STRICTLY

NO PARKING

decimals 6

Richter scale a bit shaky

The decimal point packs a punch in the measurement of earthquakes.

The Richter scale, which measures the magnitude (size) of earthquakes, uses decimals in an unusual way—it increases in powers of 10. An earthquake with a magnitude of 7.0 is actually 10 times more powerful than one with a magnitude of 6.0. The Newcastle earthquake in 1989, which measured 5.6, may not seem much larger than the one measuring 5.5 in the Dalton-Gunning area in 1949, but it was in fact almost 1.5 times more powerful. Scientists also acknowledge that there may be an error in earthquake measurement of about plus or minus 0.3. Because of the uncertainties involved, magnitudes are never given to more than one decimal place. The Richter scale has been shown to be particularly inaccurate for earthquakes larger than 7.0, and most scientists now use the moment magnitude scale instead.

outcomes

After completing this chapter you will be able to:

- express decimal numbers in expanded notation
- round off decimals
- add and subtract decimal numbers
- multiply and divide decimal numbers
- use decimal numbers in real-life situations.

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prepzone6

Prepare for this chapter by attempting the following questions. If you have difficulty with a question, click on the Replay Worksheet icon on your *eMaths Zone* CD or ask your teacher for the Replay Worksheet.

(e) Worksheet R6.1

1 Copy and complete each of the following by writing $<$ or $>$ between the given numbers.
- **(a)** 7 _____ 2
- **(b)** 4 _____ 5
- **(c)** 0.008 _____ 0.09
- **(d)** 0.7 _____ 0.07

(e) Worksheet R6.2

2 Write each of the following in words.
- **(a)** $\dfrac{7}{10}$
- **(b)** $\dfrac{8}{1000}$
- **(c)** $\dfrac{3}{100}$
- **(d)** $\dfrac{5}{10\,000}$

(e) Worksheet R6.3

3 Write each of the following in words.
- **(a)** 6
- **(b)** 72
- **(c)** 603
- **(d)** 251

(e) Worksheet R6.4

4 Calculate:
- **(a)** $34 + 76$
- **(b)** $925 + 610$
- **(c)** $67 + 409 + 3$
- **(d)** $459 + 6013 + 27$

(e) Worksheet R6.5

5 Calculate:
- **(a)** $74 - 25$
- **(b)** $823 - 376$
- **(c)** $8289 - 384$
- **(d)** $2000 - 352$

(e) Worksheet R6.6

6 Calculate:
- **(a)** 2×17
- **(b)** 25×96
- **(c)** 3×487
- **(d)** 516×800

(e) Worksheet R6.7

7 Perform the following divisions.
- **(a)** $362 \div 2$
- **(b)** $7824 \div 8$
- **(c)** $9459 \div 9$
- **(d)** $4050 \div 30$

(e) Worksheet R6.8

8 Draw a number line from 0 to 10, and place letters above the numbers following this key.
A 7, E 9, I 4, K 8, M 3, N 0, O 1, S 5, S 10, T 6

KEY WORDS

decimal point	dividend	hundredth	round
decimal	divisor	place-holding zero	tenth
digit	estimation	quotient	thousandth

6.1 Place value

Decimals involve extending our base 10 number system to include numbers less than one, which when written are separated from whole numbers by a **decimal point**.

14.625

whole number part   decimal point   part less than one
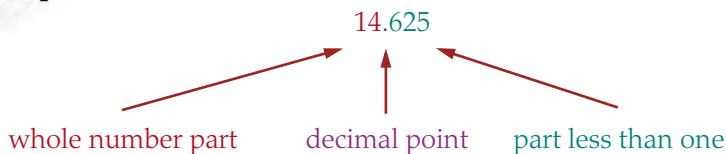
A **digit** is a single numeral. Decimal places are the places occupied by digits *after* (or to the right of) the decimal point.

3.25 has 3 digits and 2 decimal places.

50.009 has 5 digits and 3 decimal places.

The decimal value 48.237 195 (which has 8 digits and 6 decimal places) could also be represented in the following three ways.

• In place value table form:

Tens	Units	Tenths	Hundredths	Thousandths	Ten-thousandths	Hundred-thousandths	Millionths
10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$	$\frac{1}{10\,000}$	$\frac{1}{100\,000}$	$\frac{1}{1\,000\,000}$
4	8 •	2	3	7	1	9	5

• In expanded fractional form:

$$48 + \frac{2}{10} + \frac{3}{100} + \frac{7}{1000} + \frac{1}{10\,000} + \frac{9}{100\,000} + \frac{5}{1\,000\,000}$$

• In expanded word form:

four tens, *eight* units, *two* tenths, *three* hundredths, *seven* thousandths, *one* ten-thousandth, *nine* hundred-thousandths and *five* millionths.

To write the fraction represented by a digit in a decimal number:

1 Write the digit as the numerator (top number) of a fraction.

2 Write a 1 in the denominator (bottom number).

3 The position of the digit in the original decimal tells you how many zeros to add after the 1 in the denominator.

Look at the 7 in 48.237 195. It is in the *third* place after the decimal point, so it represents

$$\frac{7}{1 \text{ followed by } three \text{ zeros}} \quad \text{i.e.} \quad \frac{7}{1000}$$

Back into place!

If there are no numbers in front of the decimal point we write zero so it is clear where the point is. So we would write 0.32 instead of just .32.

If there are no hundredths, we put a zero there to hold the place. So for two tenths and three thousandths we write 0.203, not 0.2 3. This zero is called a **place-holding zero**.

worked example 1

(a) Write $4 + \frac{3}{10} + \frac{6}{1000} + \frac{5}{10\,000}$ as a decimal.

(b) Write 6.2807 in expanded fractional form.

Steps

(a) Imagine the numerators of each fraction placed in a place value table. (You don't actually have to draw the table.) Note there are no $\frac{1}{100}$s.

Units	Tenths	Hundredths	Thousandths	Ten-thousandths
1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$	$\frac{1}{10\,000}$
4 •	3	0	6	5

(b) 1. Again, imagine the decimal in a place value table.

Units	Tenths	Hundredths	Thousandths	Ten-thousandths
1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$	$\frac{1}{10\,000}$
6 •	2	8	0	7

2. Write a series of fractions using the above as a guide. There is no need to include $\frac{0}{1000}$.

Solutions

(a)

$$4 + \frac{3}{10} + \frac{6}{1000} + \frac{5}{10\,000}$$

$$= 4.3065$$

(b)

6.2807

$$= 6 + \frac{2}{10} + \frac{8}{100} + \frac{7}{10\,000}$$

worked example 2

(a) Write seven units, three tenths, six hundredths, seven thousandths and four hundred-thousandths as a decimal.

(b) Write 28.0045 in expanded word form.

Steps

(a) Think of or refer to a place value table, with digits corresponding to the words in the question at the bottom of the table.

Units	Tenths	Hundredths	Thousandths	Ten-thousandths	Hundred-thousandths
1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$	$\frac{1}{10\,000}$	$\frac{1}{100\,000}$
7 •	3	6	7	0	4

(b) 1. Imagine a place value table around the number, in particular the worded column headings.

Tens	Units	Tenths	Hundredths	Thousandths	Ten-thousandths
10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$	$\frac{1}{10\,000}$
2	8 •	0	0	4	5

2. Write the non-zero digits in words, with the worded column heading after each one.

Solutions

(a)

Seven units, three tenths, six hundredths, seven thousandths and four hundred-thousandths

= 7.367 04

(b)

28.0045

= Two tens, eight units, four thousandths and five ten-thousandths.

worked example 3

(a) Write the value of the 6 in 4.368 as a fraction.

(b) Write the value of the 9 in 0.0109 in words.

Steps

(a) The 6 is 2 places to the right of the decimal point, so we write

$$\frac{6}{1 \text{ followed by 2 zeros}} \text{ i.e.}$$

(b) The 9 is in the ten-thousandths place (refer to a place value table if you like), so it represents, in words.

Solutions

(a)

$\frac{6}{100}$

(b)

nine ten-thousandths

e eTutorial

Place value

Core

1 Write each of the following as decimals.   **e** Hint

(a) $45 + \frac{4}{10} + \frac{6}{100} + \frac{2}{1000}$

(b) $3 + \frac{7}{10} + \frac{9}{100} + \frac{8}{1000} + \frac{5}{10\,000}$

(c) $12 + \frac{5}{10} + \frac{1}{100} + \frac{9}{1000} + \frac{3}{10\,000} + \frac{7}{100\,000} + \frac{2}{1\,000\,000}$

(d) $7 + \frac{9}{10} + \frac{3}{100} + \frac{3}{1000} + \frac{5}{10\,000} + \frac{4}{100\,000} + \frac{7}{1\,000\,000}$

(e) $\frac{1}{10} + \frac{4}{100} + \frac{7}{1000} + \frac{4}{10\,000} + \frac{3}{100\,000} + \frac{7}{1\,000\,000}$

(f) $\frac{1}{10} + \frac{9}{100} + \frac{1}{1000} + \frac{6}{10\,000} + \frac{3}{100\,000} + \frac{4}{1\,000\,000}$

(g) $\frac{2}{100} + \frac{6}{1000} + \frac{3}{10\,000} + \frac{5}{100\,000} + \frac{9}{1\,000\,000}$

(h) $\frac{6}{1000} + \frac{5}{10\,000} + \frac{6}{100\,000} + \frac{8}{1\,000\,000}$

(i) $1 + \frac{8}{1000} + \frac{3}{10\,000} + \frac{3}{100\,000} + \frac{2}{1\,000\,000}$

(j) $15 + \frac{7}{100} + \frac{2}{1000} + \frac{5}{10\,000} + \frac{6}{100\,000} + \frac{6}{1\,000\,000}$

(k) $\frac{7}{10} + \frac{8}{100} + \frac{6}{1000} + \frac{6}{100\,000}$

(l) $\frac{6}{10} + \frac{7}{1000} + \frac{9}{10\,000} + \frac{5}{100\,000}$

(m) $\frac{2}{100} + \frac{3}{100\,000}$

(n) $\frac{7}{1000} + \frac{5}{100\,000}$

(o) $27 + \frac{9}{1000} + \frac{7}{100\,000}$

(p) $8 + \frac{3}{100} + \frac{5}{10\,000}$

2 Choose the correct answer.   **e** Worksheet C6.1

$42 + \frac{7}{10} + \frac{4}{1000} + \frac{5}{10\,000} + \frac{7}{100\,000}$ is equal to:

A 4.274 57   **B** 42.7457   **C** 42.074 57   **D** 42.704 57

3 Write each of the following in expanded fractional form.

(a) 6.63	(b) 0.921	(c) 0.7345	(d) 7.826	**e** Hint
(e) 23.913	(f) 45.6645	(g) 5.746 78	(h) 0.056 512	
(i) 7.036	(j) 8.0048	(k) 0.4005	(l) 0.309	
(m) 3.000 709	(n) 7.040 101	(o) 42.307 01	(p) 0.000 038	

4 Choose the correct answer.
The expanded fractional form of 5.007 64 is:

A $5 + \frac{7}{10} + \frac{6}{100} + \frac{4}{1000}$

B $5 + \frac{7}{1000} + \frac{6}{10\,000} + \frac{4}{100\,000}$

C $5 + \frac{7}{100} + \frac{6}{1000} + \frac{4}{10\,000}$

D $\frac{5}{100} + \frac{7}{1000} + \frac{6}{10\,000} + \frac{4}{100\,000}$

5 Write each of the following as a decimal.   **e** Hint

(a) six units and five tenths

(b) five units and nine tenths

(c) nine tenths and seven hundredths

(d) three units, two tenths and eight hundredths

(e) two tenths, seven hundredths and three thousandths

(f) three tenths, nine hundredths and four thousandths

(g) three tens, seven units, four tenths, two hundredths, eight thousandths, one ten-thousandth

(h) eight units, one tenth, three hundredths, seven thousandths, four ten-thousandths, seven hundred-thousandths

(i) one ten, four units, nine tenths, five hundredths, seven thousandths, six ten-thousandths, two hundred-thousandths and three millionths

(j) five tens, two units, three tenths, six hundredths, five thousandths, one ten-thousandth, four hundred-thousandths and four millionths

(k) seven tens, four thousandths, five ten-thousandths and nine hundred-thousandths

(l) nine tens, five ten-thousandths and one hundred-thousandth

(m) two tenths and seven thousandths

(n) six units, three tenths, three hundredths and eight hundred-thousandths

(o) six tens, four units, nine hundredths and five ten-thousandths

(p) one unit, eight tenths, three thousandths and four hundred-thousandths

(q) six tenths, eight thousandths and three ten-thousandths

(r) one tenth, three ten-thousandths and six millionths

6 Write three decimal numbers with 5 digits, 3 decimal places and zero in the hundredths column.

Many different answers are possible.

