

TOPIC 7

Percentages

7.1 Overview

Numerous **videos** and **interactivities** are embedded just where you need them, at the point of learning, in your learnON title at www.jacplus.com.au. They will help you to learn the concepts covered in this topic.

7.1.1 Why learn this?

Percentages, like fractions and decimals, provide a way of expressing parts of a whole. They are commonly used in advertising, statistics and shopping. Just check out the sales signs when you go shopping and you will see the % sign.



7.1.2 What do you know?

assess on

- 1. THINK** List what you know about percentages. Use a thinking tool such as a concept map to show your list.
- 2. PAIR** Share what you know with a partner and then with a small group.
- 3. SHARE** As a class, create a thinking tool such as a large concept map that shows your class's knowledge of percentages.

LEARNING SEQUENCE

- 7.1 Overview
- 7.2 Percentages as fractions
- 7.3 Percentages as decimals
- 7.4 Fractions and decimals to percentages
- 7.5 Finding percentages of an amount
- 7.6 One amount as a percentage of another
- 7.7 Common percentages and short cuts
- 7.8 Review

7.2 Percentages as fractions

- The term **per cent** means ‘per hundred’. The symbol for per cent is %. For example, 7% means 7 out of 100.
- Whether a percentage is a whole number, a mixed number, a proper fraction, or a decimal, it can be expressed as a fraction.
- To convert a whole number percentage into a fraction, write it over 100 and simplify.
- To convert a mixed number percentage into a fraction:
 - change the mixed number into an improper fraction
 - multiply the denominator by 100
 - simplify if possible.
- If the percentage is a proper fraction, multiply the denominator by 100 and simplify.
- To convert a percentage containing a decimal number into a fraction:
 - place the decimal number over 100
 - change the numerator to a whole number by multiplying both the numerator and the denominator by a required multiple of 10
 - simplify if possible.



WORKED EXAMPLE 1

Write 47% as a fraction.

THINK

Write the percentage and then change it to a fraction with a denominator of 100.

WRITE

$$47\% = \frac{47}{100}$$

WORKED EXAMPLE 2

Write 20% as a fraction in simplest form.

THINK

- 1 Write the percentage, change it to a fraction with a denominator of 100 and then cancel by dividing numerator and denominator by the same number.
- 2 Write the answer and check that the fraction cannot be simplified further.

WRITE

$$20\% = \frac{20^1}{100^5}$$

$$= \frac{1}{5}$$

WORKED EXAMPLE 3

Write the following percentages as fractions in simplest form.

a $\frac{1}{4}\%$

b $15\frac{1}{3}\%$

THINK

- a** 1 Write the percentage and then multiply the denominator by 100.
2 Simplify.
- b** 1 Write the percentage and then change the mixed number to an improper fraction.
2 Multiply the denominator by 100 and simplify by cancelling. Check to make sure that the fraction cannot be simplified further.

WRITE

$$\begin{aligned} \mathbf{a} \quad \frac{1}{4}\% &= \frac{1}{4 \times 100} \\ &= \frac{1}{400} \end{aligned}$$

$$\begin{aligned} \mathbf{b} \quad 15\frac{1}{3}\% &= \frac{46}{3}\% \\ &= \frac{46}{3 \times 100} \\ &= \frac{46^{23}}{300^{150}} \\ &= \frac{23}{150} \end{aligned}$$

WORKED EXAMPLE 4

Write 36.4% as a fraction in simplest form.

THINK

- 1 Write the percentage and change it to a fraction out of 100.
2 Change the numerator to a whole number by multiplying it by an appropriate multiple of 10, multiply the denominator by the same multiple of 10 and simplify the fraction.
3 Write the answer.

WRITE

$$\begin{aligned} 36.4\% &= \frac{36.4}{100} \\ &= \frac{36.4 \times 10}{100 \times 10} \\ &= \frac{364^{91}}{1000^{250}} \\ &= \frac{91}{250} \end{aligned}$$

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-  Complete this digital doc: SkillsHEET: Simplifying fractions with a denominator of 100
Searchlight ID: doc-6470
-  Complete this digital doc: SkillsHEET: Converting a mixed number into an improper fraction
Searchlight ID: doc-6471
-  Complete this digital doc: SkillsHEET: Changing fractions to equivalent fractions with a denominator of 100
Searchlight ID: doc-6472
-  Complete this digital doc: Spreadsheet: Percentages as fractions
Searchlight ID: doc-1909

Exercise 7.2 Percentages as fractions**assesson**

Individual pathways

PRACTISE

Questions:
1–6, 10, 16

CONSOLIDATE

Questions:
1a–h, 2a–k, 3a–k, 4a–i, 5, 6, 9, 12,
14, 16, 17

MASTER

Questions:
1h–o, 2k–u, 3k–u, 4j–r, 5–17

 Individual pathway interactivity: int-4343

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Fluency

1. **WE1** Write the following percentages as fractions. (Leave the answer as an improper fraction where appropriate.)
- | | | | | |
|--------|---------|---------|---------|---------|
| a. 17% | b. 29% | c. 81% | d. 79% | e. 99% |
| f. 43% | g. 3% | h. 19% | i. 67% | j. 33% |
| k. 9% | l. 189% | m. 243% | n. 127% | o. 353% |
2. **WE2** Write the following percentages as fractions in simplest form. (Change the answer to a mixed number where appropriate.)
- | | | |
|---------|---------|---------|
| a. 50% | b. 80% | c. 25% |
| d. 35% | e. 60% | f. 85% |
| g. 10% | h. 45% | i. 98% |
| j. 12% | k. 5% | l. 56% |
| m. 74% | n. 2% | o. 110% |
| p. 150% | q. 90% | r. 180% |
| s. 200% | t. 500% | u. 112% |
3. **WE3** Write the following percentages as fractions in simplest form. (Leave answers as mixed numbers where appropriate.)
- | | | |
|-----------------------|-----------------------|----------------------|
| a. $\frac{1}{2}\%$ | b. $\frac{1}{5}\%$ | c. $\frac{3}{4}\%$ |
| d. $\frac{2}{3}\%$ | e. $\frac{1}{10}\%$ | f. $\frac{5}{8}\%$ |
| g. $\frac{6}{11}\%$ | h. $8\frac{1}{4}\%$ | i. $3\frac{3}{4}\%$ |
| j. $20\frac{2}{3}\%$ | k. $9\frac{2}{3}\%$ | l. $14\frac{1}{4}\%$ |
| m. $60\frac{1}{4}\%$ | n. $15\frac{1}{2}\%$ | o. $22\frac{1}{2}\%$ |
| p. $11\frac{1}{5}\%$ | q. $10\frac{3}{8}\%$ | r. $11\frac{2}{3}\%$ |
| s. $150\frac{1}{2}\%$ | t. $120\frac{1}{2}\%$ | u. $33\frac{1}{3}\%$ |
4. **WE4** Write the following percentages as fractions in simplest form.
- | | | |
|-----------|-----------|-----------|
| a. 3.5% | b. 7.2% | c. 11.8% |
| d. 19.7% | e. 32.4% | f. 71.5% |
| g. 62.9% | h. 15.5% | i. 8.7% |
| j. 16.2% | k. 28.3% | l. 16.25% |
| m. 41.38% | n. 57.99% | o. 86.32% |
| p. 18.14% | q. 12.15% | r. 0.05% |
5. **MC** a. 40% as a fraction in simplest form is:
- | | | | | |
|------------------|------------------|--------------------|---------------------|-----------------------|
| A. $\frac{1}{4}$ | B. $\frac{2}{5}$ | C. $\frac{4}{100}$ | D. $\frac{4000}{1}$ | E. $\frac{0.4}{1000}$ |
|------------------|------------------|--------------------|---------------------|-----------------------|
- b. $10\frac{1}{2}\%$ as a fraction is:
- | | | | | |
|-------------------|-----------------------|---------------------|---------------------|---------------------|
| A. $\frac{21}{2}$ | B. $\frac{10.5}{100}$ | C. $\frac{2100}{2}$ | D. $\frac{42}{100}$ | E. $\frac{21}{200}$ |
|-------------------|-----------------------|---------------------|---------------------|---------------------|
- c. 1.5% as a fraction in simplest form is:
- | | | | | |
|----------------------|--------------------|--------------------|---------------------|----------------------|
| A. $\frac{1.5}{100}$ | B. $\frac{3}{100}$ | C. $\frac{3}{200}$ | D. $\frac{15}{100}$ | E. $\frac{15}{1000}$ |
|----------------------|--------------------|--------------------|---------------------|----------------------|
- d. 138% as an improper fraction in simplest form is:
- | | | | | |
|--------|----------------------|-----------------------|--------------------|-----------------------|
| A. 138 | B. $\frac{138}{100}$ | C. $\frac{13.8}{100}$ | D. $\frac{69}{50}$ | E. $\frac{138}{1000}$ |
|--------|----------------------|-----------------------|--------------------|-----------------------|

Understanding

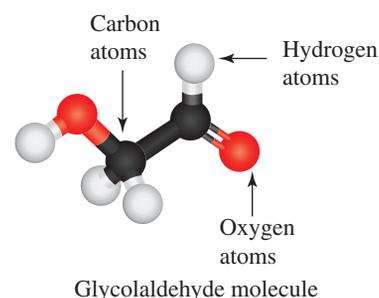
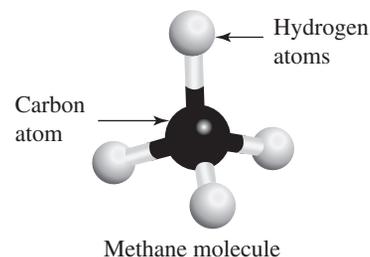
6. Imran saves 20% of his pocket money each week. What fraction does he save?
7. In one game, 35% of a football team is injured. What fraction of the team is injured?

8. Each week Jodie spends 45% of her wages at the supermarket. What fraction of Jodie's wages is spent at the supermarket?
9. What fraction of a class of students are boys if 68% are girls?
10. If the unemployment rate in Australia is 8%:
 - a. what fraction of the population is unemployed?
 - b. what fraction of the population is employed?
 - c. out of 100 people, how many would you expect to be unemployed?
11. Seventeen per cent of visitors to Australia in 2005 were from New Zealand.
 - a. What fraction of visitors to Australia was from New Zealand?
 - b. What fraction of visitors to Australia was not from New Zealand?
 - c. Out of 100 visitors to Australia, how many would you expect to be from New Zealand?
12. Less than 50% of the estimated 200 000 Australian invertebrate species have been described. What fraction is this?
13. What fraction remains if:
 - a. 65% of the winnings have been spent
 - b. 19% of the audience hated the movie
 - c. all stock was discounted by 15%
 - d. 93.5% of the school population supports the uniform policy?



Reasoning

14. a. 80% of the atoms of a molecule of methane (natural gas) are hydrogen atoms. What fraction of the methane molecule is represented by hydrogen atoms?
 - b. The diagram below right represents a molecule of glycolaldehyde, a simple form of sugar, found in the gas surrounding a young star called IRAS 16293-2422, located around 400 light-years away from Earth. 50% of the atoms of this molecule are hydrogen atoms. What fraction of the glycolaldehyde molecule is represented by hydrogen atoms?
 - c. Explain why, although both molecules have the same number of hydrogen atoms, they represent different fractions?
15. Explain why 33.33% is an approximation and not the identical value of $\frac{1}{3}$.



Problem solving

16. 80% of the students in a Year 7 class have pets and 20% have blue eyes.
 - a. What fraction of students has pets?
 - b. What fraction of students has blue eyes?
 - c. Does this mean that none of the students with blue eyes have pets? Explain your answer.

17. Shirley plays basketball in her school's team. In the last game she scored 50 points out of 75 throws but in the previous game she scored 45 points out of 60 throws.
- In what game did she score a higher percentage of points relative to the number of throws?
 - Explain how the percentage is affected by:
 - increasing the number of points when the number of throws stay the same
 - increasing the number of throws when the number of points stay the same
 - increasing both the number of points and the number of throws at the same percentage rate.

Reflection

Percentages are used everywhere in our daily lives. Why is that so?

