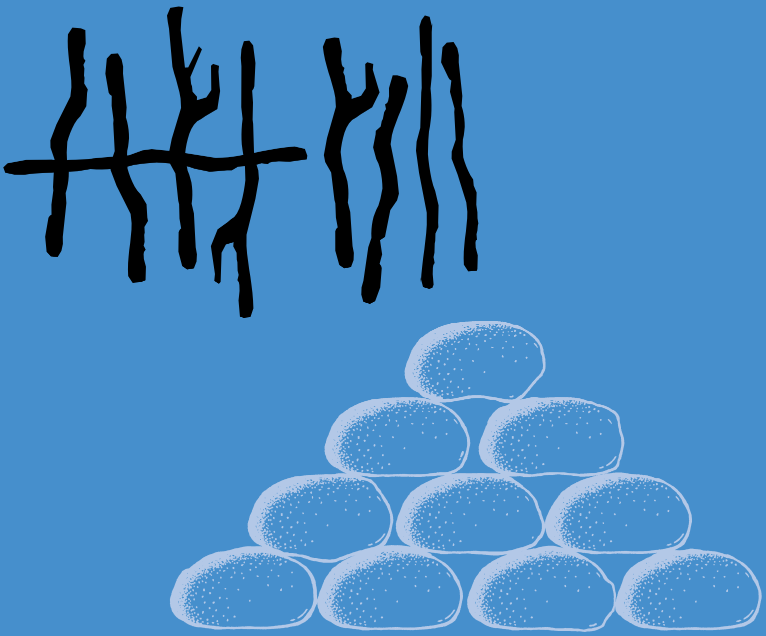
Book 1

Year 9



Mathematics

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Year 9 Book One

GOVERNMENT OF SĀMOA
MINISTRY OF EDUCATION, SPORTS AND CULTURE

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TABLE OF CONTENTS

Unit 1: NUMBER — PART 1

In this unit you will be:

1.1 Using The Four Mathematical Operations (+, –, ×, ÷)

- ◧ Integers.
- ◧ Fractions.
- ◧ Decimals.

1.2 Rounding Numbers

1.3 Evaluating Exponents

1.4 Finding Square Numbers and Square Roots

Section 1.1 Using The Four Mathematical Operations (+, −, ×, ÷)

Adding and Subtracting Integers

An integer is a number of the set $\{\ldots {}^{-}3, {}^{-}2, {}^{-}1, 0, 1, 2, 3, \ldots\}$.

$^{-}3 + {}^{-}4 = ?$ and $^{+}6 - {}^{-}3 = ?$

are examples of integer addition and subtraction.

The Rules for Integer Addition and Subtraction.

Rule 1: If the signs are the same, this means ADD.

$+\,+ \rightarrow +$

$-\,- \rightarrow +$

Rule 2: If the signs are different, this means SUBTRACT.

$+\,- \rightarrow -$

$-\,+ \rightarrow -$

Example 1

Calculate:

(a) $^{-}3 + {}^{+}8$ (b) $^{+}4 + {}^{-}2$ (c) $^{-}8 + {}^{+}5$ (d) $^{-}1 + {}^{-}3$

Solution

(a) $^{-}3 + {}^{+}8 = {}^{-}3 + 8$

$= 5$

(b) $^{+}4 + {}^{-}2 = 4 - 2$

$= 2$

(c) $^{-}8 + {}^{+}5 = {}^{-}8 + 5$

$= {}^{-}3$

(d) $^{-}1 + {}^{-}3 = {}^{-}1 - 3$

$= {}^{-}4$

Example 2

Calculate:

(a) $^{+}5 - {}^{+}7$ (b) $^{-}2 + {}^{-}3$ (c) $^{+}4 - {}^{-}2$ (d) $^{-}5 - {}^{-}3$

Solution

(a) $^{+}5 - {}^{+}7 = 5 - 7$

$= {}^{-}2$

(b) $^{-}2 + {}^{-}3 = {}^{-}2 - 3$

$= {}^{-}5$

(c) $^{+}4 - {}^{-}2 = 4 + 2$

$= 6$

(d) $^{-}5 - {}^{-}3 = {}^{-}5 + 3$

$= {}^{-}2$

Skill Exercises: Adding and Subtracting Integers

Calculate the following:

(a) $6 - {}^{-}3$
(b) $6 - {}^{-}4$
(c) ${}^{+}3 - {}^{-}5$
(d) ${}^{-}7 - {}^{-}3$
(e) ${}^{-}2 - {}^{-}5$
(f) ${}^{+}2 - {}^{-}4$
(g) ${}^{-}7 - {}^{-}7$
(h) ${}^{-}2 - {}^{-}2$
(i) ${}^{-}5 - {}^{-}8$
(j) ${}^{-}8 - {}^{-}5$
(k) ${}^{-}2 + {}^{+}3$
(l) ${}^{-}5 + {}^{+}3$
(m) $5 + {}^{+}2$
(n) ${}^{-}6 + {}^{+}6$
(o) ${}^{-}6 - {}^{-}6$
(p) ${}^{+}3 + {}^{+}2$
(q) ${}^{+}3 + {}^{-}2$
(r) ${}^{-}3 + {}^{+}5$
(s) ${}^{-}3 - {}^{-}5$
(t) ${}^{+}6 - {}^{-}10$

Multiplying Integers

${}^{+}2 \times {}^{+}3 = ?$ and ${}^{-}2 \times {}^{-}3 = ?$

are examples of integer multiplication.

The Rules for Integer Multiplication.

Rule 1: If the signs of both numbers are the same, the answer is POSITIVE.

Rule 2: If the signs of both numbers are different, the answer is NEGATIVE.

Example 1

Calculate:

(a) ${}^{+}2 \times {}^{+}3$
(b) ${}^{-}4 \times {}^{-}3$
(c) ${}^{+}5 \times {}^{-}2$
(d) ${}^{-}3 \times {}^{+}6$

Solution

(a) ${}^{+}2 \times {}^{+}3 = 6$ (Rule 1)
(b) ${}^{-}4 \times {}^{-}3 = 12$ (Rule 1)
(c) ${}^{+}5 \times {}^{-}2 = {}^{-}10$ (Rule 2)
(d) ${}^{-}3 \times {}^{+}6 = {}^{-}18$ (Rule 2)

Skill Exercises: Multiplying Integers

1. Calculate:
    (a) ${}^{-}6 \times {}^{-}3$
    (b) ${}^{-}4 \times {}^{+}2$
    (c) ${}^{+}4 \times {}^{+}3$
    (d) ${}^{+}2 \times {}^{-}3$
    (e) ${}^{+}3 \times {}^{-}2$
    (f) ${}^{-}3 \times {}^{-}5$
    (g) ${}^{-}50 \times {}^{-}2$
    (h) ${}^{-}50 \times {}^{+}2$
    (i) ${}^{-}20 \times {}^{-}2$
    (j) ${}^{+}20 \times {}^{-}3$

2. Calculate:
    (a) ${}^{-}3 \times {}^{+}2$
    (b) ${}^{-}5 \times {}^{-}5$
    (c) ${}^{+}2 \times +5$
    (d) ${}^{-}7 \times {}^{-}2$
    (e) ${}^{+}3 \times {}^{-}6$
    (f) ${}^{-}2 \times {}^{-}2$
    (g) ${}^{-}8 \times {}^{+}8$
    (h) ${}^{-}3 \times {}^{-}7$
    (i) ${}^{+}3 \times {}^{+}7$
    (j) ${}^{-}3 \times {}^{+}7$

Dividing Integers

$\frac{^{-}6}{^{+}3} = ?$ and $18 \div {}^{-}6 = ?$

are examples of integer division.

