0.40 (Redskins cost 20 cents each). How much did Jessica spend?

- 9 A triathlon consists of a 0.5-kilometre swim, a 15.35-kilometre ride and a 4.2-kilometre run. How far do the competitors have to travel altogether?
- 10 In one day Amy walked 3.6 kilometres to school, 0.8 kilometres from school to the shops, 1.2 kilometres from the shops to a friend's house and finally 2.5 kilometres from her friend's house to her home. How far did Amy walk?
- 11 For lunch Paul ordered 1 potato cake, 1 dim sim, the minimum of chips and a milkshake from the menu shown below. How much did Paul spend on his lunch?

MENU			
Flake	\$3.50	Coffee	\$2.20
Whiting	\$3.50	Tea	\$2.20
Dim sims	\$0.60	Soft drinks	\$1.80
Potato cakes	\$0.50	Milkshakes	\$3.00
Minimum chips	\$2.50		



Palindromic decimals

Palindromic numbers read the same forwards and backwards. For example 121, 23 532 and 6776 are all palindromic numbers.

Palindromic decimals read the same from left to right and right to left. For example, 75.57 is a palindromic decimal whereas 6.96 and 722.7 are not. If a decimal is not palindromic we can follow a procedure to obtain a palindromic decimal.

Start with the decimal 6.8, then add its reverse (8.6) to obtain a new decimal.

$$\begin{array}{r} 6.8 \\ + 8.6 \\ \hline 15.4 \end{array}$$

The new decimal is not palindromic, so continue the process until a palindromic decimal is obtained.

Next add 15.4 and its reverse.

$$\begin{array}{r} 15.4 \\ + 4.51 \\ \hline 19.91 \end{array}$$

The number 19.91 is a palindromic decimal. This process took 2 steps.

- How many steps are required until a palindromic decimal results after starting with 5.9?
- How many steps are required until a palindromic decimal results after starting with 9.7?
- How many steps are required until a palindromic decimal results after starting with 8.9?
- Which decimals of the form 1.1, 2.2, 3.3, 4.4, 5.5, 6.6, 7.7, 8.8, 9.9 require the most number of steps to form a palindromic decimal?

Subtracting decimals

When subtracting numbers containing decimals:

1. Line up the decimal points so that the digits of the same place value are underneath each other.
2. Work from right to left, subtracting digits as though subtracting whole numbers.
3. Make sure that the decimal point in the answer is directly underneath the decimal points in the question.

WORKED Example 16

Calculate:
$$\begin{array}{r} 0.56 \\ - 0.14 \\ \hline \end{array}$$

THINK

- 1 Copy the question exactly and subtract the digits as for whole numbers. Write the decimal point directly below the decimal points in the question.
- 2 Check the answer by rounding;
 $0.6 - 0.1 = 0.5$ which is close to 0.42.
 (This step can be done in your head.)

WRITE

$$\begin{array}{r} 0.56 \\ - 0.14 \\ \hline 0.42 \end{array}$$

Make sure when subtracting decimals that you fill in the blank decimal places with zeros.

WORKED Example 17

Rewrite the following in columns, then subtract.

a $1.82 - 0.57$ **b** $2.641 - 0.85$

THINK

- a** 1 Write in columns with the decimal points directly under each other. Subtract, and insert the decimal point directly below the other decimal points in the question.
- 2 Check the answer by rounding;
 $2 - 1 = 1$ which is close to 1.25.
- b** 1 Write in columns with the decimal points directly under each other, adding zeros as appropriate. Subtract as for whole numbers and insert the decimal point directly below the other decimal points.
- 2 Check the answer by rounding;
 $3 - 1 = 2$ which is close to 1.791.

WRITE

a
$$\begin{array}{r} 1.8^{\overline{7}}2 \\ - 0.5\ 7 \\ \hline 1.2\ 5 \end{array}$$
 or
$$\begin{array}{r} 1.8^{\overline{1}}2 \\ - 0.5^{\overline{1}}7 \\ \hline 1.2\ 5 \end{array}$$

b
$$\begin{array}{r} 2.6^{\overline{5}}41 \\ - 0.8\ 50 \\ \hline 1.7\ 91 \end{array}$$

$$\begin{array}{r} 2.6^{\overline{1}}41 \\ - 0.8^{\overline{1}}50 \\ \hline 1.7\ 91 \end{array}$$

remember

1. To subtract decimals, write the numbers in columns with the decimal points directly underneath each other. If there are blank spaces, replace them with zeros.
2. Subtract as for whole numbers and insert the decimal point directly below the decimal points in the question.

EXERCISE 6F

Subtracting decimals


**WORKED
Example**
16

- 1**
- Calculate the following.

a
$$\begin{array}{r} 0.72 \\ - 0.51 \\ \hline \end{array}$$

d
$$\begin{array}{r} 9.36 \\ - 4.04 \\ \hline \end{array}$$

g
$$\begin{array}{r} 5.83 \\ - 2.65 \\ \hline \end{array}$$

j
$$\begin{array}{r} 4.831 \\ - 2.625 \\ \hline \end{array}$$

m
$$\begin{array}{r} 0.5274 \\ - 0.3875 \\ \hline \end{array}$$

b
$$\begin{array}{r} 1.36 \\ - 0.25 \\ \hline \end{array}$$

e
$$\begin{array}{r} 10.278 \\ - 9.155 \\ \hline \end{array}$$

h
$$\begin{array}{r} 0.61 \\ - 0.48 \\ \hline \end{array}$$

k
$$\begin{array}{r} 19.26 \\ - 11.58 \\ \hline \end{array}$$

n
$$\begin{array}{r} 0.6301 \\ - 0.5495 \\ \hline \end{array}$$

c
$$\begin{array}{r} 6.87 \\ - 6.27 \\ \hline \end{array}$$

f
$$\begin{array}{r} 0.679 \\ - 0.333 \\ \hline \end{array}$$

i
$$\begin{array}{r} 12.231 \\ - 8.026 \\ \hline \end{array}$$

l
$$\begin{array}{r} 1.07 \\ - 0.89 \\ \hline \end{array}$$

o
$$\begin{array}{r} 3.0091 \\ - 1.6723 \\ \hline \end{array}$$

- 2**
- Calculate, filling the spaces with zeros as required.