7.3 Percentages as decimals

- Percentages can be expressed as decimals.
- To convert a percentage to a decimal, divide the percentage by 100 by moving the decimal point two spaces to the left.

WORKED EXAMPLE 5

Write the following percentages as decimals.

a 81%

b 16.8%

THINK

- a 1** Per cent means 'out of 100', so write the percentage as a fraction out of 100.
- 2** To write as a decimal, move the position of the decimal point 2 places to the left and place a zero in the units column.
- b 1** Write the percentage as a fraction out of 100.
- 2** To write as a decimal, move the position of the decimal point 2 places to the left and place a zero in the units column.

WRITE

$$\mathbf{a} \quad 81\% = \frac{81}{100}$$

$$= \overbrace{81} \div 100$$

$$= 0.81$$

$$\mathbf{b} \quad 16.8\% = \frac{16.8}{100}$$

$$= \overbrace{16.8} \div 100$$

$$= 0.168$$

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 Complete this digital doc. Spreadsheet: Percentages as decimals
Searchlight ID: doc-1910

Exercise 7.3 Percentages as decimals

assessment

Individual pathways

PRACTISE

Questions:
1–3, 4, 6, 10, 12

CONSOLIDATE

Questions:
1a–i, 2a–l, 3–6, 10, 12, 13

MASTER

Questions:
1j–r, 2m–x, 3–13

 Individual pathway interactivity: int-4344

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Fluency

1. **WE5a** Write the following percentages as decimals.

- | | | | |
|---------|---------|--------|---------|
| a. 36% | b. 14% | c. 19% | d. 28% |
| e. 73% | f. 92% | g. 66% | h. 59% |
| i. 11% | j. 99% | k. 9% | l. 7% |
| m. 4% | n. 1% | o. 25% | p. 200% |
| q. 150% | r. 360% | | |

2. **WE5b** Write the following percentages as decimals.

- | | | | |
|-----------|-----------|-----------|-----------|
| a. 12.3% | b. 31.6% | c. 59.2% | d. 84.9% |
| e. 37.6% | f. 42.1% | g. 21.9% | h. 16.9% |
| i. 10.7% | j. 11.1% | k. 3.1% | l. 4.6% |
| m. 9.2% | n. 5.9% | o. 6.8% | p. 8.8% |
| q. 14.25% | r. 31.75% | s. 23.55% | t. 45.75% |
| u. 0.05% | v. 1.02% | w. 4.01% | x. 0.02% |

3. **MC** a. 41% as a decimal is:

- A.** 41 **B.** 0.41 **C.** 4.100 **D.** 4.1 **E.** 0.041

b. 8% as a decimal is:

- A.** 8 **B.** 0.008 **C.** 0.08 **D.** 0.8 **E.** 800

c. 43.64% as a decimal is:

- A.** 0.4364 **B.** 4.364 **C.** 43.6400 **D.** 436.4 **E.** 4364.0

d. 110% as a decimal is:

- A.** $\frac{110}{100}$ **B.** 1100 **C.** 0.11 **D.** 1.10 **E.** 11.0

Understanding

4. Car prices have dropped by 17% over the past 8 years. What is this percentage as a:
a. fraction b. decimal?
5. The maximum legal blood alcohol concentration (BAC) for drivers in Victoria is 0.05%. What is the BAC as a:
a. fraction b. decimal?
6. In 2013, the number of visitors to Australia during February was 2.85% lower than in January. Write this percentage as a decimal.
7. Over the past decade, insurance premiums have risen by 218%. Write this percentage as a decimal.
8. In the 3 months following a drought, the price of vegetables fell by 13.8%. Write this percentage as a decimal.
9. Government funding to state schools rose by 8.35%. Write this percentage as a decimal.



Reasoning

10. a. Round the following percentages to the nearest whole number: 23.2%, 23.5%, 23.8%, 23.9%.
b. Round the following decimal numbers to two decimal places: 0.232, 0.235, 0.238, 0.239.
c. The percentages in part a are the same as the decimal numbers in part b. Does it matter whether you round up or down the percentages or the decimal values?
11. Consider the following percentages: 23.6%, 23.6%, 23.66%.
a. Which one of the three percentages is largest?
b. Convert these percentages to decimals. State your answer to four decimal places.

Problem solving

12. Consider the following percentages: 37.8%, 39.6%, 30.9%, 34.5%, 32.8%.
- Convert these numbers to decimals.
 - Arrange the percentages in order from highest to lowest.
 - Arrange the decimal numbers in order from highest to lowest.
 - Was it easier to arrange the numbers in the order required using decimals or percentages? Explain your answer.
13. Consider the following percentages: 7.291%, 72.91%, 729.1%.
- Convert these percentages to decimal numbers.
 - What effect does the conversion have on the numbers?

Reflection

When is it more convenient to express a percentage as a decimal, rather than as a fraction?

7.4 Fractions and decimals to percentages

7.4.1 Changing fractions to percentages

- To change a fraction to a percentage, multiply by $\frac{100}{1}$.
- Simplify if possible.
- Add the percentage (%) sign.

WORKED EXAMPLE 6

Change each of the following fractions to a percentage, giving the answer as a mixed number where appropriate.

a $\frac{1}{10}$

b $\frac{5}{8}$

c $\frac{1}{7}$

THINK

- a 1 Write the fraction.
- 2 Multiply by $\frac{100}{1}$ and include the % sign.
- 3 Cancel or simplify as appropriate.
- 4 Multiply the numerators and then multiply the denominators.
- 5 Simplify.
- b 1 Write the fraction.
- 2 Multiply by $\frac{100}{1}$ and include the % sign.
- 3 Cancel or simplify as appropriate.
- 4 Multiply the numerators and then multiply the denominators.
- 5 Simplify by writing as a mixed number.

WRITE

a $\frac{1}{10} = \frac{1}{10^1} \times \frac{100^{10}}{1} \%$

$$= \frac{10}{1} \%$$

$$= 10 \%$$

b $\frac{5}{8} = \frac{5}{8^2} \times \frac{100^{25}}{1} \%$

$$= \frac{125}{2} \%$$

$$= 62 \frac{1}{2} \%$$

c 1 Write the fraction.

$$c \frac{1}{7}$$

2 Multiply by $\frac{100}{1}$ and include the % sign.

$$= \frac{1}{7} \times \frac{100}{1} \%$$

3 Multiply the numerators and then multiply the denominators.

$$= \frac{100}{7} \%$$

4 Divide the numerator by the denominator.

$$\begin{array}{r} 14 \text{ rem } 2 \\ 7 \overline{)1030} \end{array}$$

5 Simplify by writing as a mixed number.

$$= 14\frac{2}{7} \%$$

WORKED EXAMPLE 7

A survey showed that 3 out of 15 locals rated the Australian Grand Prix in Albert Park as their favourite spectator sport. What percentage is this?

THINK

1 Write the information as a fraction by making the numerator the number of people who rated the Grand Prix as their favourite spectator sport and the denominator the total number of people.

WRITE

$$\frac{3}{15} = \frac{3}{15^3} \times \frac{100^{20}}{1} \%$$

2 Change to a percentage by multiplying by $\frac{100}{1}$ and including the % sign.

3 Cancel or simplify as appropriate.

$$= \frac{3^1}{3^1} \times \frac{20}{1} \%$$

4 Multiply the numerators and then multiply the denominators.

$$= \frac{20}{1} \%$$

5 Simplify.

$$= 20 \%$$

6 Answer the question by writing a sentence.

20% of the locals surveyed rated the Australian Grand Prix in Albert Park as their favourite spectator sport.

7.4.2 Changing decimals to percentages

- To change a decimal to a percentage, multiply the decimal by 100 by moving the decimal point two spaces to the right, and add a % sign.

WORKED EXAMPLE 8

Change each of the following decimals to percentages.

a 0.38

b 0.275

c 4.2

THINK

a 1 Write the decimal, multiply it by 100 (that is, move the decimal point two places to the right) and include the % sign.

WRITE

$$a \overbrace{0.38}^{\times 100} = 0.38 \times 100 \%$$

2 Write the answer.

$$= 38 \%$$

b 1 Write the decimal, multiply it by 100 (that is, move the decimal point two places to the right) and include the % sign.

2 Write the answer.

c 1 Write the decimal, multiply it by 100, fill the blanks with zeros and include the % sign.

2 Write the answer.

$$\mathbf{b} \quad 0.275 = 0.275 \times 100\%$$

$$= 27.5\%$$

$$\mathbf{c} \quad 4.2 = 4.2 \times 100\%$$

$$= 420\%$$

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 **Try out this interactivity:** Converting percentages, decimals, fractions and ratios
Searchlight ID: int-2740

 **Complete this digital doc:** SkillSHEET: Multiplying fractions by 100
Searchlight ID: doc-6473

 **Complete this digital doc:** SkillSHEET: Multiplying decimals by 100
Searchlight ID: doc-6474

 **Watch this eLesson:** Converting percentages
Searchlight ID: eles-0005

 **Complete this digital doc:** Spreadsheet: Fractions/decimals to percentages
Searchlight ID: doc-1911

Exercise 7.4 Fractions and decimals to percentages

assess on

Individual pathways

PRACTISE

Questions:
1–8, 10, 14, 19, 24

CONSOLIDATE

Questions:
1–4, 5a–i, 6a–i, 7–11, 15, 19, 22, 24

MASTER

Questions:
1p–x, 2h–l, 3i–o, 5l–r, 6l–r, 7–25

 Individual pathway interactivity: int-4345

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Fluency

1. WE6a Change each of the following fractions to a percentage.

a. $\frac{21}{100}$

b. $\frac{48}{100}$

c. $\frac{9}{100}$

d. $\frac{93}{100}$

e. $\frac{14}{50}$

f. $\frac{36}{50}$

g. $\frac{8}{50}$

h. $\frac{40}{50}$

i. $\frac{3}{25}$

j. $\frac{15}{25}$

k. $\frac{10}{25}$

l. $\frac{6}{25}$

m. $\frac{2}{20}$

n. $\frac{7}{20}$

o. $\frac{1}{20}$

p. $\frac{2}{10}$

q. $\frac{8}{10}$

r. $\frac{1}{5}$

s. $\frac{2}{5}$

t. $\frac{4}{5}$

u. $\frac{7}{10}$

v. $\frac{13}{20}$

w. $\frac{3}{10}$

x. $\frac{3}{5}$

2. WE6b Change each of the following fractions to a percentage.

a. $\frac{1}{2}$

b. $\frac{1}{4}$

c. $\frac{3}{5}$

d. $\frac{3}{12}$

e. $\frac{20}{50}$

f. $\frac{10}{50}$

g. $\frac{45}{90}$

h. $\frac{15}{30}$

i. $\frac{3}{4}$

j. $\frac{12}{15}$

k. $\frac{15}{150}$

l. $\frac{4}{20}$

3. **WE6c** Change each of the following fractions to percentages, giving the answer as a mixed number in simplest form (if appropriate).

- | | | | | | |
|------------------|-------------------|--------------------|-------------------|-------------------|--------------------|
| a. $\frac{1}{3}$ | b. $\frac{1}{6}$ | c. $\frac{2}{9}$ | d. $\frac{8}{18}$ | e. $\frac{3}{11}$ | f. $\frac{7}{15}$ |
| g. $\frac{5}{9}$ | h. $\frac{9}{16}$ | i. $\frac{11}{12}$ | j. $\frac{7}{8}$ | k. $\frac{1}{13}$ | l. $\frac{10}{17}$ |
| m. $\frac{1}{7}$ | n. $\frac{5}{6}$ | o. $\frac{2}{3}$ | | | |

4. **WE7 MC** a. To change a fraction to a percentage:

- | | |
|--------------------------------|--------------------------------|
| A. divide by 100 | B. multiply by $\frac{1}{100}$ |
| C. divide by $\frac{1}{100}$ | D. multiply by 100 |
| E. write a percentage sign (%) | |

b. Before multiplying, $\frac{3}{10} \times \frac{100}{1}$ would cancel to:

- | | | | | |
|---------------------|--------------------------------------|---------------------|---------------------------------------|--|
| A. $\frac{300}{10}$ | B. $\frac{3}{1} \times \frac{10}{1}$ | C. $\frac{3}{1000}$ | D. $\frac{3}{10} \times \frac{10}{1}$ | E. $\frac{3}{10} \times \frac{1}{100}$ |
|---------------------|--------------------------------------|---------------------|---------------------------------------|--|

c. The fraction $\frac{7}{50}$ as a percentage is:

- | | | | | |
|--------|-------|-------------------|---------|--------|
| A. 14% | B. 7% | C. $3\frac{1}{2}$ | D. 700% | E. 70% |
|--------|-------|-------------------|---------|--------|

d. The fraction $\frac{4}{9}$ as a percentage is:

- | | | | | |
|---------------------|--------|----------------------|-------|----------------------|
| A. $2\frac{1}{4}\%$ | B. 40% | C. $54\frac{5}{9}\%$ | D. 4% | E. $44\frac{4}{9}\%$ |
|---------------------|--------|----------------------|-------|----------------------|

5. **WE8a** Change each of the following decimals to percentages.