The Rules for Integer Division.

Rule 1: If the signs of both numbers are the same, the answer is POSITIVE.

Rule 2: If the signs of both numbers are different, the answer is NEGATIVE.

Example

(a) $^{-}42 \div {}^{+}6$ (b) $^{-}88 \div {}^{-}8$ (c) $\frac{^{+}21}{^{+}3}$ (d) $\frac{^{+}50}{^{-}10}$

Solution

(a) $^{-}42 \div {}^{+}6 = {}^{-}7$ (Rule 2) (b) $^{-}88 \div {}^{-}8 = 11$ (Rule 1)

(c) $\frac{^{+}21}{^{+}3} = 7$ (Rule 1) (d) $\frac{^{+}50}{^{-}10} = {}^{-}5$ (Rule 2)

Skill Exercises: Dividing Integers

1. Calculate:

(a) $+6 \div {}^{-}3$ (b) $^{-}8 \div {}^{-}2$ (c) $^{-}9 \div {}^{+}3$ (d) $^{-}15 \div {}^{-}5$

(e) $+12 \div {}^{-}4$ (f) $^{+}18 \div {}^{+}6$ (g) $^{-}21 + {}^{-}7$ (h) $^{-}27 \div {}^{+}3$

(i) $^{+}30 \div {}^{-}10$ (j) $^{-}24 \div {}^{-}8$

2. Calculate:

(a) $\frac{^{-}6}{3}$ (b) $\frac{^{-}8}{4}$ (c) $\frac{^{-}10}{^{-}5}$ (d) $\frac{^{-}30}{^{+}6}$

(e) $\frac{^{-}27}{^{+}3}$ (f) $\frac{^{-}32}{4}$ (g) $\frac{^{-}21}{^{-}7}$ (h) $\frac{^{-}40}{4}$

(i) $\frac{^{-}54}{^{-}6}$ (j) $\frac{^{-}60}{^{+}6}$

Fractions

A fraction is used to refer to part of a quantity.

<table>
<tr><td colspan="4">$\frac{1}{2}$</td><td colspan="4">$\frac{1}{2}$</td></tr>
<tr><td colspan="2">$\frac{1}{4}$</td><td colspan="2">$\frac{1}{4}$</td><td colspan="2">$\frac{1}{4}$</td><td colspan="2">$\frac{1}{4}$</td></tr>
<tr><td>$\frac{1}{8}$</td><td>$\frac{1}{8}$</td><td>$\frac{1}{8}$</td><td>$\frac{1}{8}$</td><td>$\frac{1}{8}$</td><td>$\frac{1}{8}$</td><td>$\frac{1}{8}$</td><td>$\frac{1}{8}$</td></tr>
</table>

$\frac{1}{2} + \frac{1}{2} = 1$

$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = 1$

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

Notice that $\frac{2}{4}$ is the same as $\frac{1}{2}$, and $\frac{2}{8}$ is the same as $\frac{1}{4}$.

Equivalent Fractions

Fractions that represent the same amount are called equivalent fractions.

Example

Fill in the boxes to complete the equivalent fractions.

(a) $\frac{1}{2} = \frac{\square}{8}$ (b) $\frac{2}{5} = \frac{\square}{15}$ (c) $\frac{3}{4} = \frac{\square}{12}$ (d) $\frac{5}{9} = \frac{\square}{45}$

Solution

(a) The denominator (bottom number) has been multiplied by 4. Do the the same to the numerator (top number).

$$\frac{1 \times 4}{2 \times 4} = \frac{4}{8}$$

(b) The denominator has been multiplied by 3. Do the same to the numerator.

$$\frac{2 \times 3}{5 \times 3} = \frac{6}{15}$$

(c) $\frac{3 \times 3}{4 \times 3} = \frac{9}{12}$

(d) $\frac{5 \times 5}{9 \times 5} = \frac{25}{45}$

Skill Exercises: Equivalent Fractions

Fill in the boxes:

(a) $\frac{1}{3} = \frac{\square}{18}$ (b) $\frac{2}{3} = \frac{\square}{18}$ (c) $\frac{1}{4} = \frac{\square}{12}$ (d) $\frac{2}{4} = \frac{\square}{12}$

(e) $\frac{3}{4} = \frac{\square}{12}$ (f) $\frac{1}{5} = \frac{\square}{25}$ (g) $\frac{2}{5} = \frac{\square}{25}$ (h) $\frac{3}{5} = \frac{\square}{25}$

(i) $\frac{4}{5} = \frac{\square}{25}$ (j) $\frac{3}{8} = \frac{\square}{24}$ (k) $\frac{3}{7} = \frac{\square}{14}$ (l) $\frac{4}{7} = \frac{\square}{21}$

(m) $\frac{4}{9} = \frac{\square}{18}$ (n) $\frac{5}{9} = \frac{\square}{27}$ (o) $\frac{3}{2} = \frac{\square}{6}$ (p) $\frac{5}{8} = \frac{\square}{16}$

(q) $\frac{8}{10} = \frac{\square}{70}$ (r) $\frac{3}{10} = \frac{\square}{70}$ (s) $\frac{7}{10} = \frac{\square}{30}$ (t) $\frac{9}{10} = \frac{\square}{100}$

Simplifying Fractions

When a fraction is changed into the smallest equivalent fraction it is called simplifying.

Example

Simplify these fractions by filling in the boxes:

(a) $\frac{15}{20} = \frac{\square}{4}$　(b) $\frac{4}{12} = \frac{\square}{3}$　(c) $\frac{6}{9} = \frac{\square}{\square}$　(d) $\frac{12}{16} = \frac{\square}{\square}$

Solution

(a) The denominator has been divided by 5. Do the same to the numerator.

$$\frac{15 \div 5}{20 \div 5} = \frac{3}{4}$$

(b) The denominator has been divided by 4. Do the same to the numerator.

$$\frac{4 \div 4}{12 \div 4} = \frac{1}{3}$$

(c) The biggest number that will will divide evenly into both the numerator and denominator is 3.

$$\frac{6 \div 3}{9 \div 3} = \frac{2}{3}$$

(d) The biggest number that will divide evenly into both the numerator and denominator is 4.

$$\frac{12 \div 4}{16 \div 4} = \frac{3}{4}$$

Skill Exercises: Simplifying Fractions

Fill in the boxes:

(a) $\frac{3}{6} = \frac{\square}{2}$　(b) $\frac{4}{8} = \frac{\square}{2}$　(c) $\frac{20}{40} = \frac{\square}{2}$　(d) $\frac{3}{9} = \frac{\square}{3}$

(e) $\frac{6}{9} = \frac{\square}{3}$　(f) $\frac{9}{12} = \frac{\square}{4}$　(g) $\frac{4}{12} = \frac{\square}{3}$　(h) $\frac{6}{12} = \frac{\square}{2}$

(i) $\frac{8}{12} = \frac{\square}{3}$　(j) $\frac{16}{20} = \frac{\square}{5}$　(k) $\frac{18}{24} = \frac{\square}{4}$　(l) $\frac{30}{45} = \frac{\square}{3}$

(m) $\frac{32}{64} = \frac{\square}{2}$　(n) $\frac{40}{64} = \frac{\square}{8}$　(o) $\frac{24}{30} = \frac{\square}{5}$　(p) $\frac{18}{30} = \frac{\square}{5}$

(q) $\frac{70}{100} = \frac{\square}{10}$　(r) $\frac{30}{100} = \frac{\square}{\square}$　(s) $\frac{45}{100} = \frac{\square}{\square}$　(t) $\frac{95}{100} = \frac{\square}{\square}$

Adding and Subtracting Fractions (Same Denominator)

To add or subtract fractions with the same denominator (the bottom line), add or subtract the numerators (the top line). The denominator stays the same (simplify the answer if possible).