7 Choose the correct answer.
Nine hundredths, four thousandths and three ten-thousandths is equal to:
A 9.43   **B** 0.0943   **C** 0.009 43   **D** 0.090 43

8 Write the following decimals in expanded worded form.

(a) 5.2	**(b)** 4.9	**(c)** 34.17	**(d)** 0.61
(e) 2.794	**(f)** 0.042	**(g)** 1.5892	**(h)** 6.5187
(i) 35.865 43	**(j)** 0.394 52	**(k)** 0.823 227	**(l)** 30.054 912
(m) 9.092	**(n)** 6.0015	**(o)** 0.000 027	**(p)** 0.000 48
(q) 0.080 006	**(r)** 0.006 005	**(s)** 3.200 501	**(t)** 9.000 207

🅔 Hint

9 Choose the correct answer.
53.017 expressed in expanded worded form is:
A five tens, three units, one tenth and seven hundredths
B five tens, three units, one hundredth and seven thousandths
C five tenths, three hundredths, one ten-thousandth and seven hundred-thousandths
D five tens, three units, one tenth and seven thousandths

10 Write a fraction to show what the 2 in each of the following represents.

(a) 6.012	**(b)** 0.004 52	**(c)** 3.287	**(d)** 2.034
(e) 0.005 23	**(f)** 3.285	**(g)** 5.580 092	**(h)** 9.727
(i) 5.8204	**(j)** 0.000 62	**(k)** 3.033 021	**(l)** 0.000 672

🅔 Hint

11 Write in words what the 7 in each of the following represents.

(a) 5.734	**(b)** 0.0076	**(c)** 1.27	**(d)** 8.130 037
(e) 0.0078	**(f)** 0.75	**(g)** 0.548 078	**(h)** 9.3557
(i) 0.004 719	**(j)** 70.006	**(k)** 0.000 027	**(l)** 6.429 07

🅔 Hint

Extension

12 Explain what mistakes the students have made in the following.

(a) Minh states that the decimal 34.162 has a 2 in the hundredths column.

(b) Al writes four hundreds, nine units, six tenths and seven hundredths as 409.067.

(c) Max writes seven tens, eight hundredths and nine ten-thousandths as 0.7809.

(d) Polly writes 0.9056 as $\frac{9}{10} + \frac{5}{100} + \frac{6}{1000}$.

🅔 eQuestions

problem solving

Polly's decimal

Polly has cut out the digits 2, 5 and 7 as well as a decimal point from coloured paper to stick on a poster to show a decimal number. If she uses all three digits:

(a) how many different decimals with two decimal places could she make?

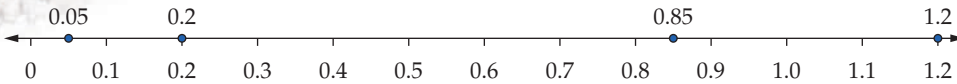**(b)** how many decimals greater than 2 could she make?

💡 **Explore all possibilities.**

6.2 Comparing decimals

One way of comparing decimal numbers is to use a number line.

Several decimal numbers are shown on the number line below. Notice it is not necessarily the number with the most decimal places that is the largest.

```
    0.05      0.2                                    0.85              1.2
◄────●─────────●──────────────────────────────────────●─────────────────●──►
    0    0.1   0.2   0.3   0.4   0.5   0.6   0.7   0.8   0.9   1.0   1.1   1.2
```

The following list show the decimals from the number line above in order from smallest to largest.

0.05, 0.2, 0.85, 1.2

Less than (<) and greater than (>) signs may be used when comparing decimals.

worked example 4

Write < or > between each of the following pairs of decimals to make a true statement.

(a) 5.173 _____ 5.0731   **(b)** 0.472 39 _____ 0.4731   **(c)** 3.5 _____ 3.51

Steps

(a) 1. Compare the whole number parts of each decimal.

2. Since the whole number parts are the same, compare the tenths digits.

3. Look at the tenths digits to see which is larger.

Solutions

(a)

> Mmmm, 1 is greater than 0, so 5.173 must be greater than 5.0731.

5.173 > 5.0731

(b) 1. Compare the whole numbers parts of each decimal.

2. Since the whole number parts are the same, compare the tenths digit.

3. Since the tenths digits are the same, compare the hundredths digits.

4. Repeat until you get different digits.

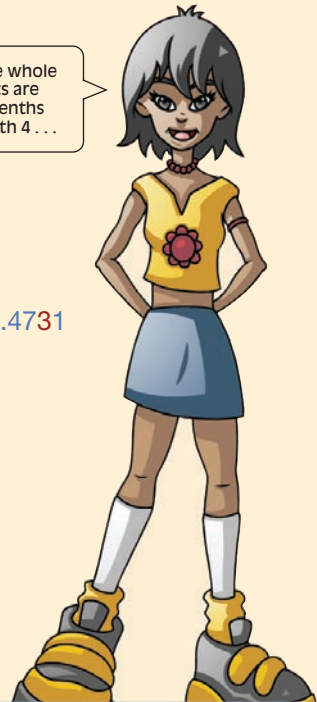5. The thousandths digits are 2 and 3. So 0.472 39 is less than 0.4731.

(b)

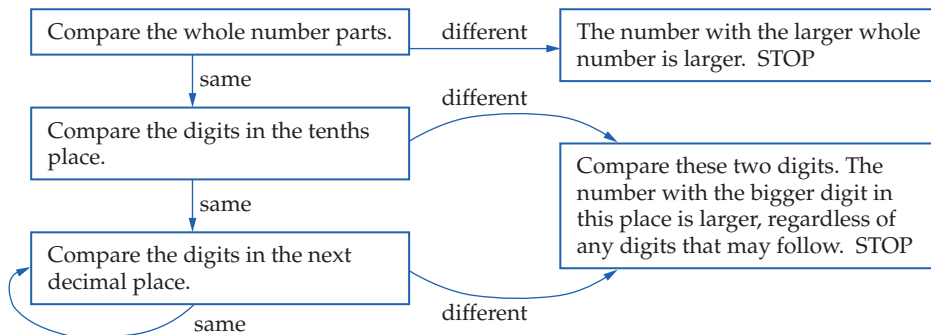Let's see, the whole number parts are both 0, the tenths digits are both 4 . . .

$0.472\textcolor{red}{2}39 < 0.473\textcolor{red}{1}$

(c) 1. 3.5 is the same as 3.50.

2. Compare 3.50 and 3.51.

3. Since both numbers have the same units and tenths digits, it is necessary to compare the hundredths digits.

4. 3.50 has the smaller hundredths digit, so it is the smaller decimal. Hence 3.5 is less than 3.51.

(c)

$3.5 < 3.51$

To decide which of two decimal numbers is larger:

Compare the whole number parts.	different →	The number with the larger whole number is larger. STOP

same ↓

Compare the digits in the tenths place.	different

same ↓

different →

Compare these two digits. The number with the bigger digit in this place is larger, regardless of any digits that may follow. STOP

Compare the digits in the next decimal place.

same ↺ different →

Man, this seems hard! Maybe the worked examples will help.

e eTutorial

exercise 6.2 *Comparing decimals*

p Preparation: Prep Zone Q1, Ex 6.1

e Worksheet C6.2

Core

1 Copy the following pairs of decimals and write < or > between the values in each case to make a true statement.

(a) 0.65 _____ 0.57

(b) 2.4 _____ 0.42

(c) 0.3003 _____ 0.333

(d) 2.32 _____ 1.955

(e) 4.7038 _____ 4.7312

(f) 8.251 _____ 8.2501

(g) 7.02 _____ 7.002

(h) 4.7367 _____ 4.7376

(i) 0.927 _____ 0.927 34

(j) 3.980 54 _____ 3.985 04

e Hint

(k) 6.013 _____ 6.31   **(l)** 0.005 _____ 0.000 055

(m) 8.737 65 _____ 2.737 66   **(n)** 3.406 _____ 0.4063

(o) 7.2568 _____ 8.7562   **(p)** 5.000 001 _____ 5.01

(q) 0.9995 _____ 0.9986   **(r)** 2.689 01 _____ 2.69

2 Write TRUE or FALSE for each of the following.

(a) $7.5 < 5.77$ **(b)** $4.09 > 4.12$

(c) $6.08 > 6.8$ **(d)** $67.54 < 67.504$

(e) $0.0676 > 0.009\,76$ **(f)** $3.023 < 3.203$

(g) $4.847\,63 < 0.484\,763$ **(h)** $8.2212 > 8.2139$

(i) $0.548 > 0.547\,08$ **(j)** $0.0076 < 0.01$

(k) $2.000\,012 < 2.0001$ **(l)** $4.145\,29 > 4.200\,01$

e Hint

3 Which is the larger decimal in each pair?

(a) 4.6 or 4.16   **(b)** 7.31 or 7.13

(c) 7.35 or 7.53   **(d)** 8.52 or 8.523

(e) 0.0084 or 0.0079   **(f)** 0.4646 or 0.4707

(g) 3.972 or 3.5972   **(h)** 0.345 or 0.453

(i) 0.005 or 0.000 06   **(j)** 17.52 or 15.71

(k) 0.0468 or 0.046 82   **(l)** 3.909 or 3.099

e Hint

4 For each of the following, copy the number line shown, then mark the points on it, approximately.

Number line from 2.0 to 2.9 marked at 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9
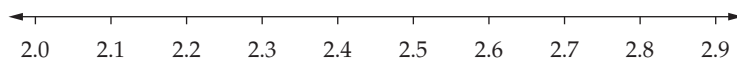
(a) 2.2, 2.4, 2.85, 2.35, 2.05   **(b)** 2.05, 2.09, 2.6, 2.12, 2.59

(c) 2.0, 2.8, 2.88, 2.9, 2.805, 2.85   **(d)** 2.7, 2.4, 2.47, 2.07, 2.04, 2.407

e Hint

5 Write each set of decimals in order from smallest to largest.

(a) 2.3, 2.03, 2.13   **(b)** 8.7, 8.007, 8.67

(c) 6.646, 6.6403, 6.64   **(d)** 0.0095, 0.0905, 0.0509

(e) 5.3281, 5.38, 5.003 821   **(f)** 3.616, 3.116, 3.661

(g) 0.7149, 0.7059, 0.7109   **(h)** 0.92, 0.29, 0.092

(i) 0.85, 0.815, 0.086   **(j)** 4.677, 4.706, 4.71

(k) 3.7, 7.3, 7.03   **(l)** 21.2, 2.21, 2.12

e Hint

6 Copy and complete the following number patterns.

(a) 0.03, 0.06, 0.09, ___, ___, ___   **(b)** 1.0, 1.4, 1.8, ___, ___, ___

(c) 9, 8.7, 8.4, ___, ___, ___   **(d)** 0.14, 0.12, 0.1, ___, ___, ___

(e) 0.6, 0.3, 0, ___, ___, ___   **(f)** −0.5, −0.1, 0.3, ___, ___, ___

e Hint

Extension

7 The heights of four students in a class are as follows.

Anthea: 1.45 m

Karen: 1.54 m

Jarryd: 1.495 m

Brendan: 1.409 m

List the students in order from tallest to shortest.

e Hint

8 Jane records her three best practice times for the 100 m sprint. They are as follows: 13.95 seconds, 13.08 seconds and 13.69 seconds.
   (a) Which was Jane's best time?
   (b) Which was Jane's worst time of the three listed?