a
$$\begin{array}{r} 3.27 \\ - 1.2 \\ \hline \end{array}$$

d
$$\begin{array}{r} 29.154 \\ - 16.32 \\ \hline \end{array}$$

g
$$\begin{array}{r} 0.0026 \\ - 0.00071 \\ \hline \end{array}$$

j
$$\begin{array}{r} 1000.0201 \\ - 6.43 \\ \hline \end{array}$$

m
$$\begin{array}{r} 12 \\ - 8.64 \\ \hline \end{array}$$

b
$$\begin{array}{r} 0.64 \\ - 0.5 \\ \hline \end{array}$$

e
$$\begin{array}{r} 95.678 \\ - 38.1 \\ \hline \end{array}$$

h
$$\begin{array}{r} 11.11 \\ - 9.99 \\ \hline \end{array}$$

k
$$\begin{array}{r} 18.26 \\ - 12.7 \\ \hline \end{array}$$

n
$$\begin{array}{r} 1.41 \\ - 0.943 \\ \hline \end{array}$$

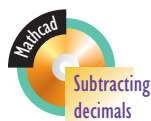
c
$$\begin{array}{r} 5.283 \\ - 1.19 \\ \hline \end{array}$$

f
$$\begin{array}{r} 31.02 \\ - 26 \\ \hline \end{array}$$

i
$$\begin{array}{r} 98.26 \\ - 9.07 \\ \hline \end{array}$$

l
$$\begin{array}{r} 146 \\ - 58.91 \\ \hline \end{array}$$

o
$$\begin{array}{r} 3.2 \\ - 0.467 \\ \hline \end{array}$$


 Subtracting
decimals

 Subtracting
decimals


**WORKED
Example**

17

3 Rewrite the following in columns, then subtract.

a $5.64 - 2.3$

b $12.07 - 6.14$

c $13.869 - 10.02$

d $0.687 - 0.36$

e $15.226 - 11.08$

f $42.83 - 15$

g $6.734 - 4.8$

h $12.2 - 8.911$

i $13.9009 - 12.65$

j $100.562 - 86.0294$

k $38 - 21.234$

l $47 - 8.762$

m $5 - 0.8864$

n $0.2 - 0.0049$

o $3.279 - 2.50684$

4 **multiple choice****a** $0.39 - 0.15$ equals:

A 0.0024

B 0.024

C 0.24

D 2.4

b $1.4 - 0.147$ would be rewritten as:

A 1.4

B -1.400

C 1.40

D 1.004

-0.417

-0.147

-1.47

-0.147

c $0.3 - 0.024$ equals:

A 0.06

B 0.276

C 0.7

D 0.76

d $150.278 - 0.99$ equals:

A 150.728

B 149.288

C 1.49288

D 159.388

5 Ryan works in a newsagency. A customer buys \$9.65 worth of goods and gives Ryan a \$20 note. How much change should Ryan give the customer?**6** A jockey has a mass of 52.3 kilograms. After exercising for 2 days and spending time in a sauna, the jockey has lost 1.82 kilograms. What is the jockey's mass now?**7** If 1.27 metres is cut from a piece of material that is 13 metres long, how much material is left?**8** Cathy Freeman won a particular 400 metres race in 51.35 seconds. In her next race, her time was 2.97 seconds faster than this. What was Cathy's time for this race?**9** Gary and Liz are replacing the skirting boards in their lounge room. They know the perimeter of the room is 34.28 metres. If there is a door 0.82 metres wide and a fireplace 2.18 metres wide that do not require skirting boards, how much wood will they need to buy for their lounge room?

- 10 The following table shows the times recorded for each swimmer in the under-13, 50-metre freestyle relay for 6 teams.

Team	Times for each swimmer (seconds)			
	Swimmer 1	Swimmer 2	Swimmer 3	Swimmer 4
1	36.7	41.3	39.2	35.8
2	38.1	46.5	38.8	35.9
3	34.6	39.2	39.9	35.2
4	41.6	40.8	43.7	40.5
5	37.9	40.2	38.6	39.2
6	38.3	39.1	40.8	37.6

- a Find the total time for each team. Put your results in a table.
 b Which team won the relay?
 c What was the difference in time between the first and second placed teams?

Multiplying decimals by a whole number

When multiplying a decimal by a whole number:

1. set the question out as for multiplying whole numbers
2. ignore the decimal points and multiply the numbers
3. count the total number of decimal places in all parts of the question. The answer has the same number of decimal places as the question.

WORKED Example 18

Calculate: a 12.6×7 b 4.361×32 .

THINK

- a 1 Rewrite and multiply digits as for whole numbers, ignoring the decimal point. Count the number of decimal places altogether (1) and put in the decimal point.
- 2 Check the answer by rounding;
 $10 \times 7 = 70$ which is close to 88.2.
- b 1 Rewrite and multiply digits as for whole numbers, ignoring the decimal point. Count the number of decimal places altogether (3) and put in the decimal point.
- 2 Check the answer by rounding;
 $4 \times 30 = 120$ which is close to 139.552.

WRITE

$$\begin{array}{r} \text{a} \quad 12.6 \\ \times 7 \\ \hline 88.2 \end{array}$$

$$\begin{array}{r} \text{b} \quad 4.361 \\ \times 32 \\ \hline 8722 \\ 130830 \\ \hline 139.552 \end{array}$$

WORKED Example 19Calculate: **a** 5.1×600 **b** $0.0364 \times 24\,000$.**THINK**

- a** ① Multiplying by 600 is the same as first multiplying by 6 then multiplying by 100. Calculate 5.1×6 .
- ② Multiply the result by 100. Move the position of the decimal point 2 places to the right.
- b** ① Multiplying by 24 000 is the same as first multiplying by 24 then multiplying by 1000. Calculate 0.0364×24 .
- ② Multiply the result by 1000. Move the position of the decimal point 3 places to the right.