Example

Calculate the following and simplify:

(a) $\frac{3}{7} + \frac{2}{7} =$ (b) $\frac{5}{8} - \frac{3}{8} =$

Solution

(a) $\frac{3}{7} + \frac{2}{7} = \frac{5}{7}$

This answer is in its simplest form.

(b) $\frac{5}{8} - \frac{3}{8} = \frac{2}{8}$

This answer can be simplified by dividing the numerator and denominator by 2.

$\frac{2 \div 2}{8 \div 2} = \frac{1}{4}$

Skill Exercises: Adding and Subtracting Fractions (Same Denominators)

1. Add these fractions, simplify each answer if possible:

(a) $\frac{2}{5} + \frac{2}{5}$ (b) $\frac{1}{8} + \frac{5}{8}$ (c) $\frac{3}{7} + \frac{2}{7}$ (d) $\frac{2}{9} + \frac{4}{9}$

(e) $\frac{5}{12} + \frac{5}{12}$ (f) $\frac{3}{10} + \frac{5}{10}$ (g) $\frac{1}{11} + \frac{7}{11}$ (h) $\frac{2}{15} + \frac{8}{15}$

(i) $\frac{1}{7} + \frac{3}{7} + \frac{2}{7}$ (j) $\frac{4}{15} + \frac{7}{15} + \frac{3}{15}$

2. Subtract these fractions, simplify each answer if possible:

(a) $\frac{4}{5} - \frac{3}{5}$ (b) $\frac{6}{11} - \frac{4}{11}$ (c) $\frac{7}{10} - \frac{3}{10}$ (d) $\frac{5}{8} - \frac{2}{8}$

(e) $\frac{3}{4} - \frac{1}{4}$ (f) $\frac{9}{10} - \frac{3}{10}$ (g) $\frac{5}{6} - \frac{1}{6}$ (h) $\frac{11}{12} - \frac{5}{12}$

(i) $\frac{5}{8} - \frac{3}{8}$ (j) $\frac{11}{12} - \frac{3}{12}$

Finding Lowest Common Multiples (LCM)

The smallest number that is common to two or more sets of multiples is called the lowest common multiple.

Example 1

Multiples of 3 = {3, 6, 9, **12**, 15, 18, . . .}

Multiples of 4 = {4, 8, **12**, 16, 20, 24, . . .}

So **12** is the lowest common multiple of the two sets of multiples of 3 and 4.

Example 2

Multiples of 4 = {4, 8, 12, 16, **20**, 24, 28, . . .}

Multiples of 5 = {5, 10, 15, **20**, 25, 30, . . .}

So **20** is the lowest common multiple of the two sets of multiples of 4 and 5.

Skill Exercises: Finding Lowest Common Multiples

Find the lowest common multiples of these pairs of numbers (you might need to write out the sets of multiples of each number first):

(a) 2 and 3
(b) 5 and 3
(c) 4 and 6
(d) 2 and 5
(e) 7 and 4
(f) 4 and 8
(g) 3 and 7
(h) 2 and 6
(i) 5 and 7
(j) 12 and 8

Adding and Subtracting Fractions (Different Denominators)

To add or subtract fractions with different denominators change one or both of them so that they become fractions with the same denominator.

Example

Calculate the following:

(a) $\frac{2}{3} + \frac{1}{4}$

(b) $\frac{3}{5} - \frac{1}{3}$

Solution

The denominators in both examples are different. But to add or subtract fractions, the denominators must be the same.

To make the denominators the same, find their lowest common multiple. Then find the equivalent fractions.

(a) $\frac{2}{3} + \frac{1}{4} \Rightarrow \text{LCM} = 12$ (b) $\frac{3}{5} - \frac{1}{3} \Rightarrow \text{LCM} = 15$

$= \frac{8}{12} + \frac{3}{12}$ $= \frac{9}{15} - \frac{5}{15}$

$= \frac{11}{12}$ $= \frac{4}{15}$

Skill Exercises: Adding and Subtracting Fractions (Different Denominators)

1. Calculate:

(a) $\frac{2}{3} + \frac{4}{15}$ (b) $\frac{1}{6} + \frac{4}{5}$ (c) $\frac{2}{5} + \frac{2}{7}$ (d) $\frac{5}{8} + \frac{1}{4}$

(e) $\frac{1}{5} + \frac{1}{4}$ (f) $\frac{2}{3} + \frac{1}{7}$ (g) $\frac{1}{5} + \frac{2}{3}$ (h) $\frac{2}{5} + \frac{3}{4}$

(i) $\frac{1}{3} + \frac{3}{8}$ (j) $\frac{1}{3} + \frac{3}{7}$

2. Calculate:

(a) $\frac{3}{4} - \frac{2}{3}$ (b) $\frac{7}{8} - \frac{1}{2}$ (c) $\frac{5}{9} - \frac{2}{7}$ (d) $\frac{5}{6} - \frac{1}{9}$

(e) $\frac{9}{10} - \frac{1}{5}$ (f) $\frac{5}{6} - \frac{4}{7}$ (g) $\frac{3}{10} - \frac{1}{5}$ (h) $\frac{1}{2} - \frac{1}{3}$

(i) $\frac{2}{3} - \frac{1}{4}$ (j) $\frac{2}{5} - \frac{1}{7}$

Writing Mixed Numbers and Improper Fractions

A mixed number is a combination of a counting number and a fraction smaller than one.

$2\frac{3}{4}$ and $1\frac{4}{15}$ are mixed numbers.

An improper fraction is one in which the numerator is bigger than the denominator.

$\frac{11}{4}$ and $\frac{15}{11}$ are improper fractions.

$2\frac{3}{4}$ and $\frac{11}{4}$ are equivalent (both have the same value).

Example 1

Change these mixed numbers into improper fractions:

(a) $4\frac{1}{2}$ (b) $3\frac{2}{5}$

Solution

(a) $4\frac{1}{2} = 4 + \frac{1}{2} = \frac{4}{1} + \frac{1}{2} = \frac{8}{2} + \frac{1}{2} = \frac{9}{2}$

(b) $3\frac{2}{5} = 3 + \frac{2}{5} = \frac{3}{1} + \frac{2}{5} = \frac{15}{5} + \frac{2}{5} = \frac{17}{5}$

Example 2

Change these improper fractions into mixed numbers:

(a) $\frac{7}{3}$ (b) $\frac{12}{7}$

Solution

Divide the numerator (top number) by the denominator (bottom number) and get the remainder.

(a) $\frac{7}{3}$ = 7 ÷ 3

= 2 + 1 remainder

= $2\frac{1}{3}$

(b) $\frac{12}{7}$ = 12 ÷ 7

= 1 + 5 remainder

= $1\frac{5}{7}$

Skill Exercises: Writing Mixed Numbers and Improper Fractions

1. Change these mixed numbers into improper fractions:

(a) $3\frac{1}{2}$ (b) $1\frac{3}{4}$ (c) $2\frac{3}{5}$ (d) $1\frac{5}{8}$

(e) $3\frac{2}{3}$ (f) $5\frac{1}{4}$ (g) $7\frac{1}{2}$ (h) $5\frac{3}{7}$

(i) $17\frac{2}{3}$ (j) $2\frac{5}{12}$

2. Change these improper fractions into mixed numbers:

(a) $\frac{5}{2}$ (b) $\frac{7}{4}$ (c) $\frac{3}{2}$ (d) $\frac{7}{5}$

(e) $\frac{7}{6}$ (f) $\frac{11}{4}$ (g) $\frac{5}{3}$ (h) $\frac{8}{7}$

(i) $\frac{5}{4}$ (j) $\frac{17}{11}$

Multiplying Fractions

Fractions are multiplied by multiplying the numerator (top number) and denominator (bottom number). Mixed numbers must be changed to improper fractions first.