9 Egor throws a shot-put the following distances during a competition: 25.6 m, 25.56 m and 25.008 m. Which was Egor's longest throw? (Give the distance.)

10 The Australian dollar had the following values in euros over a three-day period.
   Monday: 0.6039 euros
   Tuesday: 0.5996 euros
   Wednesday: 0.6105 euros
   On which day was the dollar worth the most euros?

11 Write three decimal numbers between 7.2 and 7.3.

6.3 Rounding

Decimal numbers sometimes contain more decimal places than we need. For example an industrial chemist may have calculated that 4.58 cubic metres of water are needed to dilute a chemical solution, but really only needs to know this figure to the nearest tenth of a cubic metre to make the correct strength of solution. The amount added would be 4.6 cubic metres. What the chemist has done is **round** the calculated figure to one decimal place. (The amount is rounded up, since 4.6 is greater than 4.58.) If the initial amount measured was 4.52 cubic metres, the chemist would have rounded down to 4.5.

Sometimes, instead of saying the decimal number has been rounded to a certain number of decimal places, we say it is written correct to that number of places.

To round decimals:

1 Note the number of the decimal places you are required to round off to.

2 Look at the digit in the decimal place *one place past* the one required.

Round down if 0, 1, 2, 3 or 4. This means write the original number to the place required, leaving off all other digits.

Round up if 5, 6, 7, 8 or 9. This means write the original number to the place required, but increase this digit by 1. Leave off all further digits.

worked example 5

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

(a) 3.785 (2)　　　　　　**(b)** 0.958 34 (3)　　　　　　**(c)** 6.214 96 (4)

Steps

(a) 1. Two decimal places are required, so look at the digit in the third place.

2. The digit in the third place is 5. As this digit is equal to or greater than 5, round up.

(b) 1. Three decimal places are required, so look at the digit in the fourth place.

2. The digit in the fourth place (3) is less than 5, so round down.

(c) 1. Four decimal places are required, so look at the digit in the fifth place.

2. The digit in the fifth place (6) is greater than 5, so round up.

3. To round up, increase the digit in the last required place (9) by 1. Since $9 + 1$ is 10, we put a 0 in the last required place, and add the 1 to the digit in the next place to the left. The 0 must be written to make sure we have 4 digits after the decimal point as required by the question.

Solutions

(a) 3.78**5**

3.785 rounded to 2 decimal places is 3.79

(b) 0.958 **34**

0.958 34 rounded to 3 decimal places is 0.958

(c) 6.214 **96**

6.214 96 rounded to 4 decimal places is 6.2150

e eTutorial

exercise 6.3 Rounding

e Interactive

Core

1 Round the following to the number of places indicated in brackets.

e Hint

- **(a)** 4.88 (1)
- **(b)** 6.72 (1)
- **(c)** 7.635 (2)
- **(d)** 4.552 (2)
- **(e)** 0.6416 (3)
- **(f)** 3.2772 (2)
- **(g)** 6.3637 (2)
- **(h)** 45.6228 (3)
- **(i)** 8.011 25 (3)
- **(j)** 0.314 42 (4)
- **(k)** 11.828 55 (2)
- **(l)** 2.917 96 (2)
- **(m)** 0.005 173 3 (4)
- **(n)** 15.0005 (3)
- **(o)** 5.200 95 (4)
- **(p)** 0.707 04 (4)
- **(q)** 42.2222 (2)
- **(r)** 5.3333 (2)
- **(s)** 18.499 95 (3)
- **(t)** 90.899 99 (4)
- **(u)** 18.959 699 (3)

2 Choose the correct answer.

- **(a)** 5.0542 rounded to the nearest thousandth is:
  - **A** 5.05
  - **B** 5.053
  - **C** 5.054
  - **D** 5.0542
- **(b)** 0.837 256 rounded to the nearest ten-thousandth is:
  - **A** 0.837
  - **B** 0.8372
  - **C** 0.8373
  - **D** 0.837 25
- **(c)** 3.2998 rounded to the nearest thousandth is:
  - **A** 3.29
  - **B** 3.210
  - **C** 3.299
  - **D** 3.300

3 Write three different decimal numbers with four decimal places that could be rounded up to 3.79.

Extension

4 Ruth calculates the length of shelf required for a wall unit to be 1.266 66 m. Since her tape measure is only accurate enough to measure metres to the nearest hundredth, she needs to round this figure accordingly. What length should she measure?

5 Abdul calculates that the interest on one of his investments should amount to $56.1342. Round this amount to the nearest cent (i.e. to two decimal places).

e Hint

6 Trang has worked out that, on average, she runs 2.7665 km per day. Round this value to three decimal places.

7 A physics student calculates the speed of sound to be 352.153 metres per second. The equipment she used is not accurate enough to justify her writing this value with so many decimal places in her report, so she decides to round it to the nearest tenth. What value does she write in her report, assuming she rounds off correctly?

8 Crummy Corporation's annual profit is 5.386 million dollars. The business editor of a newspaper wants to round this value to two decimal places for a headline. What value should he use?

e Hint

9 The top temperature recorded one day in Dubbo was 41.6°C. What figure should Bob Cream read out in his weather report as the day's maximum if he rounds the temperature reading to the nearest whole number (i.e. no decimal places)?

10 Sir Donald Bradman's batting average was 99.943 (rounded to the nearest thousandth). What would his average be rounded to the nearest tenth?

6.4 Addition of decimals

Decimals are added the same way as whole numbers.

> The most important rule to remember when setting out a decimals addition question is to line up the decimal points.

worked example 6

Calculate 12.45 + 6 + 0.3478.

Steps	**Solution**
1. Place the numbers on top of each other with the decimal points lined up. (*Note:* Write 6 as 6.0.)	
2. Fill in the spaces with zeros if desired.	12.4500
3. Add as if the values were whole numbers.	6.0000
4. Place a decimal point in the answer so it lines up with the others.	+ 0.3478
	18.7978

exercise 6.4 Addition of decimals

p Preparation: Prep Zone Q4, Ex 6.1

Core

1 Calculate:

(a)   3.76
     + 5.22
     _____

(b)   1.45
     + 0.51
     _____

(c)   24.432
     + 3.259
     _____

(d)   9.2
     + 8.8
     _____

(e) 6.9 + 4.1	**(f)** 16.425 + 5.781	**(g)** 0.0052 3.9172 + 0.2443	**(h)** 0.736 0.285 + 1.907
(i) 9.81 + 0.6	**(j)** 2.0831 + 4.521	**(k)** 23.17 + 0.672	**(l)** 8.55 + 0.0623
(m) 8.6542 + 0.07	**(n)** 2.1149 + 1.92	**(o)** 32.0 8.335 + 0.2284	**(p)** 0.00626 5.676 + 31.25

2 Set out the following and add.

(a) $2.5 + 3.7$ (b) $8.3 + 7.9$ (c) $9.7 + 0.6$

(d) $4.85 + 8.09$ (e) $6.15 + 2.33$ (f) $0.237 + 0.677$

(g) $5.004 + 4.141$ (h) $7.78 + 6.228$ (i) $0.368 + 2.934$

(j) $25.61 + 0.038$ (k) $0.025 + 39.786$ (l) $5.098 + 21.32$

(m) $9.703 + 5.624 + 7.5$ (n) $7.35 + 0.609 + 2.3$ (o) $0.648 + 7.31 + 0.9$

(p) $1.972 + 3.4541 + 8.6$ (q) $42.65 + 0.3 + 0.851$ (r) $0.007 + 56.2 + 1.99$

(s) $6 + 5.017 + 12.9$ (t) $2.59 + 15 + 0.005$ (u) $0.0004 + 3.583 + 8$

e Hint

3 Choose the correct answer.

Which of the following shows the correct way to set out the addition of 0.56, 15.092 and 2.7?

A	**B**	**C**	**D**
0.5 6 1 5.0 9 2 + 2.7	0 . 5 6 1 5 . 0 9 2 + 2 . 7	0.5 6 1 5.0 9 2 + 2.7	0.5 6 1 5.0 9 2 + 2.7

Extension

4 Al orders the following from his favourite hamburger restaurant:

    1 quarter-kilogrammer $3.25

    1 mega-fries $2.50

    1 large prune juice $1.85

    1 caramel Saturday $1.35

Find the total cost of Al's order.

e Hint

Hmmm, prune juice …

5 Daily rainfall totals for three days over a long weekend were 3.78, 2.50 and 6.42 millimetres. What was the total rainfall over this three-day period?

e Hint

6 John loads his shopping trolley with several items priced as shown.

1 frozen lasagna	$4.71
500 grams of potato salad	$3.69
1 tub of yogurt	$3.77
1 packet of choc-pops	$3.83

Find the total cost of John's purchases.

7 In a gymnastics competition, Matthew scores the following from the five judges: 7.5, 8.5, 7.9, 8.0 and 8.6. Find his total score.

8 Rozeta's lunch order consists of:

1 salad roll	$2.85
1 pineapple donut	$1.30
1 orange	$0.55
1 fruit juice drink	$1.80

How much must Rozeta pay for her lunch?

9 During a car tour of Europe, Helena travels distances of 25.64 km, 165.35 km and 5.97 km all in one day. How many kilometres did she travel altogether during this day?

10 Amanthi's credit card bill shows the following purchase amounts: $23.56, $40.15, $7.89, $18.48, $45.50, $21.73 and $8.59. The total at the bottom of her statement is $184.38, which she is sure is wrong.

e Hint

   (a) What should the total be?
   (b) How do you think the error was made?

11 Steve records his total spending in several categories for one month. His totals are as follows:

Food	$256.40
Leisure	$76.95
Petrol	$64.70
Clothing	$44.85
Rent	$634.30
Insurance	$117.75
Bills (electricity, gas, etc.)	$142.40

Determine Steve's total spending for the month.

12 Write three numbers, each with three decimal places, that could add to 2.79.

6.5 Subtraction of decimals

Decimals are handled the same way as whole numbers when subtracted. Remember that, as with addition, the decimal points must be lined up.

worked example 7

Calculate:

(a) 2.74 – 0.51 **(b)** 34.65 – 7.896 **(c)** 5 – 2.14

Steps

(a) 1. Place the decimals with the larger one on top and the decimal points lined up.
2. Subtract, lining up the decimal point in the answer with those in the question.

(b) 1. Place the decimals with the larger one on top and the decimal points lined up.
2. Fill empty spaces with zeros.
3. Subtract, lining up the decimal point in the answer with those in the question.

(c) 1. Place the decimals with the larger one on top and the decimal points lined up (*Note:* Write 5 as 5.00).
2. Fill empty spaces with zeros.
3. Subtract normally.