WRITE

$$\begin{array}{r} \text{a} \quad 5.1 \\ \times 6 \\ \hline 30.6 \end{array}$$

$$5.1 \times 600 = 3060$$

$$\begin{array}{r} \text{b} \quad 0.0364 \\ \times 24 \\ \hline 1456 \\ 7280 \\ \hline 0.8736 \end{array}$$

$$0.0364 \times 24\,000 = 873.6$$

remember

- When multiplying a decimal by a whole number, set the question out as for multiplying whole numbers. Ignore the decimal points and multiply the numbers then count the total number of decimal places in all parts of the question. The answer has the same number of decimal places as the question.
- When multiplying by a multiple of 10, move the position of the decimal point the same number of places to the right as there are zeros. When multiplying by a multiple of 10, the answer is always larger.

EXERCISE 6G**Multiplying decimals by a whole number****WORKED Example 18a**

- 1 Calculate the following.

- a** 3.5×4
d 10.2×6
g 27.18×7
j 1.064×6

- b** 15.7×8
e 22.34×5
h 64.87×8
k $0.264\,81 \times 3$

- c** 16.3×9
f 47.63×9
i 3.724×7
l $14.192\,683 \times 8$

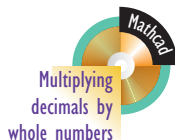
WORKED Example 18b

- 2 Calculate the following. (You may use a calculator for parts
- g**
- to
- o**
- .)

- a** 14.9×21
d 2.38×23
g 4.621×58
j 86.324×39
m 347.016×21

- b** 21.8×15
e 4.93×31
h 3.921×82
k 94.9286×12
n 824.095×84

- c** 0.62×17
f 8.62×27
i 0.6438×47
l 87.652×18
o 9632.1048×96





3 Calculate the following.

a 14.23×10

b 8.652×10

c 3.149×10

d 0.99×10

e 27.4815×10

f 0.0023×10

4 Copy and complete the following sentence.

Multiplying a decimal by 10 is the same as moving the position of the decimal point _____ place to the _____.

5 Calculate.

a 8.278×100

b 4.962×100

c 0.2784×100

d 13.026×100

e 5.2943×100

f 296.845×100

6 Copy and complete the following sentence.

Multiplying a decimal by 100 is the same as moving the position of the decimal point _____ places to the _____.

7 Calculate the following.

a 0.2498×1000

b 0.60249×1000

c 1.4861×1000

d 83.02091×1000

8 Copy and complete the following sentence.

Multiplying a decimal by 1000 is the same as moving the position of the decimal point _____ places to the _____.

9 State the number of places that the position of the decimal point would be moved to the right when multiplying by:

a 10 000

b 100 000

c 1 000 000.

10 Calculate the following by moving the position of the decimal point.

a 13.27×10

b 0.264×10

c 8.049×10

d 0.486×10

e 7.457×10

f 127.729×10

g 82.3×10

h 197×10

i 3.0×10

11 Calculate the following by moving the position of the decimal point.

a 6.48×10

b 13.896×100

c 589.0643×100

d 0.2708×1000

e 217.14896×1000

f $8.42619 \times 100\,000$

g $0.820496783 \times 100\,000$

h $32.689043267 \times 100\,000$

i $0.984326641 \times 1\,000\,000$

j $59.027683017 \times 1\,000\,000$

k $0.00027849832 \times 1\,000\,000$

l 0.46×1000

m $529 \times 10\,000$

n $39.486 \times 1\,000\,000$

12 Change the following amounts of money to cents. (*Hint:* There are 100 cents in one dollar.)

a \$35

b \$127

c \$11

d \$25.35

e \$58.20

f \$110.15



13 Calculate the following.

a 3.64×300

b 7.58×600

c 26.9×500

d 42.6×900

e 0.127×8000

f $0.543 \times 11\,000$

g $4.6 \times 32\,000$

h $8.1 \times 54\,000$

- 14 One thousand Year 7 students contributed 75 cents each to the bushfire appeal. How many dollars did they contribute altogether?
- 15 Benjamin and Robyn were providing ice-cream for 600 children. How much ice-cream would be needed if each child was expected to eat 0.18 litres?



- 1 If a bottle and its cork cost \$1.10 and the bottle costs \$1.00 more than the cork, how much does the cork cost? (*Hint: The answer is not 10 cents.*)
- 2 What decimal gives the same result when multiplied by 5 as it does when 5 is added to it?
- 3 Identify the pattern in this sequence of numbers:
0.1, 0.2, 0.3, 0.6, 1.1, 2.0.
What are the next three numbers in the sequence?

Multiplying decimals

To multiply numbers containing decimals, ignore the decimal point and follow the same steps as if multiplying by whole numbers. Count the number of decimal places in all parts of the question to find the number of decimal places in the answer.

WORKED Example 20

Calculate the following. a 3.26

$$\begin{array}{r} \times 0.4 \\ \hline \\ \hline \end{array}$$

b 0.4629

$$\begin{array}{r} \times 2.6 \\ \hline \\ \hline \end{array}$$

THINK

- a 1 Multiply, ignoring the decimal places.
- 2 Count the number of digits after the point in both the decimals being multiplied and insert the decimal point in the answer.
There are 2 decimal places in 3.26 and 1 in 0.4 so there will be 3 decimal places in the answer.
- 3 Check the answer by rounding;
 $3 \times 0.4 = 1.2$ which is close to 1.304.

WRITE

$$\begin{array}{r} 326 \\ \times 4 \\ \hline 1304 \end{array}$$

$$3.26 \times 0.4 = 1.304$$

Continued over page 

THINK

b ① Multiply, ignoring the decimal places.

- ② Count the number of digits after the point in both the decimals being multiplied and insert the decimal point in the answer.
There are 4 decimal places in 0.4629 and 1 in 2.6 so there will be 5 decimal places in the answer.

- ③ Check the answer by rounding;
 $0.5 \times 3 = 1.5$ which is close to 1.203 54.

WRITE

$$\begin{array}{r} 4629 \\ \times 26 \\ \hline 27\,774 \\ 92\,580 \\ \hline 120\,354 \end{array}$$

$$0.4629 \times 2.6 = 1.203\,54$$

remember

1. To multiply numbers containing decimals, ignore the decimal points and multiply them in the same way as for whole numbers. Count the number of decimal places in all parts of the question. Place a decimal point in the answer so that the number of decimal places is the same as the total number in the question.
2. Check calculations by rounding.