Example 1

Calculate:

(a) $\frac{1}{2} \times \frac{4}{5}$ (b) $\frac{3}{4} \times \frac{2}{3}$ (c) $2\frac{1}{3} \times \frac{3}{4}$ (d) $4\frac{1}{2} \times 2\frac{2}{3}$

Solution

(a)
$$\begin{aligned} \frac{1}{2} \times \frac{4}{5} &= \frac{1 \times 4}{2 \times 5} \\ &= \frac{4}{10} \\ &= \frac{2}{5} \end{aligned}$$

(b)
$$\begin{aligned} \frac{3}{4} \times \frac{2}{3} &= \frac{3 \times 2}{4 \times 3} \\ &= \frac{6}{12} \\ &= \frac{1}{2} \end{aligned}$$

(c)
$$\begin{aligned} 2\frac{1}{3} \times \frac{3}{4} &= \frac{7}{3} \times \frac{3}{4} \\ &= \frac{21}{12} \\ &= 1\frac{9}{12} \\ &= 1\frac{3}{4} \end{aligned}$$

(d)
$$\begin{aligned} 4\frac{1}{2} \times 2\frac{2}{3} &= \frac{9}{2} \times \frac{8}{3} \\ &= \frac{72}{6} \\ &= 12 \end{aligned}$$

Skill Exercises: Multiplying Fractions

1. Calculate the following and simplify the answer if you can:

(a) $\frac{2}{3} \times \frac{1}{5}$ (b) $\frac{3}{4} \times \frac{5}{8}$ (c) $\frac{5}{6} \times \frac{2}{5}$

(d) $\frac{3}{4} \times \frac{7}{8}$ (e) $\frac{3}{5} \times \frac{1}{4}$ (f) $\frac{1}{2} \times \frac{1}{2}$

(g) $\frac{3}{4} \times \frac{3}{4}$ (h) $\frac{2}{5} \times \frac{3}{4}$ (i) $\frac{3}{4} \times \frac{2}{5}$

(j) $3\frac{1}{2} \times \frac{4}{7}$ (k) $1\frac{1}{2} \times 2\frac{3}{4}$ (l) $4\frac{1}{8} \times 3\frac{3}{5}$

(m) $2\frac{1}{3} \times 1\frac{2}{3}$ (n) $3\frac{5}{6} \times 1\frac{1}{4}$

Instead of writing the multiplication sign (×), another way of writing such an operation is using the word OF.

Example 2

(a) What is $\frac{1}{2}$ of 10? (b) What is $\frac{1}{4}$ of $2\frac{1}{2}$?

Solution

(a) $\frac{1}{2}$ of $10 = \frac{1}{2} \times \frac{10}{1}$ $\quad$ $\frac{1}{4}$ of $2\frac{1}{2} = \frac{1}{4} \times 2\frac{1}{2}$

$= \frac{10}{2}$ $\quad$ $= \frac{1}{4} \times \frac{5}{2}$

$= 5$ $\quad$ $= \frac{5}{8}$

2. Calculate:

(a) What is $\frac{1}{2}$ of $\frac{3}{4}$? (b) What is $\frac{2}{5}$ of 20?

(c) What is $\frac{3}{4}$ of $\frac{5}{8}$? (d) What is $\frac{2}{3}$ of $\frac{3}{8}$?

(e) What is $\frac{3}{4}$ of $5\frac{1}{2}$? (f) What is $\frac{4}{5}$ of $3\frac{3}{4}$?

Finding Reciprocals of Fractions

The reciprocal of a fraction is the fraction turned upside down.

Example

Find the reciprocals of:

(a) $\frac{2}{3}$ (b) $2\frac{3}{4}$

Solution

(a) Reciprocal $= \frac{3}{2}$

(b) $2\frac{3}{4} = \frac{11}{4}$

Reciprocal $= \frac{4}{11}$

Skill Exercises: Finding Reciprocals of Fractions

1. Find the reciprocals of:

   (a) $\frac{1}{3}$ (b) $\frac{3}{5}$ (c) $\frac{2}{3}$

   (d) $\frac{3}{8}$ (e) $\frac{4}{5}$ (f) $\frac{7}{8}$

   (g) $\frac{2}{5}$ (h) $\frac{3}{4}$ (i) $\frac{3}{7}$

   (j) $\frac{4}{9}$

2. Find the reciprocals of:

   (a) $1\frac{1}{3}$ (b) $1\frac{2}{5}$ (c) $1\frac{1}{4}$

   (d) $2\frac{1}{2}$ (e) $\frac{9}{2}$ (f) $\frac{8}{3}$

   (g) $3\frac{1}{5}$ (h) $2\frac{1}{4}$ (i) $3\frac{1}{3}$

   (j) $\frac{5}{4}$

Dividing with Fractions

To divide by a fraction, multiply by the reciprocal.

Example

(a) $\frac{1}{2} \div \frac{1}{3}$

(b) $2\frac{3}{4} \div \frac{2}{3}$

Solution

(a)
$$\begin{aligned} \frac{1}{2} \div \frac{1}{3} &= \frac{1}{2} \times \frac{3}{1} \\ &= \frac{3}{2} \\ &= 1\frac{1}{2} \end{aligned}$$

(b)
$$\begin{aligned} 2\frac{3}{4} \div \frac{2}{3} &= 2\frac{3}{4} \times \frac{3}{2} \\ &= \frac{11 \times 3}{4 \times 2} \\ &= \frac{33}{8} \\ &= 4\frac{1}{8} \end{aligned}$$

Skill Exercises: Dividing with Fractions

1. Calculate:

   (a) $\frac{2}{3} \div \frac{1}{2}$ (b) $\frac{3}{5} \div \frac{4}{6}$ (c) $\frac{3}{8} \div \frac{2}{5}$

   (d) $\frac{3}{4} \div \frac{1}{2}$ (e) $\frac{4}{5} \div \frac{2}{5}$ (f) $\frac{3}{8} \div \frac{5}{2}$

   (g) $\frac{1}{2} \div \frac{2}{3}$ (h) $\frac{7}{8} \div \frac{2}{3}$ (i) $\frac{4}{5} \div \frac{1}{3}$

   (j) $\frac{3}{7} \div \frac{2}{7}$

2. Calculate:

   (a) $\frac{4}{5} \div \frac{2}{3}$ (b) $\frac{3}{7} \div \frac{4}{5}$ (c) $\frac{3}{4} \div \frac{5}{2}$

   (d) $2\frac{3}{5} \div \frac{2}{5}$ (e) $4\frac{4}{7} \div \frac{2}{5}$ (f) $3\frac{7}{8} \div \frac{4}{5}$

   (g) $\frac{2}{5} \div 1\frac{3}{5}$ (h) $\frac{5}{9} \div 2\frac{1}{3}$ (i) $2\frac{7}{9} \div 1\frac{2}{3}$

   (j) $4\frac{7}{8} \div 2\frac{3}{4}$

Adding and Subtracting Decimals

Decimals are numbers that have a point (.) in them.

2.39 and 56.4 are decimals.

When adding or subtracting decimals, arrange the numbers so that the decimal points line up.