Solutions

(a)   2.74
        – 0.51
        ‾‾‾‾‾
          2.23
        ‾‾‾‾‾

(b)   34.650
        – 07.896
        ‾‾‾‾‾‾‾
          26.754
        ‾‾‾‾‾‾‾

(c)   5.00
        – 2.14
        ‾‾‾‾‾
          2.86
        ‾‾‾‾‾

dangerzone

When doing a subtraction like 34.65 – 7.896 it is very easy to incorrectly record the last digit in the answer as 6. Filling in the zeros helps to avoid this error.

e eTutorial

exercise 6.5 Subtraction of decimals

p Preparation: Prep Zone Q5, Ex 6.1

Core

1 Calculate:

(a)   3.6
         – 1.4
         ‾‾‾‾

(b)   7.3
         – 5.2
         ‾‾‾‾

(c)   8.1
         – 6.3
         ‾‾‾‾

(d)   2.8
         – 0.9
         ‾‾‾‾

e Hint

(e)   8.98
         – 2.75
         ‾‾‾‾‾

(f)   8.64
         – 3.43
         ‾‾‾‾‾

(g)   4.69
         – 2.83
         ‾‾‾‾‾

(h)   9.77
         – 5.18
         ‾‾‾‾‾

(i) 9.02
  − 4.22
  _____

(j) 2.08
  − 1.17
  _____

(k) 3.569
  − 0.254
  _____

(l) 5.987
  − 4.126
  _____

(m) 22.662
  − 7.343
  _____

(n) 45.865
  − 4.618
  _____

(o) 4.506
  − 2.263
  _____

(p) 8.007
  − 4.205
  _____

(q) 9.003
  − 8.604
  _____

(r) 7.401
  − 0.825
  _____

(s) 7.6488
  − 2.2909
  _____

(t) 8.3591
  − 7.4067
  _____

2 Copy and complete the following, writing zeros after the last digit in numbers where necessary before subtracting.

(a) 5.4
  − 2.16
  _____

(b) 2.6
  − 0.57
  _____

(c) 7.865
  − 6.2
  _____

(d) 4.491
  − 1.3
  _____

(e) 0.79
  − 0.239
  _____

(f) 57.820
  − 9.594
  _____

(g) 14.3765
  − 5.16
  _____

(h) 37.8183
  − 22.71
  _____

(i) 15.25
  − 4.4502
  _____

(j) 0.77
  − 0.3909
  _____

(k) 3.6
  − 0.087
  _____

(l) 5.1
  − 0.025
  _____

3 Calculate answers to the following. Remember that a decimal point may be placed just after the units digit in whole numbers and zeros added as required after it. (e.g. 7 may be written as 7.0 or 7.00 or 7.000 etc.)

(a) 9
  − 2.6
  ____

(b) 5
  − 0.8
  ____

(c) 4
  − 2.35
  _____

(d) 7
  − 4.97
  _____

(e) 25
  − 13.801
  _____

(f) 12
  − 6.339
  _____

(g) 60
  − 59.522
  _____

(h) 30
  − 29.036
  _____

(i) 300
  − 56.073
  _____

(j) 400
  − 91.254
  _____

(k) 20
  − 0.683
  _____

(l) 50
  − 0.251
  _____

4 Calculate:

(a) 6.7 − 3.3
(b) 9.6 − 7.5
(c) 5.7 − 3.8

(d) 2.58 − 1.04
(e) 8.33 − 4.15
(f) 7.05 − 2.93

(g) 2.013 − 0.666
(h) 23.982 − 11.735
(i) 10.451 − 1.508

(j) $0.3734 - 0.1856$	(k) $36.2585 - 10.9537$	(l) $56.298 - 20.309$
(m) $9.663 - 2.7$	(n) $4.984 - 1.8$	(o) $7.238 - 3.4$
(p) $9.5 - 2.24$	(q) $16.2 - 8.75$	(r) $3.7 - 0.931$
(s) $8 - 7.44$	(t) $3 - 2.92$	(u) $93 - 0.698$
(v) $17 - 0.581$	(w) $25 - 3.792$	(x) $97 - 18.837$

Extension

5 Massood took a piece of marble with a mass of 53.18 kg and carved off 5.25 kg of chips while making a sculpture. What did his sculpture weigh?

6 Cristina's bank account balance was $335.96 just before she withdrew $40.45 to pay a gas bill. How much did she have left in her account after the withdrawal?

e Hint

7 Max places his pet rat in a container of mass 0.925 kg and places it on an electronic balance. The balance gives a reading of 1.773 kg. How much of this mass is due to the rat?

8 A family drives to a holiday resort, and records the car's odometer readings as shown.

e Hint

Departure: 234.8 km   Arrival: 502.7 km

How far did they travel to get to the resort?

9 Georgina pays for $36.35 worth of groceries with a $100 note. How much change should she receive?

10 Naomi pours 1.625 litres of milk from a full 2 litre container. How much milk is left in the container?

e Hint

11 Murray has run 12.347 km of a 40.5 km marathon. How much further has he got to go to complete the race?

12 Ms Fitzgerald's take-home pay is $518.90 per week. If she arranges to have her health insurance payments of $34.65 per week deducted from her salary, how much then would her weekly take-home pay be?

e Hint

13 Timos sells take-away food to passing motorists on a busy highway. One day he takes in $253.70 from the sale of food. If the food cost Timos $98.45, and he had to pay a fee of $14.50 to park his food caravan on the side of the road, what profit did he make for the day?

e Worksheet C6.3

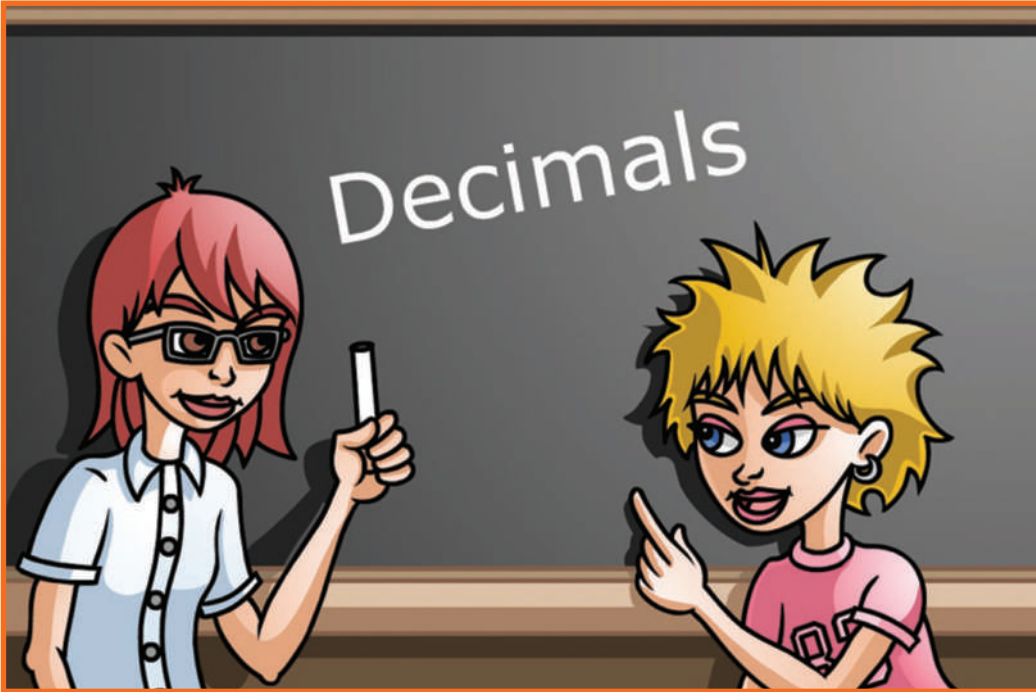**14** Write two decimal numbers, each with three decimal places, that have a difference of 8.71.

e eQuestions

Answer the following, showing your working, and then arrange the letters in the order shown by the corresponding answers to find the cartoon caption.

Evaluate:

$6 + \frac{1}{100} + \frac{1}{1000}$	**N**	$\frac{3}{10} + \frac{4}{1000} + \frac{7}{10\,000}$	**S**	$9.2 + 0.5$	**I**
$3.6 + 2.8$	**O**	$5.26 + 1.87$	**R**	$0.189 + 1.96$	**I**
$2.6 + 0.895$	**T**	$3.765 + 2.8921$	**I**	$0.004 + 6.1$	**E**
$2.01 + 0.008 + 3.99$	**T**	$2.57 + 0.0908 + 5.1$	**H**	$2.06 + 0.149 + 4.8$	**T**
$4.5 - 2.7$	**A**	$19.861 - 12.05$	**P**	$15.09 - 8.3071$	**S**
$72.0891 - 69.4$	**T**	$0.78 - 0.4008$	**H**	$72 - 0.087$	**O**
$34 - 0.0812$	**E**				

'

2.149	**0.3047**		**6.008**	**0.3792**	**6.104**	**7.13**	**33.9188**		**1.8**

7.811	**71.913**	**6.6571**	**6.011**	**7.009**	**2.6891**	**6.4**

				? '
3.495	**7.7608**	**9.7**	**6.7829**	

problem solving

Ten dollars and eighty-nine cents

1 Follow these instructions carefully, writing all numbers as decimals to the hundredths place.
  (a) Choose an amount of money less than $10.00. Write the amount down (e.g. $7.25).
  (b) Reverse the digits and write down the amount formed (e.g. $5.27).
  (c) Subtract the smaller number from the larger one (e.g. $7.25 – $5.27 = $1.98).
  (d) Reverse the digits in your answer from step **(c)** and add the resulting number to your answer from step **(c)** (e.g. $1.98 + 8.91 = $10.89).

2 Repeat the procedure above with a different starting amount. Do you get the same final answer? Investigate what happens with other numbers. Compare your numbers with those of someone else in the class. Together can you discover a pattern?

Explore many possibilities.

6.6 Multiplication of a decimal by a whole number

When multiplying a decimal by a whole number, multiply normally (as if both values were whole numbers), and place a decimal point in the answer so that there are an equal number of decimal places in the question and the answer.

7.2×4 is close to 7×4 so the answer will be close to 28.

To check that your decimal point is in the correct place it is good to do a quick estimate in your head, as Max is doing.

worked example 8

Calculate:

(a) 4.172×3 **(b)** 0.0003×2 **(c)** 12.65×570

Steps

(a) 1. Estimate the answer—it will be roughly equal to $4 \times 3 = 12$.

   2. Multiply as you would for whole numbers.

   3. Because there are three decimal places in the question, place a decimal point in the answer so that there are three decimal places there also.

   $\overset{\frown}{12.516}$

(b) 1. Multiply as if both values were whole numbers (ignore leading zeros).

   2. Because there are four decimal places in the question, place a decimal point in the answer so that there are four decimal places there also.

   $\overset{\frown}{0.0006}$

(c) 1. Multiply as you would for whole numbers.

   2. Because there are two decimal places in the question, place a decimal point in the answer so that there are two decimal places there also.

   $\overset{\frown}{7210.50}$

   3. Simplify by leaving off the last zero.

Solutions

(a)

$$\begin{array}{r} 4172 \\ \times \quad 3 \\ \hline 12516 \end{array}$$

$4.172 \times 3 = 12.516$

> Count back 3 places from the right.

(b)
$$\begin{array}{r} 3 \\ \times\, 2 \\ \hline 6 \end{array}$$

$0.0003 \times 2 = 0.0006$

> Count back 4 places from the right-hand end of the answer, filling in empty spaces with zeros.

(c)
$$\begin{array}{r} 1265 \\ \times \quad 570 \\ \hline 0000 \\ 88550 \\ 632500 \\ \hline 721050 \end{array}$$

$1265 \times 570 = 7210.50$

$= 7210.5$

exercise 6.6 — **Multiplication of decimals by whole numbers**

p Preparation: Prep Zone Q6, Ex 6.1

Core

1 Find the answers to the following multiplication problems. Remember, the number of decimal places in your answer should equal the number in the decimal being multiplied.