- | | | | | | |
|---------|---------|---------|----------|----------|----------|
| a. 0.45 | b. 0.32 | c. 0.56 | d. 0.68 | e. 0.90 | f. 0.84 |
| g. 0.12 | h. 0.08 | i. 0.02 | j. 0.10 | k. 0.99 | l. 0.05 |
| m. 0.29 | n. 0.09 | o. 0.19 | p. 0.105 | q. 0.001 | r. 0.067 |

6. **WE8b, c** Write the following decimals as percentages.

- | | | | | | |
|----------|------------|---------|---------|----------|----------|
| a. 0.3 | b. 0.8 | c. 0.9 | d. 0.1 | e. 0.002 | f. 0.007 |
| g. 0.005 | h. 0.009 | i. 1.32 | j. 1.50 | k. 8.65 | l. 2.05 |
| m. 4.50 | n. 0.00015 | o. 2.00 | p. 10 | q. 5 | r. 100 |

7. **MC** a. 0.14 is the same as:

- | | | | | |
|---------|---------|------------|--------|----------|
| A. 1.4% | B. 140% | C. 0.0014% | D. 14% | E. 0.145 |
|---------|---------|------------|--------|----------|

b. When multiplying a decimal by 100, move the position of the decimal point:

- | | | |
|---------------------|--------------------|-------------------|
| A. two places right | B. two places left | C. one place left |
| D. one place right | E. not at all | |

c. 0.73 as a percentage is:

- | | | | | |
|---------|---------|-----------|----------|--------|
| A. 7.3% | B. 730% | C. 0.073% | D. 0.73% | E. 73% |
|---------|---------|-----------|----------|--------|

d. 6.1 as a percentage is:

- | | | | | |
|---------|--------|---------|----------|-----------|
| A. 6.1% | B. 61% | C. 610% | D. 0.61% | E. 0.061% |
|---------|--------|---------|----------|-----------|

Understanding

8. Put the following in order from smallest to largest by converting the fractions to percentages first.

$$15\%, \frac{1}{4}, \frac{125}{1000}, \frac{85}{100}, \frac{3}{4}\%, \frac{1}{2}, \frac{94}{100}$$

9. One-fifth of the people in the snowfields preferred snowboarding to skiing. What percentage preferred snowboarding?

10. Eight twenty-fifths of people participate in sport or physical activity. What percentage is this?



11. Three-fortieths of the Australian population attended at least one cricket match last year. What percentage attended a cricket match?
12. Twenty-nine out of every 50 kilograms of waste at the tip is household waste. What percentage is household waste?
13. Three out of 10 people surveyed preferred water to soft drink. What percentage preferred water?
14. Sixty students in Year 8 have seen all of the Harry Potter films. If there are 150 students in Year 8, what percentage of them have seen all of the Harry Potter films?
15. Eight out of 22 houses in one street get the newspaper delivered. What percentage get the newspaper delivered?
16. In 2010, 23 out of every 44 Year 12 students were female. What percentage were female?



17. In Australia, 0.7 of all students attend government schools. What percentage of students attend government schools?
18. Sabrina is a secondary-school teacher. She works 0.4 of the week. What percentage of the week does Sabrina work?
19. Sales of notebooks have increased by 0.43 over the past 3 years. By what percentage have notebook sales increased?
20. The last census showed that 0.031 of the Australian population does not speak any English. What percentage does not speak any English?
21. A teacher recorded her class test results as decimals (decimal amount = mark student achieved \div total possible mark). The table below shows some of the class marks. Copy the table and convert each mark to a percentage.

Student name	Directed number test	
	Mark	Percentage
Mandy Adams	0.86	
Sandra Bazumik	0.72	
Malcolm Boncev	0.64	
James Callan	0.91	
Kate D'Arpa	0.79	
Louise Edmonds	0.92	
Chris Edwards	0.95	
Thomas Evancik	0.10	
Jessie Farmer	0.88	
Mia Yazzett	0.46	

Reasoning

22. a. Place the following percentages, decimals and fractions on a number line from lowest to highest.

$$25\%, \frac{3}{4}, 0.39, 78.2\%, \frac{7}{10}$$

b. Give reasons for the placement of each number.

23. a. Convert the following fractions to:

i. decimals

ii. percentages.

$$\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}$$

b. Add up the following numbers:

i. $\frac{1}{2}, \frac{1}{3}, \frac{1}{6}$

ii. 50%, 33.33̄, 16.6̄

c. Have you noticed anything about the values in part b i and ii?

d. Find three other fractions that add up to 1 and check that their percentages add up to 100%.

Problem solving

24. Shirley works for a publishing company for $\frac{2}{5}$ of the week and teaches Mathematics in a school for 0.4 of the week.

a. For what percentage of the week does Shirley work

i. as a publisher

ii. as a teacher?

b. Considering the two jobs, does Shirley work full time? Explain.

c. Shirley would like to volunteer some of her time at the local charity shop for one day during the week.

d. Does she have the time to help at the charity shop?

25. You have a discount voucher for $\frac{1}{3}$ off the price of electrical items at a particular shop. As you walk into the shop, you notice the following sign displayed.



The fine print at the bottom of the sign means that you cannot use your discount voucher to receive a further $\frac{1}{3}$ off the sale price. Will it be cheaper to buy your electrical item today or after the sale using your discount voucher? Explain your answer.

Reflection

Think of a situation related to your school life where it would be convenient to express fractions as percentages.

7.5 Finding percentages of an amount

7.5.1 Finding percentages of an amount using fractions

- To find a percentage of an amount using fractions, follow these steps.
 - Step 1:** Convert the percentage into a fraction.
 - Step 2:** Multiply by the amount.
- A percentage of something means a part of it; therefore, the percentage of an amount will be measured in the same units as the amount itself. For example, the percentage of an amount of dollars will be a certain number of dollars; the percentage of an amount of kilograms will be a certain number of kilograms.

WORKED EXAMPLE 9

Find 40% of 135.

THINK

- 1 Write the question.
- 2 Write the percentage as a fraction with a denominator of 100, change *of* to \times and write the amount as a fraction over 1.
- 3 Cancel and simplify as appropriate.
- 4 Multiply the numerators and then multiply the denominators.
- 5 Simplify by dividing the numerator by the denominator.

WRITE

$$\begin{aligned} & 40\% \text{ of } \$135 \\ &= \frac{40}{100} \times \frac{135}{1} \\ &= \frac{40^2}{20^1} \times \frac{27}{1} \\ &= \frac{54}{1} \\ &= \$54 \end{aligned}$$

WORKED EXAMPLE 10

Find 26% of 75 and write the answer as a mixed number.

THINK

- 1 Write the question.
- 2 Write the percentage as a fraction, change *of* to \times and write the number as a fraction over 1.
- 3 Cancel and simplify as appropriate.
- 4 Multiply the numerators and then multiply the denominators.
- 5 Write the answer as a mixed number by dividing the denominator into the numerator.

WRITE

$$\begin{aligned} & 26\% \text{ of } 75 \\ &= \frac{26}{100} \times \frac{75}{1} \\ &= \frac{26^{13}}{4^2} \times \frac{3}{1} \\ &= \frac{39}{2} \\ &= 19\frac{1}{2} \end{aligned}$$

WORKED EXAMPLE 11

Of the 250 students selected at random to complete a survey, 18% were in Year 11. How many students were in Year 11?

THINK

- 1 Decide what percentage of the total is required and write an expression to find the percentage of the total.
- 2 Write the percentage as a fraction, change *of* to \times and write the total as a fraction.
- 3 Cancel and simplify as appropriate.
- 4 Multiply the numerators and then multiply the denominators.
- 5 Simplify by dividing the numerator by the denominator.
- 6 Answer the question by writing a sentence.

WRITE

18% of 250

$$= \frac{18}{100} \times \frac{250}{1}$$

$$= \frac{18^9}{2^1} \times \frac{5}{1}$$

$$= \frac{45}{1}$$

$$= 45$$

45 of the 250 students were in Year 11.

7.5.2 Finding percentages of an amount using decimals

- To find the percentage of an amount using decimals, convert the percentage to a decimal and multiply by the amount.
- *Remember:* When you are multiplying decimal numbers, the total number of decimal places in the question gives the number of decimal places in the answer.

WORKED EXAMPLE 12**Evaluate each of the following by converting the percentage to a decimal.****a** 20% of 50**b** 34% of 15**c** 4.3% of 12**THINK**

- a** 1 Write the question.
- 2 Write the percentage as a number out of 100 and change *of* to \times .
- 3 Write the fraction as a decimal.
- 4 Multiply the numbers, inserting the decimal point in the answer.
Note: There are 2 decimal places in 0.20, so there will be 2 decimal places in the answer.

- b** 1 Write the question.
- 2 Write the percentage as a number out of 100 and change *of* to \times .
- 3 Write the fraction as a decimal.
- 4 Multiply the numbers, ignoring the decimal point.

WRITE**a** 20% of 50

$$= \frac{20}{100} \times 50$$

$$= 0.20 \times 50$$

$$= 10.00$$

$$= 10$$

b 34% of 15

$$= \frac{34}{100} \times 15$$

$$= 0.34 \times 15$$

$$= 5.10$$

$$\begin{array}{r} ^1 15 \\ \times 34 \\ \hline 60 \\ 450 \\ \hline 510 \end{array}$$

$$= 5.10$$

$$= 5.10$$

5 Write the answer with the decimal point in the correct position.

Note: There are 2 decimal places in 0.34, so there will be 2 decimal places in the answer.

c 1 Write the question.

2 Write the percentage as a number out of 100 and change *of* to \times .

3 Write the fraction as a decimal.

4 Multiply the numbers, ignoring the decimal point.

$$34\% \text{ of } 15 = 5.1$$

c 4.3% of 12

$$= \frac{4.3}{100} \times 12$$

$$= 0.043 \times 12$$

$$\begin{array}{r} 12 \\ \times 43 \\ \hline 36 \\ 408 \\ \hline 516 \end{array}$$

5 Write the answer with the decimal point in the correct position.

Note: There are 3 decimal places in 0.516, so there will be 3 decimal places in the answer.

$$4.3\% \text{ of } 12 = 0.516$$

WORKED EXAMPLE 13

Only 2.3% of Zambians have a television set. In a class of 32 Zambian Year 8 students, how many would be expected to have a television set? Write the answer to the nearest whole number.

THINK

1 Write the question.

2 Write the percentage as a number out of 100 and change *of* to \times .

3 Write the fraction as a decimal.

4 Multiply the numbers, ignoring the decimal point.

5 Write the answer with the decimal point in the correct position.

6 Round to the nearest whole number because we are referring to whole students.

7 Write the answer as a sentence.

WRITE

2.3% of 32

$$= \frac{2.3}{100} \times 32$$

$$= 0.023 \times 32$$

$$\begin{array}{r} 32 \\ \times 23 \\ \hline 96 \\ 640 \\ \hline 736 \end{array}$$

$$2.3\% \text{ of } 32 = 0.736$$

$$\approx 1$$

One student in a class of 32 would be expected to have a television set.