Example

(a) 24.7 + 3.07 (b) 24.7 – 3.07

Solution

$$\text{(a)}\quad \begin{array}{r} 24.70 \\ \underline{+\ 3.07} \\ 27.77 \end{array} \qquad\qquad \text{(b)}\quad \begin{array}{r} 24.70 \\ \underline{-\ 3.07} \\ 21.63 \end{array}$$

Skill Exercises: Adding and Subtracting Decimals

1. Calculate:

(a) 3.4 + 6.23 (b) 17.04 + 3.81

(c) 23.02 + 1.69 (d) 16 + 7.08

(e) 16.92 + 14.28 (f) 10 + 11.01

(g) 16.1 + 2.07 + 2.41 (h) 3.46 + 0.87

(i) 5.07 + 0.39 + 6.3 (j) 4 + 6.09 + 0.96

2. Calculate:

(a) 3.6 – 1.4 (b) 17.36 – 1.26

(c) 8.4 – 2.7 (d) 3.4 – 0.32

(e) 6 – 2.4 (f) 10 – 3.86

(g) 6 – 0.96 (h) 17.4 – 2.87

(i) 10 – 0.89 (j) 17.48 – 2.8

Multiplying Decimals

To multiply decimals, first count how many places there are after the decimal points.

Do the multiplication, without using the decimal points.

Put the decimal points in.

Example

(a) 23.4×1.36 (b) 6.36×0.498

Solution

(a)	23.4	(1 decimal place)	(b)	6.36	(2 decimal places)
	$\underline{\times 1.3}$	(1 decimal place)		$\underline{\times 0.498}$	(3 decimal places)
	702			5088	
	$\underline{2340}$			57240	
	3042			$\underline{254400}$	
				316728	
	30.42	(use 2 decimal places)		3.16728	(use 5 decimal places)

Skill Exercises: Multiplying Decimals

Calculate:

(a) 3.7×1.2 (b) 3.8×0.5 (c) 47.2×0.3

(d) 23.6×0.03 (e) 236×0.5 (f) 13.2×3.3

(g) 0.036×0.5 (h) 0.058×20 (i) 0.086×2

(j) 0.86×100

Dividing with Decimals

The two parts of a division calculation are the dividend and the divisor.

e.g. $$\underset{\text{(dividend)}}{1.45} \div \underset{\text{(divisor)}}{0.5} \Rightarrow \frac{1.45}{0.5}\begin{array}{l}\text{(dividend)}\\ \text{(divisor)}\end{array}$$

To divide by a decimal, make the divisor a whole number by moving the decimal points in the divisor and the dividend the same number of places.

Example

(a) $1.45 \div 0.5$ (b) $0.345 \div 0.05$

Solution

(a)
$$\begin{aligned} 1.45 \div 0.5 &= \frac{1.45}{0.5} \\ &= \frac{14.5}{5} \\ &= 2.9 \end{aligned}$$

(b)
$$\begin{aligned} 0.345 \div 0.05 &= \frac{0.345}{0.05} \\ &= \frac{34.5}{5} \\ &= 6.9 \end{aligned}$$

Skill Exercises: Dividing with Decimals

Calculate:

(a) $3.6 \div 0.4$ (b) $4.2 \div 0.3$ (c) $5.8 \div 0.2$ (d) $7.2 \div 0.6$

(e) $1.23 \div 0.3$ (f) $2.44 \div 0.4$ (g) $36.5 \div 0.5$ (h) $13.8 \div 0.6$

(i) $0.312 \div 0.3$ (j) $0.464 \div 0.4$

Skill Exercises: Practical Problems – Decimals

1. Tavita walked 1.4 km then rode 3.7 km. How far did he travel altogether?

2. The sides of a triangle are 2.6 cm, 1.7 cm and 2.4 cm. How far is it around the triangle?

3. If it is 2.47 km to the bank and Sione has to travel there and back, how far does Sione have to travel?

4. One side of a square is 0.47 m. How far is it around the square?

5. Upu has run 37.5 m of a 100 m race. How far has she to go?

6. Siose jumped 5.7 m and Tavita jumped 5.38 m. How much further than Tavita did Siose jump?

7. If 73 cm of material is cut from a piece 2 m long, how long is the piece left?

8. Ioane is 1.74 m tall. Mareko is 1.09 m. How much taller is Ioane?

9. The petrol tank on Ray's car holds 40 litres. If he has 6.47 litres in it, how much petrol will it take to fill the tank?

10. Fili has $8.60 and Lelia gives her another $7.70. If Fili spends $7.50, how much does she have left?

Section 1.2 Rounding Numbers

Numbers are rounded to give a sensible answer.

Example 1

Miss Etuati asked her class of 30 pupils to get into groups of four even teams. How many would be in each team?

Solution

30 pupils divided into 4 teams $= \frac{30}{4}$

$= 7\frac{1}{2}$ pupils per team.

But there cannot be half a person. The answer must be rounded to the nearest whole number. We can only have four teams of seven pupils. (This means two students are not in a team.)

Example 2

Sani bought 1.5 metres of material at $7.95 a metre. How much would she pay?

Solution

Cost = 1.5 m × \$7.95

= \$11.925

Usually the shop keeper would round this up to $11.95.

Example 3

Rounding is also used to find approximate answers.

Five items cost $3.95 each. What is the approximate total cost?

Solution

$3.95 can be rounded up to $4.00

Total cost ≈ \$4.00 × 5 = \$20

The cost will be approximately $20.

Skill Exercises: Rounding Numbers

Do the following examples and give sensible answers for each:

1. How would you organize 13 people into three groups?
2. What is the approximate cost of 3.5 m of material at $7.95 per metre?

3. Give the approximate answer to 98 × 22. What numbers did you use for your approximation?

4. Give the approximate answer to 611 ÷ 19. What numbers did you use for your approximation?

5. Give the approximate answer to 105 × 38. What numbers did you use for your approximation?

6. Give the approximate answer to 296 ÷ 29. What numbers did you use for your approximation?

7. If you were dividing 5 tala among seven people, about how much would each get?

8. If you were dividing 12 tala among 11 people, about how much would each get?

9. What is the approximate total cost of seven items at $6.95 each?

10. Here is my account after shopping at Lucky Foodtown: $2.95, $3.10, $0.95, $1.35, $2.80. What is the approximate total cost?

Section 1.3 Evaluating Exponents

An exponent is a number (or variable) written above and to the right of another number (or variable) which is called the base.

3^2 is read as '3 to the power of 2'.

2 is the exponent and 3 is the base.

$3^2 = 3 \times 3 = 9$.

3^2 means that 3 is used as a factor 2 times.

Instead of writing $5 \times 5 \times 5 \times 5$, simply write 5^4 (count the number of times the 5 is used as a factor, i.e., 4 times). Write 5 as the base and 4 as the exponent.

A number to the power of 1 is just the number, e.g., $5^1 = 5$.