(a) 7.6×4	(b) 5.3×7	(c) 6.5×9	**e** Hint
(d) 4.62×5	(e) 0.54×4	(f) 12.33×6	
(g) 8.047×8	(h) 18.309×3	(i) 0.619×7	
(j) 2.558×9	(k) 38.262×2	(l) 20.216×8	
(m) 47.184×8	(n) 4.713×2	(o) 5.3652×3	
(p) 0.8572×5	(q) 0.9067×9	(r) 9.0569×4	

2 Calculate:

(a) 0.05×3	(b) 0.09×2	(c) 0.04×6	**e** Hint
(d) 0.006×6	(e) 0.008×5	(f) 0.008×9	
(g) 0.007×9	(h) 0.005×8	(i) 0.009×5	
(j) 0.032×2	(k) 0.026×3	(l) 0.059×2	
(m) 0.0007×8	(n) 0.0002×6	(o) 0.0005×4	
(p) 0.0029×3	(q) 0.0076×4	(r) 0.0043×7	
(s) 0.00014×7	(t) 0.00079×7	(u) 0.00051×8	

3 Calculate:

(a) 4.5×32	(b) 3.9×24	(c) 7.3×84	**e** Hint
(d) 22.91×25	(e) 0.65×31	(f) 5.26×42	
(g) 1.92×47	(h) 7.94×63	(i) 8.31×64	
(j) 3.807×53	(k) 8.447×52	(l) 0.107×79	
(m) 4.005×26	(n) 6.913×61	(o) 11.304×85	
(p) 2.0457×33	(q) 0.889×98	(r) 5.6083×41	

4 Choose the correct answer.
One of the following numbers is equal to 5.372×8. Which is it?
A 42.976 **B** 4297.6 **C** 429.76 **D** 42 976

5 Choose the correct answer.
A reasonable estimate of the answer to 6.72×3.34 is:
A 18 **B** 21 **C** 200 **D** 2000

Extension

6 Angela buys 6 chocolate frogs from the school canteen. If each one has a mass of 8.93 grams, find the total mass of the frogs.

7 A pill bottle contains 37 pills, each of mass 0.287 grams. What is the total mass of the bottle's contents?

8 Find the total cost of 8 pens if they cost $0.65 each.

Hint

9 Renée buys 52 light-emitting diodes from an electronics shop for $0.35 each. What is the total cost of the components?

10 A snail crawls 0.041 metres in an hour. If it kept up this pace, how far could it move in a day?

11 A banana dessert contains 0.46 grams of dietary fibre per 100 gram serving. How much fibre does Osgood consume if he eats 300 grams of this particular dessert?

Hint

12 Find a whole number and a decimal number, each with three decimal places, that multiply to give 2.056.

6.7 Multiplication of decimals by multiples of 10

Multiples of ten include numbers such as 10, 100, 1000, 10 000 (which are also called powers of 10) as well as numbers such as 20, 300 and 60 000.

To multiply by a multiple of 10:

1 Ignore the zeros in the multiplier and multiply the decimal. (Start at step 2 if the multiplier is a power of 10, i.e. 10, 100, 1000 etc.)

2 Move the decimal point a number of places to the right corresponding to the number of zeros in the multiplier. (For example, if the multiplier has 4 zeros, shift the decimal point 4 places to the right.)

worked example 9

Calculate:

(a) 3.6×1000 **(b)** 0.6295×7000 **(c)** $9.81 \times 340\,000$

Steps

(a) 1. The multiplier contains three zeros, so move the decimal point three places to the right.

2. Fill the empty spaces with zeros.

(b) 1. Ignore the zeros in the multiplier and multiply 0.6295 by 7. (Note the equal number of decimal places in the decimal being multiplied and the answer.)

2. There are three zeros in the multiplier (7000), so move the decimal point three places to the right.

(c) 1. Ignore the zeros in the multiplier and multiply 9.81 by 34.

2. There are four zeros in the multiplier, so move the decimal point four places to the right. (Fill the spaces with zeros.)

Solutions

(a) $3.6 \quad \times 1000$

$= 3600$

(b)
$$
\begin{array}{r}
0.6295 \\
\times \quad 7 \\
\hline
4.4065 \\
\end{array}
$$

4.4065
$0.6295 \times 7000 = 4406.5$

(c)
$$
\begin{array}{r}
9.81 \\
\times \quad 34 \\
\hline
3924 \\
29430 \\
\hline
333.54 \\
\end{array}
$$

333.54
$9.81 \times 340\,000 = 3\,335\,400$

exercise 6.7 Multiplication of decimals by multiples of 10

Core

1 Calculate:

(a) 8.36×100 **(b)** 0.39×100 **(c)** 6.48×100 **e** Hint

(d) 33.76×1000 **(e)** 7.1×10 **(f)** 5.8×10

(g) 0.59×10 **(h)** 2.79×10 **(i)** 19.706×1000

(j) 4.832×100 **(k)** 0.2818×1000 **(l)** 0.4003×1000

(m) 9.214×100 **(n)** 6.331×100 **(o)** 6.763×10

(p) 7.112×10 **(q)** 8.4546×1000 **(r)** 22.5313×1000

(s) 4.5004×100 **(t)** 8.3045×100 **(u)** $34.9965 \times 10\,000$

(v) $2.8582 \times 10\,000$ **(w)** $0.635\,388 \times 10\,000$ **(x)** $0.8319 \times 10\,000$

2 Calculate:

(a) 4.5×1000	**(b)** $0.56 \times 10\,000$	**(c)** 2.1×100	**e** Hint
(d) 2.44×1000	**(e)** 7.8×100	**(f)** 3.7×100	
(g) 9.45×1000	**(h)** 7.1×1000	**(i)** $0.351 \times 10\,000$	
(j) $0.47 \times 10\,000$	**(k)** $8.9 \times 10\,000$	**(l)** $9.4 \times 100\,000$	
(m) $0.23 \times 100\,000$	**(n)** $6.08 \times 1\,000\,000$	**(o)** $1.007 \times 100\,000$	

3 Choose the correct answer.
7.9267×1000 equals:

A 0.007 926 7   **B** 7.926 700 0   **C** 7926.7   **D** 79 267 000

4 Calculate:

(a) 2.49×60	**(b)** 3.27×7000	**(c)** 2.991×400	**e** Hint
(d) 9.141×8000	**(e)** 2.88×30	**(f)** 8.69×50	
(g) 7.3521×200	**(h)** 2.2853×300	**(i)** 9.304×6000	
(j) 0.57×2000	**(k)** $4.34 \times 50\,000$	**(l)** $6.625 \times 40\,000$	
(m) $1.328 \times 700\,000$	**(n)** $9.036 \times 900\,000$	**(o)** $5.506 \times 6\,000\,000$	

5 Calculate:

(a) $4.591 \times 56\,000$	**(b)** 6.38×4300	**(c)** 3.14×9300	**e** Hint
(d) $0.571 \times 68\,000$	**(e)** $0.9465 \times 71\,000$	**(f)** $7.4832 \times 55\,000$	
(g) $6.575 \times 470\,000$	**(h)** 3.9×1300	**(i)** $2.92 \times 33\,000$	
(j) $5.8 \times 26\,000$	**(k)** $8.3 \times 850\,000$	**(l)** $0.97 \times 790\,000$	

Extension

6 Write three whole numbers that when multiplied by 4.65 give an answer between 90 000 and 110 000.

7 Gavin sells 300 punnets of berries to a supermarket. If he is paid $1.72 for each punnet, how much does he receive? (Answer in dollars.)

8 Roy buys 500 Eastpac shares at $25.90 each. What does the total share package cost him?   **e** Hint

9 Marita fills her car's fuel tank with petrol at a cost of $0.85 per litre. If she adds 70 litres, how much must she pay? (Answer in dollars.)

10 Rod packs 500 tins of caviar into a carton for delivery to a customer. If each tin has a mass of 0.453 kilograms, what will be the total mass of the carton's contents? (Answer in kilograms.)   **e** Hint

11 Kim works in an ice-cream parlour, and one hot day sells 500 scoops of vanilla. If each cone holds 0.185 litres of ice-cream and the day started with 130 litres of vanilla in the freezer, how much vanilla ice-cream is left at the end of the day? (Answer in litres.)

12 Phil orders 23 000 nails from a supplier at a cost of $0.027 per nail. How much will the nails cost altogether? (Answer in dollars.)

13 Im buys honey from a bee-keeper for $0.0078 per millilitre. How much does it cost her to have a 2000 millilitre container filled with honey? (Answer in dollars.)

14 The instructions on the back of manure concentrate say to spread 0.75 kilograms per square metre of area to be fertilised. Raisa wants to fertilise 2600 square metres of property using this product. What mass of manure concentrate should she use? (Answer in kilograms.)

15 A woodwork teacher needs 50 pieces of pine, each 0.135 metres long, to issue to students to make a particular model. What total length (in metres) of timber does the teacher need? (Ignore any lost length due to saw cuts.)

6.8 Multiplication of decimals by other decimals

When multiplying a decimal by another decimal:
1 Ignore the decimal points and multiply as if both values were whole numbers.
2 Count the number of decimal places in each decimal and add to find the *total* number of decimal places involved in the question.
3 Place a decimal point in the answer so it has a number of decimal places equal to the *total* from step 2.

worked example 10

Evaluate:
(a) 0.63×0.4 **(b)** 0.0014×0.0002 **(c)** 2.917×0.35

Steps

(a) 1. Ignore the decimal points and calculate 63×4.

Solutions

(a)
$$\begin{array}{r} 63 \\ \times \quad 4 \\ \hline 252 \end{array}$$

> 04 is the same as 4.

2. Count the number of decimal places in both decimals being multiplied.

There is a total of 3 decimal places.

3. Place a decimal point in the answer so that it has three decimal places. Place a zero in the units place to emphasise the placement of the decimal point.

$$252$$
$$0.63 \times 0.4 = 0.252$$

(b) 1. Ignore the decimal points and calculate 14×2.

(b)
$$\begin{array}{r} 14 \\ \times\ \ 2 \\ \hline 28 \end{array}$$

2. Count the number of decimal places in both decimals being multiplied.

There is a total of 8 decimal places.

3. Place a decimal point in the answer so that it has 8 decimal places. Place zeros in the empty spaces and the units place.

$$28$$
$$0.0014 \times 0.0002 = 0.000\,000\,28$$

(c) 1. Ignore the decimal points and calculate 2917×35.

(c)
$$\begin{array}{r} 2917 \\ \times\ \ \ \ \ 35 \\ \hline 14585 \\ 87510 \\ \hline 102095 \end{array}$$

2. Count the number of decimal places in both decimals being multiplied.

There are 5 decimal places in total.

3. Place a decimal point in the answer so that it has 5 decimal places.

$$102095$$
$$2.917 \times 0.35 = 1.020\,95$$

exercise 6.8 Multiplication of decimals by other decimals

P Preparation: Prep Zone Q6, Exs 6.1, 6.3 and 6.6

Core

1 Calculate:

(a) 0.6×0.8	**(b)** 0.4×0.6	**(c)** 0.9×0.4	**e** Hint
(d) 0.13×0.5	**(e)** 0.85×0.7	**(f)** 0.74×0.3	
(g) 9.32×0.7	**(h)** 4.12×0.3	**(i)** 5.26×0.8	
(j) 82.65×0.02	**(k)** 67.7×0.04	**(l)** 92.57×0.06	
(m) 3.8×0.6	**(n)** 9.3×0.5	**(o)** 8.9×0.5	
(p) 27.4×0.03	**(q)** 79.4×0.09	**(r)** 1.58×0.09	

2 Calculate:

(a) 0.06×0.005	**(b)** 0.004×0.6	**(c)** 0.9×0.04	**e** Hint
(d) 0.08×0.7	**(e)** 0.0002×0.04	**(f)** 0.005×0.08	**e** eTester

(g) 0.02×0.3 **(h)** 0.09×0.0002 **(i)** 0.06×0.008

(j) 0.32×0.003 **(k)** 0.56×0.4 **(l)** 0.058×0.0009

(m) 0.072×0.05 **(n)** 0.47×0.6 **(o)** 0.13×0.09

(p) 0.25×0.07 **(q)** 0.0308×0.3 **(r)** 0.0603×0.2

3 Calculate:

(a) 2.7×3.6 **(b)** 4.2×8.9 **(c)** 4.9×8.4

(d) 1.23×4.5 **(e)** 5.83×8.7 **(f)** 0.628×2.9

(g) 7.74×0.31 **(h)** 9.46×0.22 **(i)** 3.76×0.18

(j) 0.53×0.047 **(k)** 0.32×0.0061 **(l)** 0.48×0.0039

(m) 2.24×5.79 **(n)** 4.33×9.85 **(o)** 9.24×4.87

(p) 5.007×8.3 **(q)** 8.0302×0.6 **(r)** 0.6005×3.2

(s) 2.105×5.6 **(t)** 6.357×0.18 **(u)** 3.217×0.028

4 What is the effect of multiplying by a number less than 1?

5 Choose the correct answer.

  (a) How many decimal places are in the answer to 6.65×7.277?