EXERCISE 6H**Multiplying decimals****WORKED Example 20a**

- 1 Calculate the following.

a 1.4×0.6

d 9.7×0.8

g 0.77×0.5

j 5.38×0.8

m 4.832×0.6

b 4.2×0.7

e 0.35×0.4

h 0.49×0.9

k 0.347×0.6

n 12.2641×0.4

c 0.8×0.4

f 0.64×0.3

i 1.63×0.2

l 0.498×0.7

o $20.032\,79 \times 0.5$

- 2 Calculate the following.

a 0.002×0.05

d 0.037×0.006

g 0.56×0.7

b 0.003×0.004

e $0.000\,061 \times 0.04$

h $0.030\,31 \times 0.02$

c 0.7×0.09

f 0.004×0.09

i 0.0006×0.007

WORKED Example 20b

- 3 Calculate the following. (You may use a calculator for parts **g** to **o**.)

a 0.25×1.2

d 0.79×8.3

g 11.64×4.8

j 67.73×0.28

m 13.56×0.31

b 0.37×2.3

e 4.68×3.6

h 15.08×1.9

k 90.65×0.88

n 3.694×0.46

c 0.47×5.4

f 8.04×7.5

i 35.17×0.35

l 46.96×0.76


o 12.41×1.2

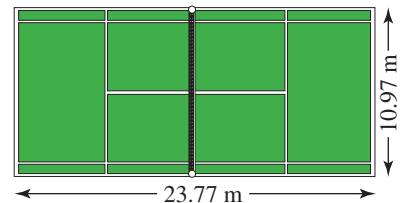


4 multiple choice

- a** When calculating 8.32×0.64 , the number of decimal places in the answer is:
A 0 **B** 1 **C** 2 **D** 4
- b** 0.2×0.2 equals:
A 0.004 **B** 0.04 **C** 0.4 **D** 4
- c** 1.4×0.8 equals:
A 1.12 **B** 8.2 **C** 82 **D** 11.2
- d** 0.0312×0.51 equals:
A 0.001 5912 **B** 0.015 912 **C** 0.156 312 **D** 0.159 12
- 5** Michael bought 0.65 kilograms of cubed steak. How much did Michael pay for the steak?



- 6** Judy bought 34.5 litres of petrol at 92.9 cents per litre. How much did Judy pay for her petrol:
- a** in cents? **b** in dollars?
- 7** James is using the recipe for chocolate chip muffins to make 1.5 times the given amount. If the recipe lists 0.25 litres of milk in the ingredients, how much milk should James use for his muffins?
- 8** Find the area of the tennis court shown if
area = length \times breadth.
- 



- 1 A grasshopper can jump about 59 times its length. How far can a 3.25 cm long grasshopper jump?
- 2 What number can you multiply by itself to get an answer of 0.36?
- 3 A ball is dropped from a height of 1 metre. If it reaches 0.7 times the height of the previous bounce at each bounce, work out how many times the ball bounces until the height is less than 1 centimetre.

Dividing decimals by whole numbers

To divide a decimal by a whole number:

1. set the question out as for division of whole numbers
2. divide as for whole numbers
3. the decimal point in the answer must be exactly in line with the decimal point in the question.

WORKED Example 21

Calculate: **a** $1.48 \div 2$ **b** $124.968 \div 12$.

THINK

- a** ① Set up the division. Write the decimal point in the answer directly above the decimal point in the question and divide as for short division.
- ② Check by rounding;
 $1 \div 2 = 0.5$ which is close to 0.74.
- b** ① Set up the division. Write the decimal point in the answer directly above the decimal point in the question and divide as for short division.
- ② Check by rounding;
 $120 \div 12 = 10$ which is close to 10.414.

WRITE

$$\begin{array}{r} 0.74 \\ 2 \overline{)1.48} \end{array}$$

$$\begin{array}{r} 10.414 \\ 12 \overline{)124.968} \end{array}$$

Sometimes, when you are dividing numbers, you will find that there is a remainder.

For example $15.3 \div 4$: $\begin{array}{r} 3.8 \\ 4 \overline{)15.3} \end{array}$ remainder 1

Instead of leaving a remainder, you can sometimes add zeros to the end of the decimal and keep dividing until there is no remainder.

$$\begin{array}{r} 3.825 \\ 4 \overline{)15.300} \end{array}$$

WORKED Example 22

Calculate $21.76 \div 5$. Add zeros and keep dividing until there is no remainder.

THINK

- ① Set up the division. Write the decimal point in the answer directly above the decimal point in the question and divide as for short division adding zeros as required.
- ② Check the answer by rounding;
 $20 \div 5 = 4$ which is close to 4.352.

WRITE

$$\begin{array}{r} 4.352 \\ 5 \overline{)21.760} \end{array}$$

WORKED Example 23Calculate: **a** $4.8 \div 40$ **b** $19.2 \div 6000$.**THINK**

- a**
- 1 Dividing by 40 is the same as first dividing by 4 then dividing by 10.
 - 2 To divide by 10, move the position of the decimal point 1 place to the left.
 - 3 Write your final answer.
- b**
- 1 Dividing by 6000 is the same as dividing by 6 then dividing by 1000.
 - 2 To divide by 1000, move the position of the decimal point 3 places to the left.
 - 3 Write your final answer.

WRITE

$$\begin{array}{r} 1.2 \\ 4 \overline{)4.8} \end{array}$$

$$1.2 \div 10 = 0.12$$

$$4.8 \div 40 = 0.12$$

$$\begin{array}{r} 3.2 \\ 6 \overline{)19.2} \end{array}$$

$$3.2 \div 1000 = 0.0032$$

$$19.2 \div 6000 = 0.0032$$

remember

1. To divide a decimal by a whole number, set the question out as for division of whole numbers and divide as for whole numbers.
2. The decimal point in the answer must be exactly in line with the decimal point in the question.
3. When there is a remainder, add zeros to the end of the decimal and keep dividing until there is no remainder.
4. When dividing a decimal by a multiple of 10, move the position of the decimal point to the left the same number of places as there are zeros. When dividing by a multiple of 10, the answer is always smaller.