Example 1

Write the following expressions using exponents:

(a) $3 \times 3 \times 3 \times 3$ (b) 5×5

Solution

(a) $3 \times 3 \times 3 \times 3 = 3^4$ (b) $5 \times 5 = 5^2$

Example 2

Evaluate:

(a) 2^4 (b) 6^3

Solution

(a) $2^4 = 2 \times 2 \times 2 \times 2 = 16$

(b) $6^3 = 6 \times 6 \times 6 = 216$

Skill Exercises: Evaluating Exponents

1. Write the following expressions using exponents:
   (a) $4 \times 4 \times 4 \times 4$
   (b) $2 \times 2 \times 2 \times 2$
   (c) $5 \times 5 \times 6 \times 6$
   (d) $2 \times 3 \times 3 \times 2 \times 2$
   (e) $10 \times 10 \times 5 \times 10$
   (f) $8 \times 8 \times 8 \times 8$
   (g) $2 \times 3 \times 2 \times 3 \times 2$
   (h) $2 \times 6 \times 6 \times 2 \times 2$
   (i) $5 \times 4 \times 4 \times 5 \times 4$
   (j) $5 \times 5 \times 5 \times 2 \times 2$

2. Evaluate:
   (a) 3^3 (b) 3^1 (c) 4^2 (d) 3^4
   (e) 5^1 (f) 3^2 (g) 4^3 (h) 10^2
   (i) 7^2 (j) 9^2

Section 1.4 Finding Square Numbers And Square Roots

Any whole number multiplied by itself gives a square number.

$$\left.\begin{array}{l}1 \times 1 = 1\\ 2 \times 2 = 2\\ 3 \times 3 = 9\\ 4 \times 4 = 16\end{array}\right\}\text{These answers are all square numbers.}$$

The $\boxed{\sqrt{\ }}$ (square root) button on a calculator gives the reverse process. It finds the original number that was multiplied by itself.

Example 1

Calculate the squares of the following:

(a) 2 (b) 5 (c) 6

Solution

(a) $2^2 = 2 \times 2 = 4$

(b) $5^2 = 5 \times 5 = 25$

(c) $6^2 = 6 \times 6 = 36$

Example 2

Find the square roots of the following:

(a) 4 (b) 25 (c) 169

Solution

(a) $\sqrt{4} = 2$ (b) $\sqrt{25} = 5$ (c) $\sqrt{169} = 13$

Skill Exercises: Finding Square Numbers and Square Roots

1. Square the following:

   (a) 7 (b) 12 (c) 9 (d) 10

   (e) 20 (f) 100

2. Find the square roots of:

   (a) 4 (b) 36 (c) 256 (d) 49

   (e) 100 (f) 1

Unit 2: ALGEBRA — PART 1

In this unit you will be:

2.1 Simplifying Algebraic Expressions

- Addition and Subtraction.
- Multiplication.
- Division.

2.2 Expanding and Factorising Algebraic Expressions

- Expanding.
- Factorising.

Section 2.1 Simplifying Algebraic Expressions

Addition and Subtraction

In algebra, letters (called variables) are used instead of numbers.

$3x + 4y = 18$ is an algebraic expression.

Variables that are the same can be added or subtracted. This is called simplifying.

Example

Simplify:

(a) $3x + 2x$ (b) $5y - 3y$

(c) $8m + 15m + 3n$ (d) $6p + 2q - p - 6q$

Solution

(a) $3x + 2x = 5x$ (b) $5y - 3y = 2y$

(c) $8m + 15m + 3n = 23m + 3n$ (d) $6p + 2q - p - 6q = 5p - 4q$

Skill Exercises: Addition and Subtraction

Simplify:

1. (a) $3x + 5x$ (b) $7a + 3a$ (c) $6p + p$

(d) $5c + 6c$ (e) $4m + 5m$ (f) $9k + 7k$

(g) $5w + 14w$ (h) $10n + n$ (i) $9g + 2g$

(j) $d + d$ (k) $5t - 3t$ (l) $6b - 3b$

(m) $15r - 12r$ (n) $12p - 12p$ (o) $24x - 12x$

(p) $8p - 2p$ (q) $7a - 3a$ (r) $23z - 7z$

(s) $11c - 10c$ (t) $16m - 12m$

2. (a) $3n +2n + 4y$ (b) $4y + 6y - 7y$ (c) $5x + 8x - 3x$

(d) $10y + 6g - 3y$ (e) $8a - 8b - a$ (f) $5a - 9a + 6a$

(g) $8xy + 3xy - xy$ (h) $18n - 11n + 4n$ (i) $11g - g - 2g$

(j) $10z - 7z + 5x$ (k) $2a + 5a -12$ (l) $10r - 2r + 4s$

(m) $13a - 3a - 3a$ (n) $7d + 3s + d$ (o) $10a +6b - 6b$

(p) $3m - 7n + 4m$ (q) $10ab + ab - 7ab$ (r) $19x - 7y + 3x$

(s) $15cd - 10cd + 7a$ (t) $ak - 9 + 9ak$

Multiplication

There are three processes used when multiplying algebraic expressions:

1. Variables are multiplied to give powers.

   $y \times y \times y \quad = \quad y^3$

2. Numbers are multiplied separately.

   $2y \times 3y \quad = \quad 6y^2$

3. Unlike variables are put together in order of powers, then alphabetically without multiplication signs.

   $p \times q \quad = \quad pq$

   $b \times c \times a \times b \quad = \quad b^2ac$

Example

Simplify:

(a) $4 \times 2r$ (b) $5 \times p \times p$ (c) $uv \times 3u \times r$ (d) $4p \times 3q \times {}^{-}2r$

Solution

(a) $4 \times 2r \quad = \quad 8r$

(b) $5 \times p \times p \quad = \quad 5p^2$

(c) $uv \times 3u \times r \quad = \quad 3u^2rv$

(d) $4p \times 3q \times {}^{-}2r \quad = \quad {}^{-}24pqr$

Skill Exercises: Multiplication

Simplify:

1. (a) $5 \times 2m$
   (b) $2 \times 10c$
   (c) ${}^{-}7b \times {}^{-}d$
   (d) $5 \times {}^{-}3f$
   (e) ${}^{-}10s \times {}^{-}2y \times 2$
   (f) $7a \times 4y$
   (g) $8a \times 10b \times a$
   (h) $5p \times 6s \times s$
   (i) $a \times a \times b$
   (j) $ab \times ab \times b$
   (k) $3 \times 3r \times 2$
   (l) $12 \times ac$
   (m) $2m \times {}^{-}3s$
   (n) ${}^{-}6 \times -m \times m$
   (o) ${}^{-}11 \times {}^{-}k \times 2k$
   (p) $4a \times a \times {}^{-}2$
   (q) $1b \times 2ab \ \times 3a$
   (r) $qr \times {}^{-}3qr \times {}^{-}3q$
   (s) $wy \times {}^{-}3w \times y$
   (t) $2 \times {}^{-}2a \times -8$

2. (a) $3a \times 4a$
   (b) $8y^2 \times 2x$
   (c) $10f \times {}^{-}4f$
   (d) $h^2 \times 5h \times {}^{-}2$
   (e) $8a \times 2a \times -c$
   (f) $3ad \times ad \times {}^{-}d$
   (g) $7dp \times {}^{-}3p$
   (h) $klm \times {}^{-}k \times 6m$
   (i) $zm \times pm \times -m$
   (j) ${}^{-}2 \times {}^{-}3 \times 2f$
   (k) $5s \times {}^{-}4s$
   (l) $6p \times 7p \times -p$
   (m) $9a \times {}^{-}3a$
   (n) $11s \times 3s \times {}^{-}1$
   (o) $7w \times {}^{-}7w$
   (p) $6yz \times {}^{-}3y$
   (q) $5a \times {}^{-}3ac$
   (r) $pqr \times -qr$
   (s) ${}^{-}3 \times {}^{-}4d \times {}^{-}d$
   (t) $2p \times 3p \times -p$

Division

There are two processes used when dividing algebraic expressions:

1. Numbers are simplified.

$$\frac{12q}{3} = 4q$$

2. Variables are cancelled out.

$$\frac{5pq}{q} = \frac{5p\cancel{q}^{1}}{\cancel{q}_{1}}$$

$$= 5p$$

Example

Simplify:

(a) $\frac{6xy}{2x}$ (b) $\frac{8x}{2xy}$ (c) $\frac{3x}{6xy}$

Solution

(a) $\frac{6xy}{2x} = \frac{3\cancel{x}y}{\cancel{x}}$

$= 3y$

(b) $\frac{8x}{2xy} = \frac{4\cancel{x}}{\cancel{x}y}$

$= \frac{4}{y}$

(c) $\frac{3x}{6xy} = \frac{1\cancel{x}}{2\cancel{x}y}$

$= \frac{1}{2y}$

Skill Exercises: Division

Simplify:

(a) $\frac{12x}{4x}$ (b) $\frac{12x}{3x}$ (c) $\frac{15p}{5p}$ (d) $\frac{20q}{10q}$

(e) $\frac{20pq}{5q}$ (f) $\frac{20pq}{10p}$ (g) $\frac{5h}{10h}$ (h) $\frac{6gh}{12g}$

(i) $\frac{7x}{28xy}$ (j) $\frac{3abc}{6ac}$

Section 2.2 Expanding And Factoring Algebraic Expressions

Expanding

Removing the brackets of an algebraic expression is called expanding. Everything inside the brackets is multiplied by the term outside.