-  **Complete this digital doc:** SkillSHEET: Multiplying fractions by a whole number
Searchlight ID: doc-6475
-  **Complete this digital doc:** SkillSHEET: Rounding to the nearest whole number
Searchlight ID: doc-6476
-  **Complete this digital doc:** SkillSHEET: Rounding money to the nearest 5 cents
Searchlight ID: doc-6477
-  **Try out this interactivity:** Percentages
Searchlight ID: int-0004
-  **Complete this digital doc:** Spreadsheet: Calculating percentages
Searchlight ID: doc-1912
-  **Complete this digital doc:** WorkSHEET 7.1
Searchlight ID: doc-6490

Exercise 7.5 Finding percentages of an amount

assesson

Individual pathways

■ PRACTISE

Questions:
1–11, 13, 18, 24

■ CONSOLIDATE

Questions:
1a–e, 2a–k, 3a–j, 4, 5, 6, 7, 8a–j,
9–13, 16, 22, 24, 25

■ MASTER

Questions:
1f–j, 2l–u, 3i–o, 4, 5, 6k–r, 7i–o,
8i–o, 9–25

■ ■ ■ Individual pathway interactivity: int-4346

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Fluency

1. Copy each of the following problems and then find the answers by completing the working.

a. 90% of 200 = $\frac{90}{100} \times \frac{200}{1} =$

b. 8% of 50 = $\frac{8}{100} \times \frac{50}{1} =$

c. 50% of 120 = $\frac{50}{100} \times \frac{120}{1} =$

d. 20% of 90 = $\frac{20}{100} \times \frac{90}{1} =$

e. 30% of 150 = $\frac{30}{100} \times \frac{150}{1} =$

f. 75% of 16 = $\frac{75}{100} \times \frac{16}{1} =$

g. 5% of 30 = $\frac{5}{100} \times \frac{30}{1} =$

h. 80% of 55 = $\frac{80}{100} \times \frac{55}{1} =$

i. 15% of 70 = $\frac{15}{100} \times \frac{70}{1} =$

j. 65% of 120 = $\frac{65}{100} \times \frac{120}{1} =$

2. **WE9** Find the following.

a. 50% of 20

b. 20% of 80

c. 5% of 60

d. 10% of 30

e. 9% of 200

f. 31% of 300

g. 40% of 15

h. 12% of 50

i. 35% of 80

j. 70% of 110

k. 52% of 75

l. 90% of 70

m. 80% of 5000

n. 44% of 150

o. 68% of 25

p. 24% of 175

q. 38% of 250

r. 95% of 200

s. 110% of 50

t. 150% of 8

u. 125% of 20

3. **WE10** Find the following and write the answer as a mixed number.

a. 18% of 20

b. 16% of 30

c. 11% of 70

d. 8% of 120

e. 74% of 25

f. 66% of 20

g. 2% of 95

h. 55% of 45

i. 15% of 74

j. 32% of 220

k. 95% of 62

l. 32% of 65

m. 18% of 80

n. 82% of 120

o. 27% of 60

4. **MC** a. 45% written as a fraction is:

- A. $\frac{45}{100}$ B. $\frac{45}{1}$ C. $\frac{450}{1}$ D. $\frac{1}{45}$ E. $\frac{90}{45}$

b. When finding 17% of 22, the 'of' will be changed to:

- A. \div B. of C. + D. \times E. -

c. Which of the following would find 15% of 33?

- A. 15 of 33 B. $\frac{15}{1} \times 33$ C. $\frac{15}{100} \times \frac{33}{100}$ D. $\frac{15}{1} \times \frac{33}{100}$ E. $\frac{15}{100} \times \frac{33}{1}$

d. 60% of 30 is:

- A. $19\frac{4}{5}$ B. $\frac{31}{5}$ C. 186 D. 19 E. 18

5. **WE11** Of the 300 Year 7 students selected to complete a questionnaire on ice-cream, 70% said that their favourite flavour was chocolate chip. How many favoured chocolate chip ice-cream?

6. **WE12a, b** Evaluate each of the following by converting the percentage to a decimal.

- a. 10% of 40 b. 20% of 90 c. 5% of 80 d. 10% of 50
e. 20% of 35 f. 50% of 82 g. 50% of 74 h. 5% of 100
i. 80% of 180 j. 90% of 45 k. 90% of 56 l. 60% of 620
m. 30% of 15 n. 80% of 318 o. 110% of 20 p. 70% of 5
q. 40% of 590 r. 4% of 312

7. Find the following by converting the percentage to a decimal.

- a. 24% of 30 b. 12% of 14.5 c. 33% of 71.3 d. 18% of 12.2
e. 67% of 18.1 f. 28% of 39.6 g. 19% of 61.7 h. 42% of 42.3
i. 8% of 13.4 j. 63% of 105.6 k. 17% of 192.4 l. 33% of 982.3
m. 53% of 507.1 n. 75% of 146.85 o. $12\frac{1}{2}\%$ of 9.95

8. **WE12c** Evaluate each of the following by converting the percentage to a decimal.

- a. 3.2% of 14.5 b. 12.8% of 22 c. 9.4% of 56 d. 23.1% of 97
e. 1.7% of 160 f. 19.8% of 88 g. 14.1% of 27.5 h. 17.3% of 176.9
i. 4.6% of 257.25 j. 57.2% of 500 k. 98.3% of 4500 l. 33.3% of 2800
m. 84.1% of 45.50 n. 68.5% of 19.95 o. 24.5% of 360

9. **MC** a. 7% of 20 equals:

- A. 35 B. 1.4 C. 3.5 D. 14 E. 2.86

b. 4.2% of 160 equals:

- A. 67.2 B. 67 200 C. 672 D. 0.672 E. 6.72

c. 63.5% of 12 equals:

- A. 76.20 B. 1.905 C. 7.660 D. 7.620 E. 19.05

d. 13% of 51.4 equals:

- A. 2.056 B. 66.82 C. 6.682 D. 20.56 E. 668.2

10. **WE13** A thunder day at a given location is a calendar day on which thunder is heard at least once. About 20% of days near Darwin are thunder days. How many days in one year are thunder days?

Understanding

11. Two per cent of Australians play lawn bowls. In a group of 50 people, how many would you expect to play lawn bowls?



12. Two thousand people entered a marathon. Some walked and the rest jogged. If 20% walked:

- a. what percentage jogged?
- b. how many people jogged?

13. William earns \$570 per week. He has just received a pay rise of 3%.

- a. How much more will William earn per week?
- b. How much in total does William earn after his pay rise?

14. The Tattsлото jackpot for Saturday night is \$20 million. If you win 8% of the jackpot, how much money will you win?

15. The Australian cricket team was fined 15% of their match payments for a slow over rate. If the team was paid \$80 000 for the match, how much was the team fined?

16. Australia has 315 species of mammals. Of these, 15% are threatened. How many threatened species of mammals does Australia have? (Round your answer to the nearest whole number.)

17. Two million people attended at least one game of Australian Rules Football last year. Of these people, 30% attended 10 games or more. How many people attended 10 or more games of Australian Rules Football?

18. The water content of a particular brand of shampoo is 35%. After performing a calculation Peter claims that an 800 mL bottle of this particular shampoo contains 28 mL of water.

- a. Why is Peter's calculation incorrect?
- b. How much of the shampoo in the 800 mL bottle is actually water?

19. In Perth, 36% of adults use a telephone to pay bills and 2% use the internet. If 50 adults need to pay bills, how many will use the:

- a. telephone
- b. internet?

20. In Weburbia, 24% of all households have access to the internet. If there are 34 houses in Website Street, how many would you expect to have access to the internet? Write the answer to the nearest whole number.

21. Terry runs a factory that makes parts for trucks. He has increased his staff by 12%. If Terry had 34 workers, how many workers does he have in the factory after the increase? Write the answer to the nearest whole number.

22. In the year 2010, 60% of households in Geelong had a smoke alarm; 94% of these worked. A street in Geelong has 20 houses

- a. How many houses would you expect to have a smoke alarm?
- b. How many would have a smoke alarm that works? Write the answer to the nearest whole number.

Reasoning

23. During pregnancy or childbirth 6.25% of African women die. Of 30 African women who are pregnant, how many are likely to die during pregnancy or childbirth? Because the answer is people, write it to the nearest whole number. Justify your answer.



24. For radioactive substances a half-life is the time it takes for half of the radioactive atoms in the substance to decay (lose their radioactivity).
400 g of a radioactive substance decays by 50% every 20 days:
- Calculate the quantity of radioactive substance left after 20 days, 40 days, 60 days, 80 days and 100 days.
 - What percentage of the initial quantity is left after 20 days, 40 days, 60 days, 80 days and 100 days?
 - The quantity of the radioactive substance halves every 20 days. Why is the percentage decrease smaller after every 20 days?

Problem solving

25. *Squeezy fruit drink* is 36% pure orange juice and 64% water. If 1 litre of *Squeezy fruit drink* is mixed with 600 mL of water, what is the concentration of juice in the new mixture?
26. The students in Year 7A were voting for a class captain. There were only two candidates. When the votes were counted, Rachel received 84% of the votes and Susi received 28% of the votes. It was discovered that some students had voted twice. If the class consisted of 25 students, how many of them voted twice?

Reflection

When would it be easier to find a percentage of an amount using fractions, and when using decimals?

CHALLENGE 7.1

A department store stocked a selection of denim jeans. At the start of December, the store had 320 of these jeans. During December, it sold 50% of the jeans. In January, it sold 25% of the remaining denim jeans. How many were left at the end of January?

7.6 One amount as a percentage of another

- To express one amount as a percentage of another, write the amounts as a fraction and change to a percentage. (*Remember:* To change a fraction into a percentage, multiply by 100 and add the % sign.)
- When expressing one amount as a percentage of another, make sure that both amounts are in the same units.

WORKED EXAMPLE 14

Express:

a 15 as a percentage of 20

b 9 as a percentage of 33 (write the answer as a mixed number).

THINK

- Write the amount as a fraction of the total: $\frac{\text{amount}}{\text{total}}$.
- Multiply by $\frac{100}{1}$, include the % sign and cancel.
- Multiply the numerators and then multiply the denominators.
- Simplify.

WRITE

$$\begin{aligned} \text{a } & \frac{15}{20} \\ & = \frac{15}{20} \times \frac{100^5}{1} \% \\ & = \frac{75}{1} \% \\ & = 75\% \end{aligned}$$

- b 5** Write the amount as a fraction of the total: $\frac{\text{amount}}{\text{total}}$.
- 6** Multiply by $\frac{100}{1}$, include the % sign and cancel.
- 7** Multiply the numerators and then multiply the denominators.
- 8** Write as a mixed number by dividing the denominator into the numerator.

$$\begin{aligned} \mathbf{b} \quad & \frac{9}{33} \\ &= \frac{9^3}{33^{11}} \times \frac{100}{1} \% \\ &= \frac{300}{11} \% \\ &= 27 \frac{3}{11} \% \end{aligned}$$

WORKED EXAMPLE 15

Express the number 8 as a percentage of 26. Round the answer to the nearest whole number.

THINK

- 1** Write the amount as a fraction of the total: $\frac{\text{amount}}{\text{total}}$.
- 2** Multiply by $\frac{100}{1}$, include the % sign and cancel.
- 3** Multiply the numerators and then multiply the denominators.
- 4** Write as a mixed number by dividing the denominator into the numerator.
- 5** Round to the nearest whole number.

WRITE

$$\begin{aligned} & \frac{8}{26} \\ &= \frac{8^4}{26^{13}} \times \frac{100}{1} \% \\ &= \frac{400}{13} \% \\ &= 30 \frac{10}{13} \% \\ &\approx 31\% \end{aligned}$$

WORKED EXAMPLE 16

Write 45c as a percentage of \$2.

THINK

- 1** Write the larger amount using the smaller unit.
- 2** Write the first amount as a fraction of the second amount: $\frac{\text{amount}}{\text{total}}$.
- 3** Multiply by $\frac{100}{1}$, include the % sign and cancel.
- 4** Multiply the numerators and then multiply the denominators.
- 5** Write as a mixed number by dividing the denominator into the numerator.

WRITE

$$\begin{aligned} \$2 &= 200 \text{ cents} \\ & \frac{45}{200} \\ &= \frac{45}{200^2} \times \frac{100^1}{1} \% \\ &= \frac{45}{2} \% \\ &= 22 \frac{1}{2} \% \end{aligned}$$

This means that 45c is $22 \frac{1}{2} \%$ of \$2.