EXERCISE 61**Dividing decimals by whole numbers****WORKED Example 21**

1 Calculate:

a $3.6 \div 6$

d $4.86 \div 9$

g $9.68 \div 4$

j $8.029 \div 7$

m $20.5782 \div 3$

p $46.80 \div 15$

s $77.052 \div 12$

b $21.7 \div 7$

e $8.05 \div 5$

h $1.576 \div 2$

k $32.5608 \div 8$

n $126.4704 \div 4$

q $24.541 \div 11$

t $121.3421 \div 11$

c $17.4 \div 6$

f $14.13 \div 3$

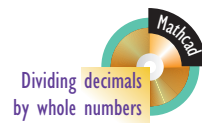
i $17.847 \div 9$

l $41.8645 \div 5$

o $37.56 \div 12$

r $17.108 \div 14$

u $56.88 \div 12$





- 2 Calculate the following. In each case, add zeros and keep dividing until there is no remainder.

a $3.7 \div 2$

b $9.5 \div 2$

c $7.3 \div 5$

d $9.8 \div 4$

e $7.5 \div 6$

f $55.6 \div 8$

- 3 Calculate the following.

a $67.2 \div 10$

b $35.9 \div 10$

c $81.4 \div 10$

d $102.5 \div 10$

e $99.9 \div 10$

f $0.546 \div 10$

g $0.989 \div 10$

h $102.04 \div 10$

i $35.492 \div 10$

- 4 Copy and complete the following sentence.

Dividing a decimal by 10 is the same as moving the position of the decimal point _____ place to the _____.

- 5 Calculate the following.

a $156.9 \div 100$

b $24.9 \div 100$

c $10.6 \div 100$

d $607.7 \div 100$

e $2340.1 \div 100$

f $34.8 \div 100$

g $24.80 \div 100$

h $0.312 \div 100$

i $0.3581 \div 100$

- 6 Copy and complete the following sentence.

Dividing a decimal by 100 is the same as moving the position of the decimal point _____ places to the _____.

- 7 Change the following to dollars (\$) by dividing by 100.

a 365 cents

b 170 cents

c 5685 cents

d 75 cents

e 90 cents

f 6350 cents

- 8 Calculate the following.

a $13.98 \div 1000$

b $29.876 \div 1000$

c $504.87 \div 1000$

d $767.9062 \div 1000$

e $140.09 \div 1000$

f $6001.65 \div 1000$

- 9 State the number of decimal places the position of the decimal point would be moved to the left when dividing by:

a 1000

b 10 000

c 100 000

d 1 000 000.

- 10 Calculate the following by changing the position of the decimal point.

a $14.07 \div 10$

b $968.13 \div 100$

c $985.06 \div 100$

d $620.8 \div 1000$

e $3592.87 \div 1000$

f $2349.78 \div 100\ 000$

g $5332.0667 \div 100\ 000$

h $9.0769 \div 100\ 000$

i $103\ 454.97 \div 1\ 000\ 000$

j $802\ 405.6 \div 1\ 000\ 000$

k $152.70 \div 1\ 000\ 000$

l $0.583 \div 1000$

m $0.7205 \div 10\ 000$

n $0.0032 \div 1\ 000\ 000$



- 11 Calculate the following.

a $15.9 \div 60$

b $23.7 \div 30$

c $164.5 \div 700$

d $238 \div 400$

e $8.79 \div 6000$

f $5.22 \div 3000$

12 multiple choice

- a** $5.2 \div 4$ equals:
A 0.013 **B** 0.13 **C** 1.3 **D** 1.5
- b** $14.025 \div 3$ equals:
A 0.4675 **B** 4.675 **C** 4.6 **D** 40.675
- c** $0.27 \div 8$ equals:
A 0.033 75 **B** 0.361 25 **C** 0.3612 **D** 0.3125
- d** $28.149 \div 100$ equals:
A 0.028 149 **B** 0.281 49 **C** 2.8149 **D** 281.49
- 13** Stephanie spent \$6.95 on these chocolates from The Chocolate Fox. What was the cost of each chocolate? Give your answer to the nearest 5 cents.
- 14** If you have \$22.50 for bus fares to school for the week, how much would you spend on each of the 5 days?
- 15** Emily wants to make 10 cushions from 6.75 metres of material that she found on a table of remnants at Cost-light Fabrics. How much material would she have for each cushion?



10 QUICK QUESTIONS 2

Calculate each of the following.

- 1** $3.86 + 2.15$
- 2** $7.4 + 1.1 + 12.78$
- 3** $3.55 - 2.61$
- 4** $4075.2 - 12.81$
- 5** 8.921×15
- 6** $398.7 \times 1\,000\,000$
- 7** 56.332×0.024
- 8** $6.784 \div 5$
- 9** $275.03 \div 100$
- 10** In preparation for a major cross-country event, the school team was required to complete the following training runs: 6.2, 8.7, 3.45, 5.5 and 12.8 kilometres. How far did the team run in total?

Converting fractions to decimals and recurring decimals

To change any fraction into a decimal, divide the denominator into the numerator. For example, to change $\frac{1}{4}$ into a decimal, divide 4 into 1:

$$\begin{array}{r} 0.25 \\ 4 \overline{)1.00} \end{array} \quad \text{Add a decimal point and as many zeros as required.}$$

WORKED Example 24

Change the following fractions into decimals. **a** $\frac{2}{5}$ **b** $\frac{1}{8}$

THINK

- a** ① Set out the question as for division of whole numbers, adding a decimal point and the required number of zeros.
- ② Divide, writing the answer with the decimal point exactly in line with the decimal point in the question.
- b** ① Set out the question as for division of whole numbers, adding a decimal point and the required number of zeros.
- ② Divide, writing the answer with the decimal point exactly in line with the decimal point in the question.