$5(c + d) = 5c + 5d$ (Everything inside the brackets is multiplied by five).

Example

Expand:

(a) $3(s - 2t)$ (b) $4x(x + s)$

Solution

(a) $3(s - 2t) = 3s - 6t$ (b) $4x(x + 8) = 4xx + 32x$

$= 4x^2 + 32x$

Skill Exercises: Expanding

Expand the following:

1. (a) $4(a + b)$ (b) $3(3m + 2)$ (c) $6(2g + h)$
   (d) $4(3y + z)$ (e) $2(4a + 7c)$ (f) $2(5d + 12)$
   (g) $b(8d + b)$ (h) $2x(4 + 3y)$ (i) $2a(4k + 3c)$
   (j) $xy(3a + x)$ (k) $4(3r -5t)$ (l) $6(f - 4h)$
   (m) $w(10 - 3w)$ (n) $9(4g - q)$ (o) $8k(4p - 7)$

2. (a) $5x(y + 3s)$ (b) $12(d + 3p)$ (c) $7c(4b - 3)$
   (d) $11(3f - 2)$ (e) $h(9e - w)$ (f) $7y(5s - 3v)$
   (g) $8q(6b - 5c)$ (h) $12x(4r - f)$ (i) $m(12 - 5m)$
   (j) $6d(3f - 7)$ (k) $7b(3m - n)$ (l) $5g(2 + 3b)$
   (m) $10(4f - g)$ (n) $5k(4 + k)$ (o) $24(2x - 3)$

Factorising

Factorising is the opposite of expanding. It puts brackets into the algebraic expression.

Find the highest common factor of each term. Put this factor on the outside of the brackets and divide it into each team.

$18b + 12c$ = ? (The highest common factor of 18 and 12 is 6)

$= 6(3b + 2c)$

Example

Factorise:

(a) $4x + 6y$ (b) $5bc - c$

Solution

(a) $4x + 6y$ (HCM is 2)
$= 2(2x + 3y)$

(b) $5bc - c$ (HCM is c)
$= c(5b - 1)$

Skill Exercises: Factorising

Factorise the following:

(a) $4s - 12y$	(b) $3w + 9m$	(c) $12 - 4n$
(d) $10k + 15r$	(e) $4f - 24v$	(f) $18b + 6r$
(g) $9j - 27$	(h) $16mn + 4n$	(i) $7ab - 21b$
(j) $abc + bc$	(k) $25xy - 5y$	(l) $15ab + 3a$
(m) $20 - 15g$	(n) $9pq + 24p$	(o) $14fg - 21g$
(p) $xyz + 2yz$	(q) $20hj + 4j$	(r) $2qr + 2q$
(s) $100 - 25d$	(t) $48bg - 36b$	

Unit 3: MEASUREMENT — PART 1

In this unit you will be:

3.1 Carrying out Practical Measuring Tasks involving Length, Mass and Time

- ◧ The Metric System.
- ◧ Estimating and Measuring (Metric Units).

3.2 Converting between Metric Measures

3.3 Converting between Metric and Imperial Measures

Section 3.1 Carrying Out Practical Measuring Tasks

The Metric System

The main system of measurement in Samoa is called the metric system. The three basic quantities of the metric system are:

Quantity	Quantity Symbol	Unit	Unit Symbol
length	l	metre	m
mass	m	kilogram	kg
time	t	second	s

Note: Mass is the amount of material in something. Most people use the word 'weight' when they are talking about mass but the two are not the same.

An astronaut has the same mass on the earth and the moon. She still has the same amount of skin, bone and blood. Her weight will be different. On the moon, gravity is less so she will be pulled down on the scales with less force and her 'weight' will be less.

Estimating and Measuring (Metric Units)

It is very useful to be able to estimate lengths and masses, because it may not always be easy to measure them. Some useful estimations are:

The height of a standard door is about 2 m.

The length of an adult step is about 1 m.

The length of a size 8 shoe is about 30 cm.

Most adults are between 1.5 m and 2.0 m in height.

It takes about 15 minutes to walk one kilometre.

The mass of a standard bag of sugar is 1 kg.

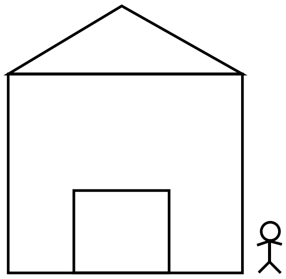
The mass of a car is about 1 tonne.

1 hectare = 10 000 m^2 (about two football fields).

A teaspoon holds about 5 ml of liquid.

The volume of a normal can of drink is about 330 cm^3.

Example 1



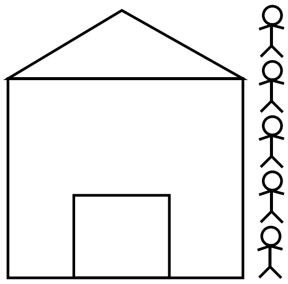
The diagram shows a tall man standing beside a factory.

Estimate:

(a) The height of the factory.

(b) The height of the door.

Solution



(a) The diagram shows that the height of the factory is approximately five times the height of the man.

Estimate the man's height as 1.8 m.

An estimate for the height of the factory is

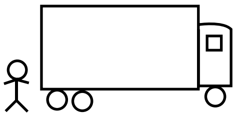
5×1.8 m = 9 m.

(b) The height of the door is approximately $1\frac{1}{2}$ times the height of the man.

An estimate for the height of the door is

$1\frac{1}{2} \times 1.8 = 2.7$ m

Example 2

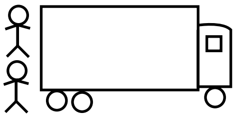


The diagram shows a tall person standing behind a lorry.

Estimate the length and height of the lorry, assuming the height of the person is about 1.8 m.

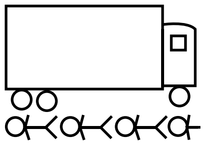
Solution

The diagram shows how to make estimates for the height and length.



Height ≈ 2×1.8 m

≈ 3.6 m



Length ≈ $3\frac{1}{2} \times 1.8$ m

≈ 6.3 m

Note: If the height of the person was actually 1.6 m, the estimates for height and length would change to 3.2 m and 5.6 m respectively.

Example 3

Feleti leaves for his uncle's village at 11.45 am. He rides in a car for 42 minutes, visits a friend on the way for 45 minutes and walks for 20 minutes.

What time does he arrive?