      A 2   **B** 3   **C** 4   **D** 5

  (b) How many decimal places are in the answer to 0.5×0.363?

      A 2   **B** 3   **C** 4   **D** 5

  (c) How many decimal places are in the answer to 0.35×1.04?

      A 2   **B** 3   **C** 4   **D** 5

  (d) How many decimal places are in the answer to 129.2×0.2?

      A 2   **B** 3   **C** 4   **D** 5

Extension

6 Write three numbers, each with two decimal places, that when multiplied by 1.65 give an answer between 0.3 and 0.5.

7 Amy orders 27.5 metres of hardwood decking priced at $0.89 per metre from her local timber-yard. How much will the decking cost her in total? (Answer in dollars.)

8 Bryan has calculated he needs 3.6 square metres of tiles for his bathroom. What will he have to pay if the tiles he wants cost $22.39 per square metre? (Answer in dollars.)

9 Joe pumps 9.54 litres of petrol into his car's tank to fill it before a long trip. How much did the fuel cost him if it was priced at $0.76 per litre? (Answer in dollars.)

10 Domenica buys a 0.056 kilogram segment of her favourite blue-vein cheese at a cost of $25.42 per kilogram. How much does the piece of cheese cost? Round off to the nearest 5 cents.

11 Stewed rhubarb contains 3.82 kilojoules per gram. How many kilojoules would an 83.5 gram portion contain?   **e** Hint

12 Wayne is following his grandfather's recipe for tomato sauce, which requires 3.5 pounds of tomatoes. (A pound is one of the old imperial units for mass.) Because he only has scales calibrated in kilograms (accurate to 0.001 kg), Wayne decides to convert the mass to kilograms. He looks at a conversion table in a cook-book which states that 1 pound equals 0.454 kilograms. What answer should he get when he converts the mass to kilograms and rounds off to three decimal places?

13 Francesca reads her electricity meter one Saturday, and again the next Saturday, and records the following readings: **e** Hint

First Saturday: 7562.3 kilowatt-hours
Second Saturday: 7638.6 kilowatt-hours

(a) How many kilowatt-hours of electricity did Francesca's household use in the week?

(b) If electricity costs $0.13 per kilowatt-hour, find the exact total cost of the electricity supplied in the week.   **e** Worksheet A6.1

6.9 Division of decimals by whole numbers

When looking at division, the following mathematical terms are useful:

Dividend—the number being divided.
Divisor—the number doing the dividing.
Quotient—the answer.
These are shown in the example below.

$$\text{quotient} \longrightarrow \quad 8.14$$
$$\text{divisor} \longrightarrow \quad 7\overline{)56.98} \longleftarrow \text{dividend}$$

When dividing a decimal by a whole number, there is an important rule to remember.

Line up the decimal point in the quotient (your answer) with the decimal point in the dividend (number being divided).

worked example 11

Calculate the following. (Round your answer to part **(c)** to 3 decimal places.)

(a) $8.24 \div 4$　　　　　　　　**(b)** $0.062 \div 4$　　　　　　　　**(c)** $4.1 \div 7$

Steps

(a) 1. Re-write the question with the setting out shown.

　　2. Divide as you would normally using short division, and place a decimal point in the answer so it lines up with the one in the dividend (8.24).

(b) 1. Re-write the question as shown.

　　2. Divide. Again, note how a zero had to be added to the dividend to allow the question to be completed.

(c) 1. Re-write the question as shown.

　　2. Divide, adding zeros as needed, until there are four decimal places in the answer.

　　3. Round off to three decimal places.

Solutions

(a) 　2.06
　　$4\overline{)8.24}$

Don't forget to write a zero if at any stage the divisor 'won't go'.

(b) 　$0.01\ 5\ 5$
　　$4\overline{)0.06^2 2^2 0}$

(c) 　$0.5\ 8\ 5\ 7\ldots$
　　$7\overline{)4.1^6 0^4 0^5 0^1}$

　　0.586

exercise 6.9　Division of decimals by whole numbers

p Preparation: Prep Zone Q7, Exs 6.1 and 6.3

Core

1 Calculate the quotient in each case. (Give exact answers: do not round off.)

(a) $6.4 \div 2$　　　　　**(b)** $20.5 \div 5$　　　　　**(c)** $12.96 \div 3$

(d) $8.48 \div 4$　　　　　**(e)** $39.42 \div 6$　　　　　**(f)** $14.22 \div 9$

(g) $17.29 \div 7$　　　　**(h)** $52.08 \div 7$　　　　**(i)** $19.35 \div 5$

(j) $26.48 \div 8$　　　　**(k)** $5.34 \div 2$　　　　　**(l)** $23.94 \div 9$

(m) $79.08 \div 12$　　　**(n)** $64.02 \div 11$　　　**(o)** $76.68 \div 9$

(p) $0.0342 \div 6$　　　**(q)** $0.0432 \div 9$　　　**(r)** $0.0656 \div 8$

e Hint

2 Calculate the following.

(a) $3.6 \div 6$ (b) $2.4 \div 4$ (c) $2.4 \div 8$

Give an exact answer. Don't round off.

(d) $3.92 \div 7$ (e) $2.45 \div 5$ (f) $2.22 \div 3$

(g) $4.23 \div 9$ (h) $1.98 \div 2$ (i) $7.59 \div 11$

(j) $0.084 \div 3$ (k) $0.0406 \div 7$ (l) $0.0246 \div 3$

(m) $2.156 \div 7$ (n) $6.324 \div 6$ (o) $5.205 \div 5$

(p) $1.809 \div 9$ (q) $8.106 \div 3$ (r) $2.604 \div 12$

3 Calculate decimal answers to the following. Remember to add a zero to the dividend if necessary to allow the division to be completed.

(a) $3.3 \div 2$ (b) $7.5 \div 6$ (c) $6.2 \div 4$

(d) $13.2 \div 5$ (e) $20.4 \div 8$ (f) $16.2 \div 12$

(g) $4.11 \div 4$ (h) $16.5 \div 8$ (i) $7.15 \div 4$

(j) $6.03 \div 2$ (k) $6.09 \div 6$ (l) $9.08 \div 5$

4 Find the following quotients. Again, remember to add a zero to the dividend if necessary to allow the division to be completed.

(a) $1.3 \div 2$ (b) $5.1 \div 6$ (c) $2.8 \div 8$

(d) $1.4 \div 4$ (e) $4.35 \div 5$ (f) $10.5 \div 12$

(g) $0.42 \div 5$ (h) $0.9 \div 6$ (i) $0.049 \div 2$

(j) $0.0154 \div 4$ (k) $0.2501 \div 5$ (l) $0.603 \div 2$

(m) $2.822 \div 4$ (n) $4.036 \div 8$ (o) $5.028 \div 8$

5 Calculate the following quotients. Remember to keep adding zeros to the dividend to allow division to continue until the question is complete.

(a) $12.5 \div 4$ (b) $21.7 \div 8$ (c) $16.29 \div 12$

(d) $3.51 \div 4$ (e) $1.79 \div 8$ (f) $8.619 \div 12$

(g) $12.07 \div 4$ (h) $0.839 \div 8$ (i) $0.563 \div 8$

6 Calculate the following quotients to four decimal places and then round off to three decimal places.

(a) $10.6 \div 7$ (b) $7.3 \div 6$ (c) $0.47 \div 9$

(d) $1.22 \div 3$ (e) $2.41 \div 6$ (f) $18.46 \div 7$

(g) $0.509 \div 3$ (h) $25.852 \div 11$ (i) $8.403 \div 12$

(j) $9.041 \div 9$ (k) $6.204 \div 9$ (l) $8.635 \div 7$

Extension

7 Write three numbers, each with three decimal places, that when divided by 4 give an answer between 0.5 and 1.

8 A 2 gram piece of chocolate contains 43.4 kilojoules of energy. How many kilojoules would one gram contain?

9 A block of walnut cheese of mass 2.312 kg is to be divided equally into 8 pieces. What will the mass of each piece be?

10 A company makes a profit of 7.86 million dollars. If the profit is to be divided equally among the four company owners, how much would each owner get? (Answer in millions of dollars.)

11 An oak wine cask contains 43.75 litres of wine. The wine-maker wishes to divide this into six equal amounts to blend with various other wines. How many litres should each smaller amount be? Answer correct to 3 decimal places.

12 Eleanor's car travels 37.29 kilometres on three litres of fuel. How far would it travel on one litre of fuel?

13 Simon buys 7 kg of spicy sausages for $32.95. How much is this per kilogram?

Working mathematically

investigation

Diving scores

Olympic divers receive scores out of 10 from seven judges after the completion of a dive.

These scores are used to calculate a single final score for a dive as shown below.

1. The highest and lowest scores are ignored. (Why do you think this is so?) For example, the scores might be
   7.0, 8.0, 7.5, 6.5, 7.5, 7.0, 6.5

2. The remaining five scores are averaged (added up and divided by 5). For the scores above, this gives

$$
\begin{array}{r}
7.0 \\
7.5 \\
7.5 \\
7.0 \\
6.5 \\
\hline
35.5
\end{array}
\qquad
\begin{array}{r}
7.1 \\
5\overline{)35.5}
\end{array}
\leftarrow \text{ average}
$$

3. The average from step 2 is multiplied by 3 (to give a value representing a 'three-judge total').

$$\begin{array}{r} 7.1 \\ \times \quad 3 \\ \hline 21.3 \end{array}$$ ⟵ three-judge total

4. The three-judge total from step 3 is multiplied by the 'degree of difficulty', which is a decimal containing one decimal place. The harder the dive, the higher the degree of difficulty. For example, if the dive was a forward dive with one twist, which has a degree of difficulty of 2.2, the final score may be calculated as follows:

$$\begin{array}{r} 21.3 \\ \times \quad 2.2 \\ \hline 426 \\ 4260 \\ \hline 46.86 \end{array}$$

21.3 ⟵ three-judge total
× 2.2 ⟵ degree of difficulty

46.86 ⟵ final score

1 Calculate the final score for each dive in the following table.

Dive	Degree of difficulty	Scores
(a) Forward somersault with 1 twist	2.0	6.0, 5.5, 7.5, 7.5, 6.0, 6.5, 7.0
(b) Reverse $2\frac{1}{2}$ somersault, tuck position	3.0	7.5, 7.5, 8.0, 8.5, 8.0, 9.0, 8.5
(c) Forward dive, tuck position	1.4	7.0, 8.0, 6.5, 7.5, 7.0, 7.0, 6.5
(d) Inward double somersault, pike position	2.6	9.0, 8.5, 9.5, 7.5, 8.0, 8.0, 8.5
(e) Reverse somersault	1.9	10.0, 9.0, 8.5, 9.0, 8.0, 9.5, 8.0
(f) Forward $1\frac{1}{2}$ somersault with 4 twists	3.3	5.0, 6.0, 4.5, 7.0, 6.0, 6.5, 4.5

2 If the dive with the highest degree of difficulty is a forward $4\frac{1}{2}$ somersault from the tuck position (degree of difficulty 3.5), what is the highest possible final score in diving?