WRITE

$$\begin{array}{r} 0.4 \\ 5 \overline{)2.0} \end{array}$$

$$\frac{2}{5} = 0.4$$

$$\begin{array}{r} 0.125 \\ 8 \overline{)1.000} \end{array}$$

$$\frac{1}{8} = 0.125$$

Sometimes when dividing the denominator into the numerator, the decimal places in the answer keep repeating and the amount left over each time also keeps repeating. When this happens, the answer is called a *recurring decimal*.

WORKED Example 25

Convert $\frac{1}{11}$ to a decimal. Continue dividing until a pattern emerges, then round the answer to 2 decimal places.

THINK

- ① Set out the question as for division of whole numbers, adding a decimal point and enough zeros to see a pattern emerging.
- ② Divide, writing the answer with the decimal point exactly in line with the decimal point in the question. (The amount left over each time is 10 then 1 then 10 then 1 again. The decimal answer is also repeating.)
- ③ Write the approximate answer rounded to 2 decimal places.

WRITE

$$\begin{array}{r} 0.090909... \\ 11 \overline{)1.00000000} \end{array}$$

$$\frac{1}{11} \approx 0.09$$

Note that the answer in worked example 25 shows the whole pattern. If a recurring decimal is rounded off it usually includes one complete cycle of the pattern.

Recurring decimals can be written in one of the following shorter ways for an *exact* answer:

- (a) 4.6666 ... could be written as $4.\dot{6}$ (with a dot above the repeating part of the decimal)
- (b) 3.512512 ... could be written as $3.\dot{5}1\dot{2}$ (with a dot above the first and last digits of the repeating part)
- (c) 6.121212 ... could be written as $6.\overline{12}$ (with a line above the repeating part of the decimal).

remember

1. To change any fraction into a decimal, divide the denominator into the numerator.
2. A *recurring decimal* is obtained when the decimal places in the answer keep repeating and the amount left over each time also keeps repeating. An approximate answer can be found by rounding so that the answer includes one complete cycle of the pattern.
3. A recurring decimal can be written exactly by placing a dot above the first and last digits of the repeating part or by drawing a line above the repeating part.

EXERCISE 6J

Converting fractions to decimals and recurring decimals

**WORKED
Example**
24

- 1 Change the following fractions to decimals.

a $\frac{3}{4}$

b $\frac{1}{2}$

c $\frac{4}{5}$

d $\frac{1}{20}$

e $\frac{3}{15}$

f $\frac{3}{12}$

g $\frac{3}{8}$

h $\frac{1}{50}$

i $\frac{8}{25}$

- 2 Write the following recurring decimals using one of the short forms.

a 2.555 ...

b 0.666 ...

c 12.888 88 ...

d 49.111 11 ...

e 0.262 626 ...

f 0.414 141 ...

g 0.913 913 ...

h 8.641 864 18 ...

i 0.040 121 21 ...

j 133.946 2462 ...

k 1.833 333 ...

l 0.127 7777 ...

**WORKED
Example**
25

- 3 Convert each of the following to a decimal. Continue dividing until a pattern emerges, then round the answer to the number of decimal places indicated in the brackets.

a $\frac{1}{6}$

(2)

b $\frac{1}{3}$

(1)

c $\frac{1}{9}$

(1)

d $\frac{2}{15}$

(2)

e $\frac{2}{11}$

(2)

f $\frac{4}{9}$

(1)

g $\frac{5}{12}$

(3)

h $\frac{1}{7}$

(6)

i $\frac{7}{15}$

(2)

- 4 **multiple choice**

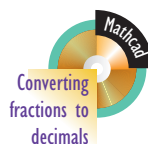
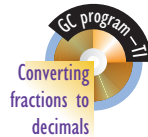
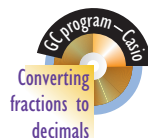
a $\frac{3}{5}$ as a decimal is:

A 0.3

B 0.6

C 0.2

D 0.9



- b** 1.8888 ... written as an exact answer is:
A 1.8̇ **B** 1.888 **C** 1.88 **D** 1.9
- c** 12.412412 ... written as an exact answer is:
A 12.412 **B** 12.412̇ **C** 12.412412 **D** 12.412̇
- d** $\frac{3}{7}$ as a decimal in exact form is:
A 0.428571̇ **B** 0.428̇ **C** 0.4 **D** 0.4285174

Fractions to decimals

- 1** Complete the following table. This table will be useful in helping you answer later questions.

2^1	2^2	2^3	2^4	2^5	2^6	2^7	2^8	2^9	2^{10}
2	4	8							

- 2** Convert each of the following to decimals.
a $\frac{1}{2}$ **b** $\frac{1}{4}$ **c** $\frac{1}{8}$ **d** $\frac{1}{16}$ **e** $\frac{1}{32}$
- 3** For each decimal obtained in question **2**, write down the number of decimal places it has.
- 4** Can you see a pattern? Write down what you think the pattern is.
- 5** Predict how many decimal places the following fractions have when expressed as decimals.
 $\frac{1}{128}, \frac{1}{64}, \frac{1}{512}$
- 6** Check your answers to question **5** by converting each fraction to a decimal.
- 7** How many decimal places will the fraction $\frac{1}{16384}$ have when expressed as a decimal?
- 8** How many decimal places will the fraction $\frac{1}{262144}$ have when expressed as a decimal?
- 9** Investigate what happens to fractions like $\frac{1}{5}, \frac{1}{25}, \frac{1}{125}, \dots$ when expressed as decimals. Write a short report on what you find.
- 10** Super challenge
- a** Investigate what happens to fractions like $\frac{1}{10}, \frac{1}{20}, \frac{1}{50}, \frac{1}{100}, \frac{1}{200}, \frac{1}{400}, \frac{1}{5000}, \frac{1}{50000} \dots$ when expressed as decimals.
(Hint: Write each denominator as a product of prime factors.) Explain the pattern you observe. Check whether this pattern works with another fraction of this type.
- b** Without calculating the decimal, predict how many decimal places the fraction $\frac{1}{2^7 \times 5^9}$ will have.
- c** Predict the number of decimal places that the following products will have when expressed as decimals. Note that all denominators have factors of 2 and 5.
- i** $\frac{1}{25} \times \frac{1}{64}$ **ii** $\frac{1}{16} \times \frac{1}{625}$ **iii** $\frac{1}{128} \times \frac{1}{125}$ **iv** $\frac{1}{1024} \times \frac{1}{625}$