WORKED EXAMPLE 17

Kye obtained 17 out of 30 on his Science test. What percentage did he score? (Round your answer to the nearest whole number.)

THINK

- 1 Write the amount as a fraction of the total: $\frac{\text{amount}}{\text{total}}$.
- 2 Multiply by $\frac{100}{1}$ include the % sign and cancel.
- 3 Multiply the numerators and then multiply the denominators.
- 4 Write as a mixed number by dividing the denominator into the numerator.
- 5 Round to the nearest whole number. (If the fraction is a half or more, add one to the number.)
- 6 Write the answer as a sentence.

WRITE

$$\begin{aligned} & \frac{17}{30} \\ &= \frac{17}{30} \times \frac{100^{10}}{1} \% \\ &= \frac{170}{3} \% \\ &= 56\frac{2}{3} \% \\ &\approx 57\% \end{aligned}$$

Kye obtained 57% for his Science test.

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Complete this digital doc: Spreadsheet: One amount as a percentage of another
Searchlight ID: doc-1913

Exercise 7.6 One amount as a percentage of another
assessment
Individual pathways
PRACTISE

Questions:
1–8, 10, 14, 19

CONSOLIDATE

Questions:
1a–h, 2a–e, 3a–e, 4a–e, 5–10, 13,
16, 17, 19, 20

MASTER

Questions:
1b, h, p, 2b, f, j, 3b, f, j, 4, 5d–f,
6–20

Individual pathway interactivity: int-4347

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Fluency

1. **WE14a** Express:
 - a. 2 as a percentage of 10
 - b. 13 as a percentage of 52
 - c. 6 as a percentage of 12
 - d. 8 as a percentage of 80
 - e. 8 as a percentage of 20
 - f. 35 as a percentage of 700
 - g. 15 as a percentage of 60
 - h. 120 as a percentage of 150
 - i. 9 as a percentage of 15
 - j. 8 as a percentage of 25
 - k. 12 as a percentage of 30
 - l. 30 as a percentage of 150
 - m. 40 as a percentage of 200
 - n. 10 as a percentage of 200
 - o. 9 as a percentage of 45
 - p. 180 as a percentage of 720.
2. **WE14b** Express (write the answers as mixed numbers):
 - a. 63 as a percentage of 200
 - b. 25 as a percentage of 400
 - c. 9 as a percentage of 120
 - d. 32 as a percentage of 500
 - e. 620 as a percentage of 3000
 - f. 30 as a percentage of 45
 - g. 70 as a percentage of 80
 - h. 12 as a percentage of 42
 - i. 9 as a percentage of 66
 - j. 52 as a percentage of 78.

3. Express (write the answers as mixed numbers):
- | | | |
|------------------------------|-----------------------------|-----------------------------|
| a. 11 as a percentage of 30 | b. 4 as a percentage of 15 | c. 8 as a percentage of 60 |
| d. 5 as a percentage of 70 | e. 4 as a percentage of 18 | f. 55 as a percentage of 66 |
| g. 3 as a percentage of 7 | h. 64 as a percentage of 72 | i. 9 as a percentage of 35 |
| j. 15 as a percentage of 21. | | |
4. **WE15** Express (round all answers to the nearest whole number):
- | | | |
|------------------------------|-----------------------------|------------------------------|
| a. 7 as a percentage of 42 | b. 18 as a percentage of 54 | c. 9 as a percentage of 16 |
| d. 95 as a percentage of 150 | e. 7 as a percentage of 65 | f. 2 as a percentage of 22 |
| g. 30 as a percentage of 36 | h. 14 as a percentage of 18 | i. 80 as a percentage of 450 |
| j. 8 as a percentage of 68. | | |
5. **WE16** Express the first amount as a percentage of the second amount.
- | | | |
|-----------------------|--------------------------|------------------|
| a. 30c and \$3 | b. 200 m and 6 km | c. 5 mm and 4 cm |
| d. 6 days and 3 weeks | e. 15 minutes and 1 hour | f. 25 mL and 2 L |
6. **MC** a. 4 as a percentage of 50 is:
- | | | | | |
|--------------|-----------------|---------------|--------------|--------------|
| A. 2% | B. 12.5% | C. 46% | D. 8% | E. 4% |
|--------------|-----------------|---------------|--------------|--------------|
- b. 9 out of 36 as a percentage is:
- | | | | | |
|---------------|--------------|----------------|---------------|---------------|
| A. 25% | B. 9% | C. 400% | D. 27% | E. 36% |
|---------------|--------------|----------------|---------------|---------------|
- c. 14 as a percentage of 35 is:
- | | | | | |
|---------------|---------------|---------------|---------------|----------------------------|
| A. 14% | B. 40% | C. 20% | D. 35% | E. $2\frac{1}{2}\%$ |
|---------------|---------------|---------------|---------------|----------------------------|
- d. Alice got 42 out of 60 for her mathematics test. Her mark as a percentage is:
- | | | | | |
|---------------|---------------|---------------|---------------|---------------|
| A. 58% | B. 60% | C. 30% | D. 42% | E. 70% |
|---------------|---------------|---------------|---------------|---------------|
7. **WE17** Alicia Molik has won 7 out of her last 10 singles matches. What percentage of her last 10 matches has Alicia won?

Understanding

8. Three out of five people prefer chocolate ice-cream to vanilla. What percentage prefer chocolate ice-cream to vanilla?
9. Caillan's pocket money increased from \$15 per week to \$20 per week.
- By how much has Caillan's pocket money increased?
 - What percentage increase is this?
10. Daniel earns \$500 per week. He spends \$50 on petrol, \$70 on rent and \$60 on food.
- What percentage does Daniel spend on:
 - petrol
 - rent
 - food?
 - What percentage of his total wage does Daniel spend on petrol, rent and food combined?
 - What percentage does Daniel have left?
11. David shot 40 baskets from the free throw line. Twenty-five of the 40 were goals. What percentage of David's shots were goals?
12. Jordan had a mass of 60 kg. After one month of not eating McDonald's, he lost 4 kg. What percentage of his mass did Jordan lose?
13. After practising for one month, Tayla increased the speed of her tennis serve from 120 km/h to 140 km/h. Give exact answers.
- By how much has the speed of Tayla's serve increased?
 - By what percentage has the speed of Tayla's serve increased?



14. There are 28 students in a class. A survey showed that 12 walk home, 8 catch a bus and 8 ride in a car. Write the answers as mixed numbers.
- Calculate the percentage of students who walk.
 - Calculate the percentage of students who catch a bus.
 - Calculate the total percentage who walk or catch a bus.
 - Calculate the percentage of students who ride in a car.
15. During one NRL season, the Melbourne Storm won 16 out of 22 games. What percentage of games did the Storm lose?
16. The teacher's mark book shows Karina has achieved the following test results in Maths.



Topic	Probability	Measurement	Algebra	Equations	Geometry
Score	$\frac{15}{20}$	$\frac{13}{15}$	$\frac{27}{30}$	$\frac{70}{80}$	$\frac{95}{100}$
Percentage					

- Copy and complete the table to show Karina's percentage for each test (round answers to the nearest whole number).
- In which test did Karina achieve her best result?
- Find Karina's average percentage mark by adding up the percentages and dividing by 5, the number of tests.

Reasoning

17. Which of the following quantities represents:
- the highest percentage
 - the lowest percentage
 - the same percentage?
 - Explain your reasoning.
- 200 g out of 500 g 420 g out of 840 g
 300 g out of 450 g 350 g out of 700 g
18. a. A baker uses 200 g of flour for 500 g of dough in a recipe and 250 g of flour for 500 g of dough in another recipe.
- Which recipe contains a higher percentage of flour? Explain.
 - What happens when the quantity of flour is increased but the quantity of dough remains constant?
- b. A type of concrete uses 10 kg of cement for a quantity of 65 kg of concrete. Another type of concrete uses 10 kg of cement for a quantity of 85 kg of concrete.
- Which type of concrete contains a higher percentage of cement? Explain.
 - What happens when the quantity of cement is constant but the quantity of concrete increases?

Problem solving

19. Roseanne is planning a tour of Australia. She calculates that 70% of the distance will be one sealed roads and the remainder on dirt roads. If there are 1356 km of dirt roads, how long will Roseanne's journey be?
20. a. If you increase \$100 by 25% and then decrease the new amount by 25%, will you end up with more than \$100, less than \$100 or exactly \$100? Give reasons for your answer.
- b. Choose another amount and another percentage to test your reasoning.

Reflection

Why do we need to be able to express one quantity as a percentage of another quantity?

CHALLENGE 7.2

My mother is four times older than I am. My sister is 75% of my age. She is also 10% of my grandfather's age. My father is 50, which is 2 years older than my mother. How old are my sister and grandfather?

7.7 Common percentages and short cuts

- Common percentages that are often used in everyday life include 10%, 20%, 25%, 50%, 75% and so on.
- It is useful to remember the relationship between some commonly used percentages and their related fractions, as it may help to calculate those percentages mentally. For example, $10\% = \frac{1}{10}$, so to find 10% of any amount we need to find $\frac{1}{10}$ of that amount; this means that we simply need to divide the amount by 10. Likewise, $25\% = \frac{1}{4}$, so to find 25% of any amount we need to find $\frac{1}{4}$ of that amount; this means we simply need to divide the amount by 4.

Percentage	Fraction	Percentage	Fraction
1%	$\frac{1}{100}$	25%	$\frac{1}{4}$
5%	$\frac{1}{20}$	$33\frac{1}{3}\%$	$\frac{1}{3}$
10%	$\frac{1}{10}$	50%	$\frac{1}{2}$
$12\frac{1}{2}\%$	$\frac{1}{8}$	$66\frac{2}{3}\%$	$\frac{2}{3}$
20%	$\frac{1}{5}$	75%	$\frac{3}{4}$

- Finding 10% without a calculator is easy, as it involves dividing the amount by 10; this is done just by moving decimal point 1 space to the left. Once you have found 10% of the amount, it's easy to find some other percentages. For example:
 - to find 5%, halve 10%
 - to find 20%, double 10%
 - to find 15%, add 10% and 5% together.
- $1\% = \frac{1}{100}$, so to find 1% of the amount, divide it by 100 by moving the decimal point two spaces to the left. Once you have found 1% of the amount, it's easy to find some other percentages. For example, to find 2%, double 1%.

WORKED EXAMPLE 18

Find 10% of each of the following, rounding the answer to the nearest 5 cents.

- a** \$37 **b** \$12.95

THINK

a Write the question and move the position of the decimal point one place to the left for the answer. Remember that if there is no decimal point, put it at the end of the number. (\$17 = \$17.00)

- b** **1** Write the question and move the position of the decimal point one place to the left for the answer.
2 Round to the nearest 5 cents.

WRITE

a 10% of \$37 = \$3.70

b 10% of \$12.95 = \$1.295

≈ \$1.30

WORKED EXAMPLE 19

Find:

- a** 5% of \$180 **b** 20% of \$7 **c** 15% of \$52 **d** 25% of 46.