3 Sandra needs a final score of 48 or more to win a competition. She chooses a back dive with $1\frac{1}{2}$ somersault, which has a degree of difficulty of 2.0. What score does she need from each judge on average?

4 Brad isn't sure whether to try an inward dive (degree of difficulty 1.7) or a back dive (degree of difficulty 1.9). He thinks he could achieve an average score of 8 from the judges for an inward dive, or an average score of 7.5 for a back dive. Calculate his possible final score in each case. Which dive should he attempt?

To divide a decimal by a multiple of 10:

1 First divide the decimal by the non-zero digit contained in the divisor.

2 Move the decimal point a number of places to the *left* corresponding to the number of zeros in the divisor. (For example, if the divisor has 3 zeros, shift the decimal point 3 places to the left.)

> I think I'll go straight to step 2 if the divisor is 10, 100, 1000 etc.

worked example 12

Calculate:

(a) $5.68 \div 100$ **(b)** $3.94 \div 80$

Steps	**Solutions**
(a) 1. Since the divisor (100) is a power of ten, shift the decimal point 2 places to the left (as the divisor ends with 2 zeros).	**(a)** $5.68 \div 100$
2. Fill empty spaces with zeros and place a zero in the units place to emphasise the placement of the decimal point.	$= 0.0568$
(b) 1. The non-zero digit in the divisor is 8, so divide by 8 to start with.	**(b)** $3.94 \div 80$ $8\overline{)3.9^74^20^40}$ gives $0.4\ 9\ 2\ 5$
2. Since the divisor contains 1 zero, move the decimal point 1 place to the left.	$= 0.04925$

e eTutorial

exercise 6.10 Division of decimals by multiples of 10

p Preparation: Prep Zone Q7, Exs 6.1, 6.3 and 6.9

Core

1 Calculate:

   (a) $42.7 \div 100$ **(b)** $8.9 \div 10$ **(c)** $73.83 \div 10$

   (d) $2.44 \div 100$ **(e)** $6.178 \div 1000$ **(f)** $79.8 \div 10\ 000$

   (g) $5.59 \div 1000$ **(h)** $8.02 \div 1000$ **(i)** $64.91 \div 10\ 000$

   (j) $125.32 \div 100$ **(k)** $803.2 \div 100$ **(l)** $0.4 \div 100$

e Hint

(m) $0.98 \div 10$	(n) $7.6 \div 1000$	(o) $0.539 \div 100$
(p) $45.897 \div 10$	(q) $2.74 \div 1000$	(r) $6.12 \div 10\,000$
(s) $912.087 \div 100$	(t) $0.045 \div 10$	(u) $0.049 \div 100$
(v) $67 \div 10$	(w) $108 \div 10\,000$	(x) $8 \div 1000$

2 Calculate the following quotients. Remember to divide by a one- or two-digit whole number first before shifting the decimal point.

(a) $3.6 \div 40$	(b) $8.1 \div 90$	(c) $18.9 \div 700$
(d) $23.4 \div 600$	(e) $233.4 \div 3000$	(f) $96.58 \div 2000$
(g) $0.908 \div 20$	(h) $1.26 \div 300$	(i) $2.82 \div 600$
(j) $2.38 \div 70$	(k) $38.05 \div 500$	(l) $67.04 \div 8000$
(m) $107.22 \div 20\,000$	(n) $68.16 \div 500$	(o) $2.532 \div 30$
(p) $2.296 \div 400$	(q) $40.6 \div 8000$	(r) $36.216 \div 60$
(s) $90.494 \div 9000$	(t) $150.57 \div 30\,000$	(u) $16.2 \div 1200$
(v) $68.4 \div 120$	(w) $3.19 \div 110$	(x) $9.02 \div 1100$

3 Choose the correct answer.

(a) $51.7489 \div 100$ is equal to:

    A 517.489 **B** $5.174\,89$ **C** $0.517\,489$ **D** $0.051\,748\,9$

(b) $8.6 \div 20$ is equal to:

    A 0.86 **B** 86.0 **C** 0.43 **D** 43.0

Extension

4 The total bill for a wedding reception involving 100 guests is $4298.55. How much does this work out to per guest?

5 An economy pack of 10 toilet rolls made of recycled paper costs $6.30. What is the cost per roll at this rate?

6 Stephanie buys 10 000 Dellco shares for $14 500. How much does each share cost?

7 Adam bought a 200 gram piece of Edam cheese for $4.35. What was the price of the cheese per gram? (Answer in dollars.)

8 An interior decorator wallpapers 50 square metres of walls for a customer at a cost of $521.50. What was the cost per square metre?

9 A 4000 millilitre container of orange juice costs $8.90. Determine the cost per millilitre.

10 Stan buys 1200 grams of bananas for $2.45, while his friend Dawn buys 800 grams of apples at the same shop for $2.10. Find the cost per gram of each fruit. Which is the better buy in terms of price per gram?

e **eQuestions**

6.11 Division of decimals by other decimals

Recall the following terms:

dividend ⟶ 23.654 ÷ 0.07 ⟵ divisor

To divide a decimal by another decimal:
1 Move the decimal point in the divisor to the right to make a new whole number divisor. Note how many places the decimal point had to be moved to do this.
2 Move the decimal point in the dividend the same number of places as the decimal point was moved in step 1 to make a new dividend.
3 Now divide the new dividend by the new whole number divisor.

worked example 13

Calculate the following. Round your answer to part **(b)** to 3 decimal places.
(a) 3.35 ÷ 0.005   **(b)** 10.52 ÷ 0.9

Steps

(a) 1. The decimal point in the divisor (0.005) must be moved 3 places to the right to turn the divisor into a whole number (5).

2. Hence move the decimal point in the dividend (3.35) 3 places to the right also.

3. Re-write the question using the new divisor and new dividend.

4. Calculate the quotient using short division.

(b) 1. The decimal point in the divisor (0.9) must be moved 1 place to the right to turn the divisor into a whole number (9).

2. Hence move the decimal point in the dividend (10.52) 1 place to the right as well, to form 105.2.

Solutions

(a)

We've got to add a zero to let us move the decimal point three places.

$3.35 \div 0.005$

$= 3350 \div 5$

$$= 5 \overline{)33^350} \quad \begin{array}{r} 6\ 70 \end{array}$$

(b)

$10.52 \div 0.9$

3. Re-write the question using the new divisor and new dividend.

$= 105.2 \div 9$

4. Calculate the quotient to 4 decimal places using short division.

$$= 9\,\overline{)10^{1}5^{6}.2^{8}\,0^{8}0^{8}0}$$
$$\quad 1\;1\;.6\;8\;8\;8$$

5. Round off the quotient to 3 decimal places.

$= 11.689$

exercise 6.11 Division of decimals by other decimals

Core

e Worksheet C6.5

1 Calculate:

e Hint

(a) $5.14 \div 0.2$
(b) $4.12 \div 0.4$
(c) $1.736 \div 0.07$
(d) $24.42 \div 0.2$
(e) $15.48 \div 0.04$
(f) $0.502 \div 0.005$
(g) $10.2 \div 0.5$
(h) $2.144 \div 0.08$
(i) $2.382 \div 0.006$
(j) $1.812 \div 0.002$
(k) $0.201 \div 0.03$
(l) $0.3996 \div 0.009$
(m) $9.018 \div 0.09$
(n) $5.1 \div 0.6$
(o) $0.196 \div 0.008$
(p) $56.07 \div 0.07$
(q) $9.96 \div 1.2$
(r) $6.457 \div 0.011$
(s) $1.2672 \div 0.011$
(t) $10.572 \div 1.2$
(u) $0.17 \div 0.2$
(v) $0.021 \div 0.006$
(w) $0.391 \div 0.04$
(x) $1.755 \div 0.08$

2 Find the following quotients.

e Hint

(a) $4.2 \div 0.03$
(b) $3.3 \div 0.05$
(c) $7.5 \div 0.005$
(d) $7.2 \div 0.003$
(e) $3.76 \div 0.008$
(f) $1.16 \div 0.002$
(g) $1.74 \div 0.0002$
(h) $60.3 \div 0.09$
(i) $7.02 \div 0.009$
(j) $10.8 \div 0.006$
(k) $8.05 \div 0.0007$
(l) $13.36 \div 0.0008$
(m) $24.9 \div 0.006$
(n) $1.808 \div 0.0004$
(o) $4.032 \div 0.0004$
(p) $39.06 \div 0.007$
(q) $63.8 \div 0.011$
(r) $10.78 \div 0.011$
(s) $0.792 \div 0.0012$
(t) $6.732 \div 0.0012$
(u) $22.6 \div 0.04$
(v) $1.32 \div 0.005$
(w) $13.7 \div 0.008$
(x) $22.9 \div 0.08$

3 Evaluate the following quotients, where necessary correct to three decimal places.

e Hint

(a) $0.14 \div 0.3$
(b) $0.16 \div 0.6$
(c) $8.16 \div 0.7$
(d) $0.507 \div 0.03$
(e) $0.935 \div 0.09$
(f) $0.68 \div 0.7$
(g) $0.0602 \div 0.006$
(h) $0.1776 \div 0.003$
(i) $26.7 \div 0.12$
(j) $1.815 \div 0.0009$
(k) $5.902 \div 0.0007$
(l) $1.49 \div 0.012$

4 What is the effect of dividing by a number less than 1?

5 Choose the correct answer.

(a) Evaluating which of the following will give the answer to $6.018 \div 0.02$?

A $2\,\overline{)6018.0}$ **B** $2\,\overline{)601.8}$ **C** $2\,\overline{)0.060\ 18}$ **D** $2\,\overline{)0.6018}$

(b) Evaluating which of the following will give the answer to
3.2 ÷ 0.005?

A $5\overline{)0.0032}$ **B** $5\overline{)0.000\,32}$ **C** $5\overline{)320.0}$ **D** $5\overline{)3200.0}$

6 Give three possible numbers that when divided by 0.03 give an answer between 1500 and 1800.

Extension

7 Anthony needs to mix 0.07 litres of poison concentrate with water each time he fills the tank of his garden sprayer. If he has 0.84 litres of poison left, how many sprayer tankfuls can he mix?

8 Regina has a tub containing 5.811 kilograms of worms which she uses for fishing. If the average worm has a mass of 0.003 kilograms, how many are in her tub?

9 A take-away food shop proprietor calculates that each souvlaki made in her shop uses 0.009 kilograms of cucumber and garlic sauce. How many souvlakis could be made before the 2.332 kilograms of sauce left in her fridge is used up?

10 Hai is making a long-distance call on a pay-phone which deducts $0.90 per minute from his phone card. For how many more minutes can he continue his call if he has $5.85 credit left on his phone card?

11 A 1.2 kilometre taxi trip costs Joan $5.70. How much is this per kilometre?

speedingzone

Do these in your head as quickly as you can and write down the answers.

Time target: 2 minutes

1 6×35 **2** 1.2×200 **3** $\frac{1}{2}$ of $4.30   **4** 40^2

5 $123 + 672$ **6** $1000 - 570$ **7** 20×1100 **8** $20.00 - $4.12

9 $2^3 + 5^2$ **10** $138 - 2038$

Decimal drinks

To compare the prices of products of different sizes it is necessary to find the price per unit. Soft drinks can be purchased in bottles of various sizes. On a particular day the following shelf prices were listed at a large supermarket chain for a particular soft drink.