Dividing decimals by decimals

To divide one decimal by another, it is necessary to change the second decimal (the divisor) to a whole number. This can be done by rewriting the question as a fraction then multiplying both numerator and denominator by whichever power of 10 makes the denominator a whole number. So:

$$14.62 \div 0.4 \text{ would be rewritten as } \frac{14.62}{0.4}.$$

The fraction can be multiplied by $\frac{10}{10}$ without changing the value of the fraction (remember that $\frac{10}{10} = 1$). This is the same as multiplying the numerator and denominator by 10.

$$\frac{14.62}{0.4} = \frac{14.62}{0.4} \times \frac{10}{10} = \frac{146.2}{4}$$

The calculation now becomes $146.2 \div 4$.

WORKED Example 26

Calculate: **a** $26.724 \div 0.4$ **b** $3.0276 \div 0.12$.

THINK

- a** 1 Rewrite the question as a fraction.
- 2 Multiply both the numerator and the denominator by the appropriate multiple of 10.
- 3 Divide the decimal by the whole number.
- 4 Write the answer.

WRITE

$$\begin{aligned} \mathbf{a} \quad 26.724 \div 0.4 &= \frac{26.724}{0.4} \\ &= \frac{26.724}{0.4} \times \frac{10}{10} \\ &= \frac{267.24}{4} \end{aligned}$$

$$\begin{array}{r} 66.81 \\ 4 \overline{) 267.24} \end{array}$$

$$26.724 \div 0.4 = 66.81$$

- b** 1 Rewrite the question as a fraction.
- 2 Multiply both the numerator and the denominator by the appropriate multiple of 10.
- 3 Divide the decimal by the whole number.
- 4 Write the answer.

$$\begin{aligned} \mathbf{b} \quad 3.0276 \div 0.12 &= \frac{3.0276}{0.12} \\ &= \frac{3.0276}{0.12} \times \frac{100}{100} \\ &= \frac{302.76}{12} \end{aligned}$$

$$\begin{array}{r} 25.23 \\ 12 \overline{) 302.76} \end{array}$$

$$3.0276 \div 0.12 = 25.23$$

remember

To divide a decimal by a decimal, change the second decimal (the divisor) to a whole number. This can be done by rewriting the question as a fraction, then multiplying both numerator and denominator by whichever power of 10 makes the denominator a whole number.

EXERCISE 6K

Dividing decimals by decimals



WORKED Example 26a

1 Calculate:

a $2.5 \div 0.5$

d $8.1 \div 0.9$

g $0.248 \div 0.8$

j $39.6 \div 0.6$

m $0.2556 \div 0.3$

b $4.2 \div 0.6$

e $2.8 \div 0.7$

h $3.57 \div 0.7$

k $57.68 \div 0.8$

n $0.067\ 354 \div 0.2$

c $6.4 \div 0.8$

f $6.66 \div 0.6$

i $1.32 \div 0.6$

l $4.924 \div 0.4$

o $0.5468 \div 0.4$



Dividing decimals

WORKED Example 26b

2 Calculate:

a $172.0488 \div 0.11$

d $2.5473 \div 0.21$

g $0.028\ 692 \div 0.06$

b $0.510\ 48 \div 0.12$

e $21.470\ 10 \div 0.15$

h $473.159\ 61 \div 0.03$

c $6.4032 \div 0.32$

f $142.888 \div 0.08$

i $32.619 \div 0.02$



Dividing decimals

3 multiple choice

a To calculate $9.84 \div 0.8$, rewrite it as:

A $9.84 \div 8$

B $0.984 \div 0.8$

C $98.4 \div 0.8$

D $98.4 \div 8$

b To calculate $151.368 \div 1.32$, rewrite it as:

A $151.368 \div 132$

B $151.368 \div 13.2$

C $1513.68 \div 132$

D $15\ 136.8 \div 132$

c $0.294 \div 0.7$ equals:

A 0.042

B 0.42

C 4.2

D 42

d $21.195 \div 0.15$ equals:

A 0.1413

B 1.413

C 14.13

D 141.3

4 How many 1.25-litre bottles of Coke could be poured into a 25-litre drink dispenser?

5 The area of Tanya's lounge room is 85.8 square metres. How many people could she fit in the lounge room if each person takes up 1.2 square metres?

6 How many compact discs can be stacked on a shelf that is 28.6 centimetres high if each compact disc case is 1.1 centimetres high?

7 How many Big Macs could be bought for \$562.80 if each Big Mac costs \$2.80?





Unusual journeys to the North Pole

Calculate the decimal divisions below to find the puzzle solution code.

A = $6.8 \div 0.5$

B = $7.68 \div 0.8$

C = $3.7 \div 0.2$

E = $9 \div 0.6$

F = $6.45 \div 0.3$

G = $6.66 \div 0.9$

H = $7.84 \div 0.7$

I = $16.17 \div 1.1$

J = $9.96 \div 1.2$

K = $0.648 \div 0.04$

L = $1.308 \div 0.12$

1987:

19.8 19.1 7.8 19.1 20.9 18.5 6.6 18.5 10.9 15
9.6 6.6 21.5 3.75 16.2 13.6 5.1 11.2 14.7
16.2 13.6 8 13.6 19.8 14.7 19.1 21.5 8.3 13.6 14.3 13.6 12.7

M = $118.8 \div 6$

N = $25.4 \div 2$

O = $152.8 \div 8$

P = $71.5 \div 5$

R = $146.3 \div 7$

S = $45.9 \div 9$

T = $312.0 \div 40$

U = $112.5 \div 30$

W = $482.4 \div 60$

Y = $0.462 \div 0.07$

Z = $1.76 \div 0.22$

1989:

8.04 13.6 10.9 16.2 14.7 12.7 7.4 9.6 6.6 20.9 19.1 9.6 15 20.9 7.8
5.1 8.04 13.6 12.7 19.1 21.5 9.6 20.9 14.7 7.8 13.6 14.7 12.7

summary

Copy the sentences below. Fill in the gaps by choosing the correct word from the word list that follows.