Exercise 7.7 Common percentages and short cuts

assesson

Individual pathways

PRACTISE

Questions:
1–8, 12, 15, 17, 21

CONSOLIDATE

Questions:
1a–l, 2a–j, 3a–h, 4a–f, 5a–f, 6a–i,
7a–i, 8, 9, 12, 15, 18, 21

MASTER

Questions:
1q–x, 2m–t, 3i–o, 4i–l, 5i–l, 6m–r,
7m–r, 9–21

Individual pathway interactivity: int-4348

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Fluency

- WE18** Find 10% of each of the following, rounding the answer to the nearest 5 cents.

a. \$10.00	b. \$18.00	c. \$45.00	d. \$81.00	e. \$150.00
f. \$112.00	g. \$93.00	h. \$79.00	i. \$47.00	j. \$22.00
k. \$16.50	l. \$17.20	m. \$12.60	n. \$1.50	o. \$32.90
p. \$47.80	q. \$81.40	r. \$192.40	s. \$507.00	t. \$4620.00
u. \$1926.00	v. \$3041.50	w. \$7219.60	x. \$1999.90	
- Find 10% of the following. Round your answers to the nearest 5 cents.

a. \$15	b. \$51	c. \$17	d. \$9	e. \$137
f. \$172	g. \$4.29	h. \$6.37	i. \$8.12	j. \$39.17
k. \$74.81	l. \$13.95	m. \$102.75	n. \$67.87	o. \$42.96
p. \$517.83	q. \$304.77	r. \$628.41	s. \$100.37	t. \$207.08
- WE19a** Find 5% of each of the following. Round the answers to the nearest 5 cents.

a. \$8.20	b. \$6.40	c. \$1.60	d. \$2.20	e. \$140.20
f. \$81.00	g. \$42.40	h. \$10.60	i. \$242.60	j. \$304.80
k. \$1000	l. \$642.75	m. \$103.27	n. \$31.70	o. \$5.90
- WE19b** Find 20% of the following. Round the answers to the nearest 5 cents.

a. \$21.50	b. \$42.30	c. \$8.20	d. \$3.30	e. \$74.10
f. \$0.90	g. \$0.79	h. \$16.40	i. \$135.80	j. \$261.70
k. \$1237	l. \$5069			
- WE19c, d** Find the following. Round the answers to the nearest 5 cents.

a. 15% of \$12	b. 15% of \$8.00	c. 15% of \$20.00	d. 15% of \$60.00
e. 25% of \$30.00	f. 25% of \$45.00	g. 25% of \$90.00	h. 25% of \$220.00
i. 30% of \$15.00	j. 30% of \$25.00	k. 30% of \$47.50	l. 30% of \$102.20
- Find 1% of the following. Round the answers to the nearest 5 cents.

a. \$268	b. \$713	c. \$573	d. \$604	e. \$5.60
f. \$12	g. \$13	h. \$14.80	i. \$21.70	j. \$81.75
k. \$19.89	l. \$429.50	m. \$4.25	n. \$6.49	o. \$9.99
p. \$0.24	q. \$0.77	r. \$1264.37		

7. **WE20** Find the following. Round the answers to the nearest 5 cents.
- | | | | |
|-------------------|-------------------|------------------|------------------|
| a. 12% of \$11 | b. 21% of \$50 | c. 11% of \$30 | d. 3% of \$22 |
| e. 6% of \$40 | f. 22% of \$10 | g. 13% of \$14 | h. 35% of \$210 |
| i. 12% of \$150 | j. 9% of \$17 | k. 2% of \$53 | l. 7% of \$29 |
| m. 45% of \$71.50 | n. 33% of \$14.50 | o. 42% of \$3.80 | p. 31% of \$1.45 |
| q. 64% of \$22.50 | r. 41% of \$1200 | | |

8. **MC** a. 10% of \$7.25 equals:
- | | | | | |
|-----------------|------------------|-------------------|------------------|------------------|
| A. \$725 | B. \$7.30 | C. \$72.50 | D. \$0.73 | E. \$0.72 |
|-----------------|------------------|-------------------|------------------|------------------|
- b. 1% of \$31.48 equals:
- | | | | | |
|------------------|------------------|------------------|-------------------|------------------|
| A. \$3.14 | B. \$0.31 | C. \$0.32 | D. \$31.50 | E. \$3.15 |
|------------------|------------------|------------------|-------------------|------------------|
- c. 15% of \$124 equals:
- | | | | | |
|-------------------|------------------|------------------|-------------------|-------------------|
| A. \$12.40 | B. \$1.24 | C. \$6.20 | D. \$13.64 | E. \$18.60 |
|-------------------|------------------|------------------|-------------------|-------------------|
- d. 22% of \$5050 equals:
- | | | | | |
|-------------------|-------------------|------------------|-------------------|-------------------|
| A. \$60.60 | B. \$50.50 | C. \$1111 | D. \$43.56 | E. \$55.55 |
|-------------------|-------------------|------------------|-------------------|-------------------|

Understanding

9. Maria is buying a new set of golf clubs. The clubs are marked at \$950, but if Maria pays cash, the shop will take 10% off the marked price. How much will the clubs cost if Maria pays cash?
10. Thirty per cent of residents in the shire of Sutherland are over the age of 65. If there are 180000 residents, how many are over the age of 65?
11. Jay is buying a new lounge suite worth \$2150. Jay has to leave a 15% deposit and then pay the balance in monthly instalments.
- How much deposit does Jay have to pay?
 - How much will Jay have to pay each month if he plans to pay the balance off in one year?
12. Ninety per cent of students at a school were present for school photographs. If the school has 1100 students, how many were absent on the day the photographs were taken?
13. Jim can swim 50 m in 31 seconds. If he improves his time by 10%, what will Jim's time for 50 m be?
14. In a survey, 40 people were asked if they liked or disliked Vegemite. Of the people surveyed, 5% said they disliked Vegemite. How many people:
- disliked Vegemite?
 - liked Vegemite?
15. Seventy-two thousand four hundred people went to the MCG to watch a Hawthorn versus Geelong football match. Of the crowd, 42% went to the game by car and 55% caught public transport. How many people:
- arrived by car
 - caught public transport?

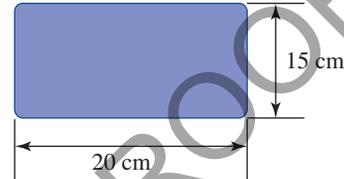


Reasoning

16. When I am 5% older than I am now, I will be 21 years old. How old am I now?
17. The price of bread is now 250% of its previous value, an increase of 150% in the past 20 years.
If a loaf of bread costs \$2.00 now, how much would it have cost 20 years ago?
18. I am six months old. If I gain 10% of my current mass I will be three times my birth mass. If my birth mass was 3 kg, what is my mass now? Round your answer to 1 decimal place.
19. I am 33 years old. I have lived in England for 8 years. If I stay in England, how old will I be when the number of years I have lived there is 50% of my age? Show how you reached your answer.

Problem solving

20. Kate is a carpenter and made a cutting board as shown.
 - a. One of her customers asked Kate to make her a similar cutting board but to double its width. What is the percentage increase of the width of the board?
 - b. A second customer asked Kate to make her a cutting board with dimensions 30 cm by 30 cm.
 - i. What is the percentage increase of the width of the board?
 - ii. What is the percentage increase of the length of the board?
 - iii. What is the percentage increase of the perimeter of the board?
 - c. Is there a connection between the percentage increase of a side and the percentage increase of the perimeter? Explain.
21. Ten per cent of the messages received by a business were from customers dissatisfied with the product bought. 32% of these customers were males.
 - a. What is the overall percentage of dissatisfied male customers?
 - b. What is the overall percentage of dissatisfied female customers?
 - c. Explain what happens when you apply a percentage to another percentage.



Reflection

Why is it important to be able to quickly evaluate common percentages mentally?

7.8 Review

Review questions

Fluency

1. Write the following percentages as fractions in simplest form.

a. 13%	b. 70%	c. 26%	d. 132%
e. $\frac{1}{4}\%$	f. $2\frac{2}{5}\%$	g. 9.7%	h. 73.17%
2. Write the following percentages as decimals.

a. 42%	b. 5%	c. 94%	d. 139%
e. 6.7%	f. 19.7%	g. 58.03%	h. 0.8%
3. Change the following fractions to percentages.

a. $\frac{15}{100}$	b. $\frac{11}{20}$	c. $\frac{3}{5}$	d. $\frac{18}{36}$
e. $\frac{30}{80}$	f. $\frac{8}{15}$	g. $\frac{5}{6}$	h. $\frac{4}{11}$
4. Change the following fractions to percentages.

a. 0.71	b. 0.84	c. 0.03	d. 0.2
e. 0.5	f. 0.008	g. 1.64	h. 3.8

5. Change the following fractions to percentages.
- | | | | |
|--------------|--------------|--------------|---------------|
| a. 5% of 120 | b. 60% of 20 | c. 75% of 52 | d. 130% of 30 |
| e. 14% of 45 | f. 7% of 530 | g. 32% of 15 | h. 17% of 80 |
6. Express:
- | | |
|--------------------------------------|---|
| a. 30 as a percentage of 50 | b. 18 as a percentage of 60 |
| c. 32 as a percentage of 80 | d. 28 as a percentage of 70 |
| e. 44 as a percentage of 132 | f. 6 as a percentage of 48 |
| g. 7 as a percentage of 15 | h. 35 as a percentage of 40 |
| i. 4 days as a percentage of 8 weeks | j. 20 minutes as a percentage of 3 hours. |
7. Find the following percentages by converting the percentage to a decimal.
- | | | | |
|----------------|-----------------|---------------|------------------|
| a. 20% of 25 | b. 12% of 31 | c. 4.5% of 50 | d. 9.2% of 75 |
| e. 21.4% of 90 | f. 32.3% of 120 | g. 76.5% of 8 | h. 42.3% of 96.2 |
8. Find 10% of each of the following by moving the position of the decimal point. Round your answer to the nearest 5 cents.
- | | | | |
|------------|------------|-------------|--------------|
| a. \$63.00 | b. \$42.00 | c. \$105.00 | d. \$216 |
| e. \$3.45 | f. \$42.68 | g. \$118.55 | h. \$2125.85 |
9. Find 5% of the following by finding 10% and halving your answer. Round your answer to the nearest 5 cents.
- | | | | |
|------------|------------|-------------|-------------|
| a. \$8.00 | b. \$21.00 | c. \$64.00 | d. \$104.00 |
| e. \$35.00 | f. \$52.00 | g. \$205.50 | h. \$77.30 |
10. Calculate the following using 'shortcuts'. Round your answer to the nearest 5 cents.
- | | | | |
|--------------------|------------------|-------------------|-------------------|
| a. 1% of \$16.00 | b. 1% of \$28.00 | c. 12% of \$42.00 | d. 30% of \$90.00 |
| e. 22% of \$220.00 | f. 43% of \$27 | g. 15% of \$19.50 | h. 8% of \$37 |

Problem solving

11. Ninety-five per cent of Year 8 students participated in the school's athletics day. What fraction of the Year 8 students participated?
12. Twenty-four per cent of visitors to Australia in 2005 were from Germany.
- What fraction of visitors to Australia was from Germany?
 - What fraction of visitors to Australia was not from Germany?
 - Out of 400 visitors to Australia, how many would you expect to be from Germany?
13. What fraction remains if:
- 38% of the winnings have been spent?
 - all stock was discounted 25%?
14. Five-eighths of the plants in my garden are Australian natives. What percentage are Australian natives?
15. Of the Australian population, 0.0041 speak Polish at home. What percentage of Australians speak Polish at home?
16. Eighty per cent of a Year 7 Maths class got question 1 correct on their percentages test. How many got the question correct if there are 30 students in the class?
17. Forty per cent of primary-school children can sing the national anthem. In a group of 675 primary-school children, how many would you expect to be able to sing the national anthem?
18. Nineteen per cent of Australia is forest and woodland. If Australia's area is approximately 7500000 km², how many km² is forest and woodland?
19. Ninety-nine of Canada's 3300 plant species are under threat of extinction. What percentage is threatened?
20. Lake Eyre in South Australia has an annual rainfall of around 100 mm. If 8 mm fell in one week, what percentage of the annual rainfall is this?
21. If a 4-litre can of paint, normally costing \$53.50, is discounted by 5%, how much will it cost? Give the answer correct to the nearest 5 cents.
22. A tennis player agreed to pay her coach 8% of her winnings from tournaments. If she wins \$145000 in a tournament, how much does her coach get?