Bottle volume (L)	Price
1.25	$1.69
1.5	$1.99
2	$2.47

In the case of these drinks the unit is the litre—we can find the cost *per litre*. To do this we divide the price by the size of the bottle, expressed in litres. For example:

1.25 L costs $1.69

So, $\frac{1.25}{1.25}$ L costs $\$\frac{1.69}{1.25} = \$1.352$

This means that each litre costs $1.352. Notice that this is a price that we could not pay exactly; however, we are not actually going to purchase a litre so we don't have to worry.

Questions

  1 List some of the reasons why you think a large range of soft drink sizes is available. When do you think you would purchase each size?

  2 (a)   Calculate the *per litre* price for the 1.5 L and 2 L bottles in the table above.

  (b)   Which of the three bottle sizes in the table is the cheapest *per litre*?

(c) Would it always be better to purchase this size? Explain your answer.

(d) Shortly after the prices in the table were recorded the 2 L bottle went on special for $1.79. In addition to this there was a four-pack of 1.25 L bottles for $5.93 and a 600 mL bottle, available in the drinks refrigerator near the check-out, for $1.78.

   (i) How much was the discount on the 2 L bottle?

   (ii) Calculate the *per litre* price for the special price of the 2 L bottle.

   (iii) Find the *per litre* price for the four-pack.

   (iv) What do you think of the price for the 600 mL bottle? Explain your answer.

(e) Out of all the prices considered so far, which is the best value?

3 As well as being available in bottles, soft drinks are also available in cans. On the same day as the bottle prices were recorded the following shelf prices were listed for cans of the same soft drink:

Number of cans	Price
1	$0.98
6-pack	$5.43
12-pack	$9.95
18-pack	$13.45
24-pack	$17.23

(a) Find the *per can* cost for each of the packs.

(b) Suppose that the 18-pack was actually on special for $9.99.

   (i) How much was the saving compared to the normal price?

   (ii) Find the price *per can* at the special price.

(c) Which of the packs offers the lowest price *per can*?

(d) How does the purchase of large quantities of cans compare to the purchase of big bottles of the drink? Do the same sorts of concerns exist?

4 What is the *per litre* price for the individual can and each of the packs (including the special price for the 18-pack) in Question **3**? Assume that each can holds 375 mL, and be careful that you divide by the number of litres (375 mL = 0.375 L).

5 (a) From your answers to Questions **2** and **4**, which product, out of all the bottles and cans, offered the lowest price *per litre*?

(b) On a day when there were no specials in effect, which product would offer the lowest price *per litre*?

(c) In general, how does the price of cans compare with the price of bottles?

Research

Find the current prices for a range of different sized bottles and packs of cans for Coca-Cola, Pepsi Cola and any other cola drinks. Write a report that discusses your findings.

languagezone

Summary

Copy and complete the following summary of this chapter using the words and phrases from the list. A word or phrase may be used more than once.

1 4.87 has three _____.

2 When adding or subtracting _____, it is important to line up the _____ _____.

3 In the hundredths column in 9.605, there is a _____ _____.

4 A _____ of 2.4 and a divisor of 6 gives a _____ of 0.4.

5 To do written division we need to use a whole-number _____.

6 It is important to use _____ when multiplying decimals to check your answer.

Key words

decimal points
decimals
digits
dividend
divisor
estimation
hundredth
place-holding zero
quotient
round
tenth
thousandth

Questions

1 Explain the differences between 'round', 'round down' and 'round up'.

2 'Deci' means ten. Why then do decimals have their name?

3 Write at least two words that begin with 'dec', where 'dec' is used to mean ten.

4 Label each of these numbers with words from the list above.

$$_____ \longrightarrow \quad 2.7 \div 0.9 = 3 \quad \longleftarrow _____$$

_____

5 What is a non-mathematical meaning of the word 'digit'?

6 In 2000, Australia's fertility rate was 1.75 babies per woman. Explain this number. Can a woman have 1.75 babies?

7 Write the following words in the form indicated in brackets:
estimation (verb)   divide (noun)

8 Unjumble these words:
TTQONIEU   TNOETMAIIS   CMDELIA

e Worksheet L6.1

e Worksheet L6.2

FAQs

Is it okay to leave off some of the zeros after a decimal point?
Any zero that comes after a decimal point and before any non-zero numbers must be included. These zeros make sure the other numbers stay in their correct places, for example in 2.090 03. If the zeros have no numbers after them then it is okay to remove them. For example, 0.501 00 is the same as 0.501, but not the same as 0.51.

Is it okay to write .37 instead of 0.37?
It is not wrong, but it is better to write 0.37. Then there is less chance of the decimal point being missed.

I keep getting the last number wrong when I am subtracting decimals. What could I be doing wrong?
Maybe you are not filling in the zeros. When doing the subtraction 2.8 − 1.62, for example, make sure that you write 2.8 as 2.80, then you will remember to carry across so that you can subtract the 2 in the hundredths column.

Core

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1 Write the following as decimals.

(a) $6 + \frac{2}{10} + \frac{3}{100} + \frac{2}{10\,000}$ (b) $\frac{2}{100} + \frac{7}{10\,000} + \frac{5}{1\,000\,000}$ (c) $\frac{1}{10} + \frac{7}{1000}$

6.1

2 Write in expanded fractional form.

(a) 0.968 (b) 5.0702 (c) 6.005

6.1

3 Write as decimals.

(a) six tenths, five hundredths, two thousandths and four ten-thousandths

(b) eight hundredths, nine hundred-thousandths and three millionths

6.1

4 Write each of the following in expanded word form.

(a) 1.8531 (b) 0.070 06 (c) 61.0009

6.1

5 Write the value of the 9 in each decimal as a fraction *and* in words.

(a) 5.091 (b) 0.0659 (c) 25.291

6.1

6 Write < or > in each of the following pairs of numbers to make a true statement.

(a) 3.0427 _____ 3.0274 (b) 0.009 95 _____ 0.01

6.2

7 Write in order from smallest to largest.

(a) 0.6055, 0.5506, 0.607 (b) 0.071, 0.701, 0.71

6.2

8 Round the following off to the number of places indicated in brackets.

(a) 5.671 (2) (b) 2.985 (1) (c) 8.007 (2)

6.3

9 Calculate:

(a) $2.52 + 0.46$ (b) $23.6 + 4.79$

(c) $3.768 + 10.9205 + 0.77$ (d) $6 + 0.408 + 35.025$

10 Calculate:

(a) $16.85 - 8.34$ (b) $10.367 - 2.65$

(c) $2.082 - 0.394$ (d) $7 - 2.2198$

11 Find the following products.

(a) 4.8×5 (b) 3.376×4 (c) 5.033×7

(d) 2.99×35 (e) 5.24×26 (f) 6.09×33

12 Calculate:

(a) 5.18×100 (b) 0.964×1000 (c) 23.6×1000

(d) $0.612 \times 10\,000$ (e) 0.548×300 (f) 0.069×50

13 Find the following products.

(a) 0.6×0.9 (b) 0.009×0.04 (c) 0.006×0.5

(d) 0.47×0.9 (e) 5.2×3.8 (f) 2.305×0.12

14 Calculate the following. (Round answers to the thousandths place.)

(a) $9.6 \div 3$ (b) $10.32 \div 4$ (c) $5.34 \div 6$ (d) $7.028 \div 7$

(e) $21.4 \div 4$ (f) $3.75 \div 8$ (g) $8.201 \div 9$ (h) $14.52 \div 7$

15 Calculate the following. Do not round answers.

(a) $556.9 \div 100$ (b) $33.65 \div 1000$ (c) $12.68 \div 100$

(d) $480.6 \div 2000$ (e) $8.23 \div 500$ (f) $54.63 \div 300$

16 Find the following quotients. (Round your answer to part **(e)** to the thousandths place.)

(a) $0.48 \div 0.04$ (b) $1.2 \div 0.5$ (c) $0.5663 \div 0.0007$

(d) $11.9 \div 0.002$ (e) $0.56 \div 0.3$ (f) $0.352 \div 0.011$

17 Choose the correct answer.

(a) 324.65×6 is closest to:

    A 1800   **B** 1900   **C** 2000   **D** 2100

(b) 0.0517×90 is closest to:

    A 0.4   **B** 2   **C** 4   **D** 40

(c) $823.56 \div 4$ is closest to:

    A 2000   **B** 200   **C** 20   **D** 0.2

(d) $6.34 \div 0.002$ is closest to:

    A 3   **B** 30   **C** 300   **D** 3000

Extension

18 A chemistry experiment requires 0.05 kg of one chemical to be mixed with 0.074 kg of another. Find the total mass of the chemicals needed.

19 Percy has covered 2.53 km of a 52.5 km journey. How far does he have to go?

20 Tim buys 6 cans of soft drink for $0.87 per can. Find the total cost, to the nearest 5 cents.

21 If 1 millilitre of oil has a mass of 0.954 grams, how much mass would 1 litre (1000 millilitres) of oil have?

22 An employer buys each of her 20 staff a uniform. If each uniform costs $75.59, how much do the uniforms cost her in total?

23 Five siblings share a 140.75 gram block of chocolate equally. What mass of chocolate does each receive?

24 Caitlin's most recent times for the 100 m sprint are 11.52 seconds, 11.03 seconds and 11.8 seconds. Find the average of these times.

25 The instructions at the start of an exam paper state there are 12 questions, and the time allowed for the exam is 90 minutes. If a student plans to spend an equal amount of time on each question, how long should be spent on each?

26 A football coach pours 40 cups of a sports drink for his players at an end-of-game victory celebration. If he used 8.75 litres of drink altogether, how much did he place in each cup on average?

27 If 0.8 kg of bacon costs $5.59, find the price per kilogram.

◄◄ REPLAY

1 John rides to and from school every school day. If he lives 5 kilometres from school, how far does he ride each week?

2 Simplify the following.
   (a) $6 + 4 \times 7$ **(b)** $(35 + 21) \div 7$ **(c)** $18 \div 3 + 6 \times 12$

3 Copy and complete by writing $<$ or $>$ in the space.
   (a) -22 ____ 10 **(b)** 100 ____ -25 **(c)** -999 ____ -1001

4 Simplify:

    (a) -2×-17 **(b)** -15×6 **(c)** $-2 \times -3 \times 4$

5 List the first five multiples of the following numbers.

    (a) 10   **(b)** 8   **(c)** 15

6 List all composite numbers between 60 and 80 inclusive.

7 Simplify:

    (a) 4^3 **(b)** $\sqrt[3]{27} + 6^2$ **(c)** $10^2 - 6^2 - 8^2$

8 Copy and complete the following number patterns.

    (a) 28, 21, 14, ____, ____, ____   **(b)** 12, 17, 23, ____, 38 ____, ____

    (c) 2, –4, 8, ____, ____, –64, ____

9 Copy and complete the following tables, using the rules given.

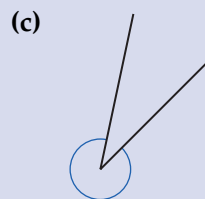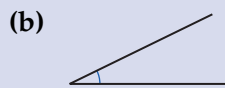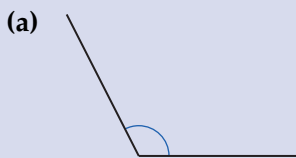   **(a)** $y = 3x$ **(b)** $b = a - 8$ **(c)** $n = 4m + 2$

x	y
0	
9	
–15	
12	
50	

a	b
–17	
0	
4	
100	
–50	

m	n
–5	
200	
35	
3	
–20	

10 Measure the size of each of the following angles.

    (a)   **(b)**   **(c)**

11 Find the complementary angle for each of the following.

    (a) 4°   **(b)** 30°   **(c)** 88°

12 A revolution is divided into 5 equal angles. What is the size of each angle?

e Assignment 6