- 1 The number of _____ places is the number of digits after the decimal point.
- 2 To compare the size of decimals, it is necessary to compare the size of the digits with the same _____ value.
- 3 The symbol $<$ means 'is _____ than'.
- 4 The symbol $>$ means 'is _____ than'.
- 5 When rounding a decimal, consider the _____ digit after the number of decimal places required.
- 6 To multiply decimals by multiples of 10, the decimal point should be moved to the _____, one place for each _____.
- 7 To show a decimal is recurring, a _____ or a _____ is placed above the repeating part of the decimal.
- 8 To simplify a fraction, divide the _____ and _____ by the same number.
- 9 When multiplying decimals, the number of decimal places in the _____ is the same as the number of decimal places in the _____.
- 10 When adding or subtracting decimals, the decimal point in the answer should be _____ with the decimal point in the question.
- 11 To change any fraction into a decimal, _____ the numerator by the denominator.
- 12 To divide decimals by multiples of _____, the position of the decimal point should be moved to the _____, one place for each zero.

WORD LIST

greater
question
lined up
denominator

dot
divide
left
answer

right
numerator
ten
less

decimal
line
zero
first
place

CHAPTER

review

- 1 Give the value of the 7 in each of the following.

a 1.719	b 3.0726	c 4.7218	d 0.2078
e 23.1487	f 0.002 57	g 17.592	h 50.007
- 2 Write the following numbers in expanded notation.

a 2.64	b 0.369	c 18.406	d 96.3428
--------	---------	----------	-----------
- 3 Add 2 tenths to the following.

a 6.2	b 0.743	c 12.06	d 3.91
-------	---------	---------	--------
- 4 Add 3 thousandths to the following.

a 0.456	b 12.803	c 1.6	d 2.79
---------	----------	-------	--------
- 5 Put $<$ or $>$ between the following.

a 8.72 _____ 8.27	b 0.35 _____ 0.37
c 1.06 _____ 1.27	d 10.214 _____ 10.219
e 0.021 _____ 0.018	f 13.0496 _____ 13.149
g 0.804 06 _____ 0.804 17	h 0.000 879 _____ 0.000 876
- 6 Write the following decimals in order from smallest to largest.

a 0.13, 0.86, 0.34, 0.71, 0.22	b 0.247, 0.274, 0.124, 0.258, 0.285
c 0.834, 0.826, 0.859, 0.888, 0.891	d 0.356, 0.358, 0.365, 0.385, 0.217
- 7 Write the following decimals as fractions in simplest form.

a 0.8	b 0.17	c 0.36	d 0.187
e 0.125	f 0.568	g 0.205	h 0.950
- 8 Write the following decimals as mixed numerals in simplest form.

a 1.5	b 4.60	c 3.48	d 5.25
e 2.75	f 2.625	g 1.56	h 8.32
- 9 Round the following to the number of decimal places shown in the brackets.

a 1.29 (1)	b 2.047 (2)	c 13.8649 (2)
d 0.0482 (3)	e 1.925 96 (4)	f 17.898 193 (2)
- 10 Round the following to the nearest unit.

a 13.6	b 29.02	c 86.99	d 100.09
--------	---------	---------	----------
- 11 Calculate the following.

a $1.8 + 7.3$	b $4.21 + 5.88$	c $6.75 + 0.243$
d $12.047 + 3.6$	e $194 + 18.62 + 3.1$	f $34.1 + 7.629 + 0.008 45$
- 12 Jim saved the following amounts of pocket money to take away on holidays: \$12.50, \$15.00, \$9.30, \$5.70, \$10.80. How much money did Jim have to spend on holidays?

6A

6A

6A

6A

6B

6B

6C

6C

6D

6D

6E

6E

6F**13** Calculate the following.

a $9.6 - 4.3$

b $18.25 - 9.18$

c $3.92 - 1.88$

d $100 - 9.341$

e $4.876 - 3.927$

f $1.6 - 0.025$

6F**14** Mandie poured 0.375 litres from a 2.5-litre bottle of cola. How much cola was left in the bottle?**6G****15** Calculate the following.

a 6.2×3

b 4.67×9

c 13.2036×5

d 0.7642×7

6G**16** Calculate the following.

a 0.23×11

b 16.28×41

c 182.94×28

d $0.028\ 94 \times 32$

6G**17** Calculate.

a 0.26×10

b 1.345×10

c 0.0645×100

d 1.8294×100

e 146.6281×100

f $0.048\ 0643 \times 1000$

g $0.839\ 204 \times 1000$

h 0.368×1000

6H**18** Calculate.

a 3.2×0.41

b 1.72×0.3

c 0.87×0.9

d 0.03×0.006

e 0.58×1.5

f 2.83×0.96

g 11.468×1.3

h 1.248×0.82

6H**19** Tara bought 0.350 kilogram of shaved ham at \$10.50 per kilogram. How much did Tara pay for the ham?**6I****20** Calculate.

a $2.4 \div 8$

b $1.64 \div 4$

c $12.48 \div 6$

d $147.24 \div 2$

e $1.76 \div 11$

f $264.88 \div 8$

6I**21** Calculate.

a $14.623 \div 10$

b $102.36 \div 10$

c $9612.347 \div 1000$

d $20.032 \div 100$

e $264\ 983.0026 \div 1000$

f $3462.94 \div 100$

6J**22** Write as a decimal.

a $\frac{1}{20}$

b $\frac{5}{8}$

c $\frac{5}{16}$

d $\frac{2}{16}$

6J**23** Write these recurring decimals using a short form.

a $4.555 \dots$

b $0.8282 \dots$

c $19.278\ 127\ 81 \dots$

d $83.016\ 262\ 62 \dots$

6K**24** Calculate.

a $4.8 \div 0.6$

b $35.7 \div 0.7$

c $12.1 \div 1.1$

d $13.72 \div 0.4$

e $17.8946 \div 0.02$

f $372.045\ 72 \div 0.06$

g $0.289\ 56 \div 0.12$

h $3214.0170 \div 0.15$