23. A bronze propeller is 75% copper. If there are 300 g of copper in the propeller, what is the mass of the propeller?
24. Alex cuts his fish into 3 pieces — head, body and tail. The head is 30% of the fish and the tail is 10% of the fish. If the body weighs 120 g, how much did the fish weigh?
25. At Queens High School, there are 900 students.
 45% are girls.
 55% are boys.
 12% of students wear glasses.
 Which of the following statements is definitely false? (There may be more than one answer.)
- There are 100 boys with glasses.
 - 10% of the boys and 2% of the girls wear glasses.
 - 20% of girls wear glasses.
 - More than 22% of boys wear glasses.
26. The label on a 500-gram pack of butter states that it contains 81% fat. On a milk bottle it says that the milk contains 3 grams of fat per 100 mL. How many litres of this milk will it take to contain the same amount of fat as there is in the butter?
27. Dragoncity has a population of 85 400. Of these, 74% are sports fans. Of the fans, 90% are followers of some kind of football (soccer, Australian rules and rugby), but only 2.1% of football fans follow all three codes.
- How many people are interested in soccer, Australian rules and rugby?
 - What percentage of the Dragoncity population are fans of all three codes?
28. After having 24% of her pay taken out as taxes, Maya had \$646 left. What was her gross pay?
29. If you travel 50% faster, would you get to your destination 50% sooner? Explain.
30. Two triangles have the same area. Show that if one triangle has a 25% wider base than the other, then it must be 20% shorter too (that is, its height must be 20% less).
31. In a recent survey of house occupancy in a town, it was discovered that 40% of the houses contained 2 or more people. Of those houses that contain only 1 person, 25% of them contained a male. Of all the houses in a town, what percentage of them contains only 1 female and no males?
32. In the Student Council elections at a school, there were 3 candidates — Ann, Bob and Charlie. Ann received 227 votes, Bob 182 and Charlie 239 votes. If 90% of the school population voted, what is the total number of students in the school?
33. For the last two years, the price of entry to a theme park has increased 12.5% each year. The latest price rise increased a ticket to \$20.25. What was the entry price 2 years ago?
34. A store prices its T-shirts so that it makes 25% profit. At a sale, the T-shirts were reduced to cost price. By what percentage were the T-shirts reduced from their normal selling price?
35. A television set has a ticketed price of \$2500. A 10% discount is allowed on the set.
- What is the negotiated price of the television set?
 - If a further 10% is negotiated off the price of the set, what is the price paid?
 - Calculate the total discount as a percentage of the original ticketed price.
 - Explain why two successive 10% discounts do not equal a 20% discount.
36. Lena saved \$32 when she purchased a pair of jeans at a sale. If the sale had 40% off any item, what was the original price for the pair of jeans?
37. Two different items of clothing costing \$45 and \$50 are on sale with 10% off. The shop assistant in the store claims that if you buy both items, you will be saving a total of 20%. Is the shop assistant correct?
38. You are given two options at work:
 OPTION 1: Your salary can be raised by 10% this month and then reduced by 10% next month, or
 OPTION 2: Your salary will be reduced by 10% this month and increased by 10% next month.
 At the end of the two months, will your salary be greater than your current salary? Which is the better option?

39. Joseph wants to spend \$2500 on a new BBQ. Since he works at Harvey Norman he can get a staff discount of 10%. He can also get a discount of 30% in the stocktaking sale. Joseph wants to know whether he should ask the salesman to apply his staff discount first, or the stock-take sale discount first, to achieve the cheapest price.
- How much will the BBQ cost if the staff discount is taken off first and then the stock-take sale discount is taken off?
 - How much will it cost if done the other way around?
 - Which way should Joseph select to get the best price?
40. a. When Nathan will be 10% older than he is now, he will be 33 years old. How old is Nathan now?
- The price of milk has increased by 300% in the past 15 years. If a litre of milk costs \$2.50 now, how much would it have cost 15 years ago?

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Language

It is important to learn and be able to use correct mathematical language in order to communicate effectively. Create a summary of the topic using the key terms below. You can present your summary in writing or using a concept map, a poster or technology.

deposit

discount

instalments

marked price

original price

per cent

percentage

selling price

survey



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<i>Wear what you want</i>		
HALF YEARLY SALE		
Hooded tops	were \$39.00	now reduced by 25%
Cargo pants	were \$59.00	now reduced by 40%
T-Shirts	were \$20.00	now reduced by 10%
Shorts	were \$29.00	now reduced by 15%
Jeans	were \$79.00	now reduced by 35%
Hurry! Limited stock available! Will not last!		



Use the sale information in the advertisement shown and the skills you have learned in this chapter to answer the following questions.

1. Before the sale, how much would it cost to buy a hooded top and a pair of cargo pants?
2. What items could you buy before the sale if you had \$100.00 to spend?
3. Calculate the sale price of each of the 5 items advertised.
4. How much would you pay if you bought a hooded top and a pair of cargo pants at the sale?
5. How much have you saved by buying these 2 items at the sale rather than before the sale?
6. How much change would you receive from \$100.00 if you bought a pair of shorts and two T-shirts at the sale?
7. What items could you buy during the sale with the \$100.00 you have to spend?
8. Choose one set of items you would prefer to buy. Write a sentence comparing the total cost of the items you have chosen before and during the sale.

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Answers

Topic 7 Percentages

Exercise 7.2 Percentages as fractions

1. a. $\frac{17}{100}$ b. $\frac{29}{100}$ c. $\frac{81}{100}$ d. $\frac{79}{100}$ e. $\frac{99}{100}$ f. $\frac{43}{100}$ g. $\frac{3}{100}$ h. $\frac{19}{100}$
i. $\frac{67}{100}$ j. $\frac{33}{100}$ k. $\frac{9}{100}$ l. $\frac{189}{100}$ m. $\frac{243}{100}$ n. $\frac{127}{100}$ o. $\frac{353}{100}$
2. a. $\frac{1}{2}$ b. $\frac{4}{5}$ c. $\frac{1}{4}$ d. $\frac{7}{20}$ e. $\frac{3}{5}$ f. $\frac{17}{20}$ g. $\frac{1}{10}$ h. $\frac{9}{20}$
i. $\frac{49}{50}$ j. $\frac{3}{25}$ k. $\frac{1}{20}$ l. $\frac{14}{25}$ m. $\frac{37}{50}$ n. $\frac{1}{50}$ o. $1\frac{1}{10}$ p. $1\frac{1}{2}$
q. $\frac{9}{10}$ r. $1\frac{4}{5}$ s. $\frac{2}{1} = 2$ t. $\frac{5}{1} = 5$ u. $1\frac{3}{25}$
3. a. $\frac{1}{200}$ b. $\frac{1}{500}$ c. $\frac{3}{400}$ d. $\frac{1}{150}$ e. $\frac{1}{1000}$ f. $\frac{1}{160}$ g. $\frac{3}{550}$ h. $\frac{33}{400}$
i. $\frac{3}{80}$ j. $\frac{31}{150}$ k. $\frac{29}{300}$ l. $\frac{57}{400}$ m. $\frac{241}{400}$ n. $\frac{31}{200}$ o. $\frac{9}{40}$ p. $\frac{14}{125}$
q. $\frac{83}{800}$ r. $\frac{7}{60}$ s. $1\frac{101}{200}$ t. $1\frac{41}{200}$ u. $\frac{1}{3}$
4. a. $\frac{7}{200}$ b. $\frac{9}{125}$ c. $\frac{59}{500}$ d. $\frac{197}{1000}$ e. $\frac{81}{250}$ f. $\frac{143}{200}$ g. $\frac{629}{1000}$ h. $\frac{31}{200}$
i. $\frac{87}{1000}$ j. $\frac{81}{500}$ k. $\frac{283}{1000}$ l. $\frac{13}{80}$ m. $\frac{2069}{5000}$ n. $\frac{5799}{10000}$ o. $\frac{1079}{1250}$ p. $\frac{907}{5000}$
q. $\frac{243}{2000}$ r. $\frac{1}{2000}$
5. a. B b. E c. C d. D
6. $\frac{20}{100} = \frac{1}{5}$
7. $\frac{35}{100} = \frac{7}{20}$
8. $\frac{45}{100} = \frac{9}{20}$
9. 32% are girls, $\frac{8}{25}$
10. a. $\frac{2}{25}$ b. $\frac{23}{25}$ c. 8 people
11. a. $\frac{17}{100}$ b. $\frac{83}{100}$ c. 17
12. Less than $\frac{1}{2}$
13. a. $\frac{7}{20}$ b. $\frac{81}{100}$ c. $\frac{17}{20}$ d. $\frac{13}{200}$
14. a. $\frac{4}{5}$ b. $\frac{1}{2}$
- c. The percentage is different for the two molecules because the total number of atoms is different in the two molecules.
15. 33.33% is a recurring decimal with no exact value.
16. a. $\frac{4}{5}$ b. $\frac{1}{5}$
- c. Not necessarily. There could be an overlap of students with blue eyes who have pets.
17. a. 75% in the previous game
- b. i. Increased percentage
ii. Decreased percentage
iii. Unchanged

Exercise 7.3 Percentages as decimals

1. a. 0.36 b. 0.14 c. 0.19 d. 0.28 e. 0.73 f. 0.92 g. 0.66 h. 0.59
i. 0.11 j. 0.99 k. 0.09 l. 0.07 m. 0.04 n. 0.01 o. 0.25 p. 2.00
q. 1.5 r. 3.6
2. a. 0.123 b. 0.316 c. 0.592 d. 0.849 e. 0.376 f. 0.421 g. 0.219 h. 0.169
i. 0.107 j. 0.111 k. 0.031 l. 0.046 m. 0.092 n. 0.059 o. 0.068 p. 0.088
q. 0.1425 r. 0.3175 s. 0.2355 t. 0.4575 u. 0.0005 v. 0.0102 w. 0.0401 x. 0.0002
3. a. B b. C c. A d. D
4. a. $\frac{17}{100}$ b. 0.17
5. a. $\frac{1}{2000}$ b. 0.0005
6. 0.0285

7. 2.18
 8. 0.138
 9. 0.0835
 10. a. 23, 24, 24, 24.
 b. 0.23, 0.24, 0.24, 0.24
 c. It does not matter as long as both values are rounded up or down at the same digit.
 11. a. 23.6%
 b. 0.2360, 0.2367, 0.2366
 12. a. 0.378, 0.396, 0.309, 0.345, 0.328
 b. 39.6%, 37.8%, 34.5%, 32.8%, 30.9%
 c. 0.396, 0.378, 0.345, 0.328, 0.309
 d. Various answers are possible.
 13. a. 0.07291, 0.7291, 7.291
 b. They are 100 times smaller.

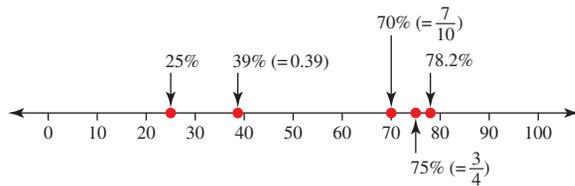
Exercise 7.4 Fractions and decimals to percentages

1. a. 21% b. 48% c. 9% d. 93% e. 28% f. 72% g. 16% h. 80%
 i. 12% j. 60% k. 40% l. 24% m. 10% n. 35% o. 5% p. 20%
 q. 80% r. 20% s. 40% t. 80% u. 70% v. 65% w. 30% x. 60%
 2. a. 50% b. 25% c. 60% d. 25% e. 40% f. 20% g. 50% h. 50%
 i. 75% j. 80% k. 10% l. 20%
 3. a. $33\frac{1}{3}\%$ b. $16\frac{2}{3}\%$ c. $22\frac{2}{9}\%$ d. $44\frac{4}{9}\%$ e. $27\frac{3}{11}\%$ f. $46\frac{2}{3}\%$ g. $55\frac{5}{9}\%$ h. $56\frac{1}{4}\%$
 i. $91\frac{2}{3}\%$ j. $87\frac{1}{2}\%$ k. $7\frac{9}{13}\%$ l. $58\frac{14}{17}\%$ m. $14\frac{2}{7}\%$ n. $83\frac{1}{3}\%$ o. $66\frac{2}{3}\%$
 4. a. D b. B c. A d. E
 5. a. 45% b. 32% c. 56% d. 68% e. 90% f. 84% g. 12% h. 8%
 i. 2% j. 10% k. 99% l. 5% m. 29% n. 9% o. 19% p. 10.5%
 q. 0.1% r. 6.7%
 6. a. 30% b. 80% c. 90% d. 10% e. 0.2% f. 0.7% g. 0.5% h. 0.9%
 i. 132% j. 150% k. 865% l. 205% m. 450% n. 0.015% o. 200% p. 1000%
 q. 500% r. 10000%
 7. a. D b. A c. E d. C
 8. $\frac{3}{4}\%$, 12.5%, 15%, 25%, 50%, 85%, 94%
 ↓ ↓ ↓ ↓ ↓ ↓ ↓
 $\frac{3}{4}\%$, $\frac{125}{1000}$, 15%, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{85}{100}$, $\frac{94}{100}$
 9. 20% 10. 32% 11. 7.5% 12. 58% 13. 30% 14. 40% 15. $36\frac{4}{11}\%$ 16. $52\frac{3}{11}\%$
 17. 70% 18. 40% 19. 43% 20. 3.1%

21.

Student name	Directed numbers test	
	Mark	Percentage
Mandy Adams	0.86	86
Sandra Bazumik	0.72	72
Malcolm Boncey	0.64	64
James Callan	0.91	91
Kate D'Arpa	0.79	79
Louise Edmonds	0.92	92
Chris Edwards	0.95	95
Thomas Evancik	0.10	10
Jessie Farmer	0.88	88
Mia Yazzett	0.46	46

22. a. 25%, 0.39, $\frac{7}{10}$, $\frac{3}{4}$, 78.2%



a. 25% = 0.25 is less than 0.39

$\frac{7}{10} = 0.7$ is less than $\frac{3}{4} = 0.75$ but greater than 0.39.

78.2% is the highest value.

23. a. i. 0.50, 0.33%, 0.25, 0.20, 0.16 ii. 50%, 33.33, 25%, 20%, 16.66

b. i. 1 ii. 100%

c. They are identical: 1 and 100%

d. Various answers possible.

24. a. i. 40% ii. 40%

b. No, because the two jobs do not add up to 100%.

c. Yes

25. After the sale with the discount voucher, because $\frac{1}{3} \approx 33.33\%$

Exercise 7.5 Finding percentages of an amount

- | | | | | | | | |
|--|--------------------|---------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| 1. a. 180 | b. 4 | c. 60 | d. 18 | e. 45 | f. 12 | g. $1\frac{1}{2}$ | h. 44 |
| i. $10\frac{1}{2}$ | j. 78 | | | | | | |
| 2. a. 10 | b. 16 | c. 3 | d. 3 | e. 18 | f. 93 | g. 6 | h. 6 |
| i. 28 | j. 77 | k. 39 | l. 63 | m. 4000 | n. 66 | o. 17 | p. 42 |
| q. 95 | r. 190 | s. 55 | t. 12 | u. 25 | | | |
| 3. a. $3\frac{3}{5}$ | b. $4\frac{4}{5}$ | c. $7\frac{7}{10}$ | d. $9\frac{3}{5}$ | e. $18\frac{1}{2}$ | f. $13\frac{1}{5}$ | g. $1\frac{9}{10}$ | h. $24\frac{3}{4}$ |
| i. $11\frac{1}{10}$ | j. $70\frac{2}{5}$ | k. $58\frac{9}{10}$ | l. $20\frac{4}{5}$ | m. $14\frac{2}{5}$ | n. $98\frac{2}{5}$ | o. $16\frac{1}{5}$ | |
| 4. a. A | b. D | c. E | d. E | | | | |
| 5. 210 students | | | | | | | |
| 6. a. 4 | b. 18 | c. 4 | d. 5 | e. 7 | f. 41 | g. 37 | h. 5 |
| i. 144 | j. 40.5 | k. 50.4 | l. 372 | m. 4.5 | n. 254.4 | o. 22 | p. 3.5 |
| q. 236 | r. 12.48 | | | | | | |
| 7. a. 7.2 | b. 1.74 | c. 23.529 | d. 2.196 | e. 12.127 | f. 11.088 | g. 11.723 | h. 17.766 |
| i. 1.072 | j. 66.528 | k. 32.708 | l. 324.159 | m. 268.763 | n. 110.1375 | o. 1.243 75 | |
| 8. a. 0.464 | b. 2.816 | c. 5.264 | d. 22.407 | e. 2.720 | f. 17.424 | g. 3.8775 | h. 30.6037 |
| i. 11.8335 | j. 286 | k. 4423.5 | l. 932.4 | m. 38.2655 | n. 13.665 75 | o. 88.2 | |
| 9. a. B | b. E | c. D | d. C | | | | |
| 10. 73 days | | | | | | | |
| 11. 1 person | | | | | | | |
| 12. a. 80% | | | | | | | |
| b. 1600 people | | | | | | | |
| 13. a. \$17.10 | b. \$587.10 | | | | | | |
| 14. \$1600000 | | | | | | | |
| 15. \$12000 | | | | | | | |
| 16. 47 species | | | | | | | |
| 17. 600000 people | | | | | | | |
| 18. a. Peter calculated 35% of 80 mL rather than 800 mL. | | | | | | | |
| b. 280 mL | | | | | | | |
| 19. a. 18 adults | b. 1 adult | | | | | | |
| 20. 8 houses | | | | | | | |

18. a. i. Second recipe. The second recipe contains 50% of flour compared to 40% in the first recipe.
 ii. The percentage of flour increases.
 b. i. First recipe. The first type of concrete contains 15.4% cement, and the second type of concrete contains 11.8% cement.
 ii. The percentage of cement decreases.
19. 4520 km
20. a. Less than \$100 because 25% of the new amount is larger than the amount added. So, a higher amount is subtracted.
 b. Various answers are possible.

Challenge 7.2

Sister is 9, Grandfather is 90

Exercise 7.7 Common percentages and short cuts

1. a. \$1.00 b. \$1.80 c. \$4.50 d. \$8.10 e. \$15.00 f. \$11.20 g. \$9.30 h. \$7.90
 i. \$4.70 j. \$2.20 k. \$1.65 l. \$1.70 m. \$1.25 n. \$0.15 o. \$3.30 p. \$4.80
 q. \$8.15 r. \$19.25 s. \$50.70 t. \$462.00 u. \$192.60 v. \$304.15 w. \$721.95 x. \$200.00
2. a. \$1.50 b. \$5.10 c. \$1.70 d. \$0.90 e. \$13.70 f. \$17.20 g. \$0.45 h. \$0.65
 i. \$0.80 j. \$3.90 k. \$7.50 l. \$1.40 m. \$10.30 n. \$6.80 o. \$4.30 p. \$51.80
 q. \$30.50 r. \$62.85 s. \$10.05 t. \$20.70
3. a. \$0.40 b. \$0.30 c. \$0.10 d. \$0.10 e. \$7.00 f. \$4.05 g. \$2.10 h. \$0.55
 i. \$12.15 j. \$15.25 k. \$50 l. \$32.15 m. \$5.15 n. \$1.60 o. \$0.30
4. a. \$4.30 b. \$8.45 c. \$1.65 d. \$0.65 e. \$14.80 f. \$0.20 g. \$0.15 h. \$3.30
 i. \$27.15 j. \$52.35 k. \$247.40 l. \$1013.80
5. a. \$1.80 b. \$1.20 c. \$3.00 d. \$9.00 e. \$7.50 f. \$11.25 g. \$22.50 h. \$55.00
 i. \$4.50 j. \$7.50 k. \$14.25 l. \$30.65
6. a. \$2.70 b. \$7.15 c. \$5.75 d. \$6.05 e. \$0.05 f. \$0.10 g. \$0.15 h. \$0.15
 i. \$0.20 j. \$0.80 k. \$0.20 l. \$4.30 m. \$0.05 n. \$0.05 o. \$0.10 p. \$0.00
 q. \$0.00 r. \$12.65
7. a. \$1.30 b. \$10.50 c. \$3.30 d. \$0.65 e. \$2.40 f. \$2.20 g. \$1.80 h. \$73.50
 i. \$18.00 j. \$1.55 k. \$1.05 l. \$2.05 m. \$32.20 n. \$4.80 o. \$1.60 p. \$0.45
 q. \$14.40 r. \$492
8. a. D b. B c. E d. C
9. \$855
10. 54 000 residents
11. a. \$322.50 b. \$152.30
12. 110 students
13. 27.9 seconds
14. a. 2 people b. 38 people
15. a. 30 240 people b. 39 600 people
16. 20 years old
17. \$0.80
18. 8.2 kg
19. 50 years old
20. a. 100%
 b. i. 100% ii. 50% iii. 71.4%
 c. No, because the two lengths have changed at different percentages.
21. a. 3.2% b. 6.8%
 c. The overall percentage is a lot smaller.

7.8 Review

1. a. $\frac{13}{100}$ b. $\frac{7}{10}$ c. $\frac{13}{50}$ d. $\frac{33}{25} = 1\frac{8}{25}$ e. $\frac{1}{400}$ f. $\frac{3}{125}$ g. $\frac{97}{1000}$ h. $\frac{7317}{10000}$

2. a. 0.42 b. 0.05 c. 0.94 d. 1.39 e. 0.067 f. 0.197 g. 0.5803 h. 0.008
3. a. 15% b. 55% c. 60% d. 50% e. $37\frac{1}{2}\%$ f. $53\frac{1}{3}\%$ g. $83\frac{1}{3}\%$ h. $36\frac{4}{11}\%$
4. a. 71% b. 84% c. 3% d. 20% e. 50% f. 0.8% g. 164% h. 380%
5. a. 6 b. 12 c. 39 d. 39 e. $6\frac{3}{10}$ f. $37\frac{1}{10}$ g. $4\frac{4}{5}$ h. $13\frac{3}{5}$
6. a. 60% b. 30% c. 40% d. 40% e. $33\frac{1}{3}\%$ f. $12\frac{1}{2}\%$ g. $46\frac{2}{3}\%$ h. $87\frac{1}{2}\%$
- i. $7\frac{1}{7}\%$ j. $11\frac{1}{9}\%$
7. a. 5 b. 3.72 c. 2.25 d. 6.9 e. 19.26 f. 38.76 g. 6.12 h. 40.6926
8. a. \$6.30 b. \$4.20 c. \$10.50 d. \$21.60 e. \$0.35 f. \$4.25 g. \$11.85 h. \$212.60
9. a. \$0.40 b. \$1.05 c. \$3.20 d. \$5.20 e. \$1.75 f. \$2.60 g. \$10.30 h. \$3.85
10. a. \$0.15 b. \$0.30 c. \$5.05 d. \$27.00 e. \$48.40 f. \$11.60 g. \$2.95 h. \$2.95
11. $\frac{19}{20}$
12. a. $\frac{6}{25}$ b. $\frac{19}{20}$ c. 96
13. a. 62% b. 75%
14. $62\frac{1}{2}$ 15. 0.41% 16. 24 students 17. 270 children 18. 1425000 km² 19. 3%
20. 8% 21. \$50.80 22. \$11600 23. 400 g 24. 200 g 25. b, d
26. 13.5 litres of milk would be needed to make the fat of 500 g of butter.
27. a. 1194 people
 b. 1.4%
28. \$850
29. No. (Check with your teacher for explanation.)
30. Check with your teacher.
31. 45% 32. 720 33. \$16 34. 20%
35. a. \$2250 b. \$2025 c. 95%
- d. The second 10% discount is not 10% of the original price but 10% of an amount which is only 90% of the original.
36. \$80
37. No. 10% off each item gives a total saving of \$9.50, while 20% of the combined purchase would give a saving of \$19.
38. No. Overall, after two months your salary will decrease by 1% using either option. However, option 1 gives an extra income (10% of the original salary) in the first month.
39. a. \$1575 b. \$1575
 c. It doesn't matter which discount is applied first; the final price will be the same.
40. a. Nathan is 30 years old now.
 a. \$0.63

Investigation — Rich task

- \$98.00
- Some examples are:
 - a pair of jeans and 1 T-shirt
 - a pair each of cargo pants and shorts
 - a pair of cargo pants and 2 T-shirts
 - 5 T-shirts.
- Hooded tops = \$29.25; cargo pants = \$35.40; T-shirts = \$18.00; shorts = \$24.65; jeans = \$51.35
- \$64.65
- \$33.35
- \$39.35
- Some examples are:
 - 1 hooded top and a pair each of cargo pants and shorts
 - a pair of jeans and 2 T-shirts
 - a pair of jeans, 1 hooded top and 1 T-shirt.
- Answers will vary. Teacher to check.