Solution

Car ride	42 mins
Visit	45 mins
Walk	20 mins
Total	107 mins
=	1 hr 47 mins

Start time 11.45 am	Travelling Time 1 hr 47 mins		
add the minutes	45 mins + 47 mins	=	92 mins
add the hours	11 am + 1 hr	=	12 pm
combine the times	12 pm + 92 min		
=	12 pm + 1 hr 32 mins		
=	1.32 pm		

Skill Exercises: Estimating and Measuring (Metric Units)

1. Estimate the following in your classroom:

   When you have finished all estimates, do the actual measurement and compare the results.

		Estimate	Actual
(a)	length of room		
(b)	width of room		
(c)	height of room		
(d)	height of door		
(e)	height of windows		
(f)	width of black/white board		

2. Estimate the following:
   (a) The height of a rugby goal.
   (b) The width of a rugby field.
   (c) The width of a netball court.
   (d) The height of a netball post.

Measure the actual heights and widths and compare with your estimates. Present your results in a table like question 1.

3. (a) Estimate the size of your text book (width, height and thickness).
   (b) Measure your text book to see how good your estimates were.

4. Estimate the lengths of the following vehicles:
   (a) A car
   (b) A bus.
   (c) A truck.
   (d) A motorcycle.

5. Collect together a number of items of various masses.
   (a) Copy and complete the table, writing in the actual mass after each estimate.

Item	**Estimate of Mass**	**Actual Mass**
Text book		
Can of drink		

   (b) Do you become more accurate at estimating as you have more practice?

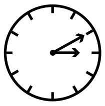
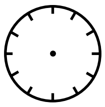
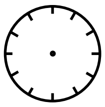
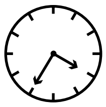
6. Estimate the mass of the following:
   (a) A table tennis ball.
   (b) A chair.
   (c) A large dog.
   (d) Your school bag, when full.
   (e) A calculator.
   (f) A pen.

Measure the actual mass and present your results in a table like question 5(a).

7. Estimate the time spent on these activities in one week:

	Time Estimate
Travelling to school	
Eating	
Doing homework	
Sleeping	
Watching movies	

8. In the table below, time can be written in four ways. Copy the table and complete the missing time.

	(a)	(b)	(c)	(d)
Time on a clock	 afternoon			 afternoon
Digital time	3.10 pm		11.45 am	
Twenty-four hour time				1635
Time in words		twenty past one at night		

9. Tasi has a 180 minute video tape in his VCR which has a 24-hour clock.

   (a) Tasi sets the video to record a live world cup rugby match. The video starts recording at 0425 hours and stops at 0605 hours. How long is the recording?

   (b) He then records a concert on the same tape. The concert lasts 55 minutes and starts at twenty-five minutes to eight at night. When does the recording stop?

   (c) Can Tasi now record a 20 minute cartoon on the same tape?

Section 3.2 Converting Between Metric Measures

The metric system uses a number of standard prefixes for units of length, mass, etc.

The three most important are:

kilo = 1000

centi = $\frac{1}{100}$

milli = $\frac{1}{1000}$

You will have met many of these already, for example:

1 millimetre $= \frac{1}{1000}$ metre so 1 metre = 1000 milimetres

1 kilogram = 1000 grams so 1 gram $= \frac{1}{1000}$ kilograms

1 centimetre $= \frac{1}{100}$ metre so 1 metre = 100 centimetres

1 millilitre $= \frac{1}{1000}$ litre so 1 litre = 1000 millilitres

It is also useful to know that:

$1 \text{ cm}^3 = 1$ millilitre (ml)

and

1000 kg = 1 tonne

Example 1

Complete each of the following statements:

(a) 150 cm $= \boxed{}$ m

(b) 360 mm $= \boxed{}$ m

(c) 3.6 tonnes $= \boxed{}$ kg

(d) 62 ml $= \boxed{}$ litres

Solution

(a) 150 cm $= 150 \times \frac{1}{100}$

$= 1.5$ m

(b) 360 mm $= 360 \times \frac{1}{1000}$

$= 0.36$ m

(c) 3.6 tonnes $= 3.6 \times 1000$

$= 3600$ kg

(d) 62 ml $= 62 \times \frac{1}{1000}$

$= 0.062$ litres

Example 2

John adds 250 ml of water to a jug that already contains 1.2 litres of water. How much water is now in the jug?

Solution

1.2 litres $= 1.2 \times 1000$

$= 1200$ ml

Total volume $= 1200 + 250$

$= 1450$ ml or 1.45 litres

Skill Exercises: Converting between Metric Measures

1. Change the following lengths to mm:

(a) 4 cm (b) 7 cm (c) 26 cm (d) 835 cm
(e) 6.2 cm (f) 14.7 cm (g) 9.25 cm (h) 0.04 cm

Change the following lengths into cm:

(i) 60 mm (j) 80 mm (k) 340 mm (l) 9450 mm
(m) 87 mm (n) 262 mm (o) 67.9 mm (p) 6 mm

2. Change the following lengths into cm:

(a) 7 m (b) 18 m (c) 36 m (d) 904 m
(e) 4.3 m (f) 53.9 m (g) 28.38 m (h) 0.09 m

Change the following lengths into m:

(i) 800 cm (j) 500 cm (k) 760 cm (l) 2150 cm
(m) 365 cm (n) 57 cm (o) 77.6 cm (p) 6 cm

3. Change the following lengths into m:

(a) 5 km (b) 11 km (c) 63 km (d) 423 km
(e) 7.4 km (f) 2.56 km (g) 14.321 km (h) 0.07 km

Change the following lengths into km:

(i) 6000 m (j) 17 000 m (k) 53 000 m (l) 4750 m
(m) 807 m (n) 62 m (o) 3 m (p) 29.3 m

4. Change the following masses into g:

(a) 6 kg (b) 8 kg (c) 15 kg (d) 92 kg
(e) 1.7 kg (f) 5.47 kg (g) 2.925 kg (h) 0.004 kg

Change the following masses into kg:

(i) 3000 g (j) 40 000 g (k) 8340 g (l) 29 750 g
(m) 237 g (n) 52 g (o) 9 g (p) 3.6 g

5. Copy and complete each of the following statements:

(a) 320 mm = ☐ m (b) 6420 mm = ☐ m

(c) 642 mm = ☐ m (d) 888 cm = ☐ m

(e) 224 cm = ☐ mm (f) 45 m = ☐ mm

(g) 320 m = ☐ cm (h) 8.73 m = ☐ mm

6. Convert the following masses to kg:

   (a) 8.2 tonnes (b) 160 tonnes (c) 88 g (d) 3470 g

7. Convert the following masses to g:

   (a) 3.6 kg (b) 3.7 tonnes (c) 840 mg (d) 62 mg

8. Convert the following volumes to ml:

   (a) $\frac{1}{4}$ litre (b) 22 litres (c) 0.75 litres (d) 450 cm^3

9. Convert the following volumes to litres:

   (a) 4740 ml (b) 64 ml (c) 300 ml (d) 3600 cm^3

10. A cake recipe requires 0.25 kg of flour. Lautele has 550 grams of flour. How much flour will she have left when she has made the cake? Give your answer:

    (a) in kg. (b) in g.

11. A chemistry teacher requires 250 mg of a chemical for an experiment. He has 30 grams of the chemical. How many times can he carry out the experiment?

12. A bottle contains 1.5 litres of cola. Sani drinks 300 ml of the cola and then Rosa drinks 450 ml. How much of the cola is left? Give your answer:

    (a) in ml. (b) in litres.

13. Tama estimates that the mass of one sweet is 20 grams. How many sweets would you expect to find in a packet that contains 0.36 kg of these sweets?

14. To make a certain solution, 50 grams of a chemical must be dissolved in 4 litres of water.

    (a) How much of the chemical should be dissolved in 1 litre of water?

    (b) How many ml of water would be needed for 200 mg of the chemical?

    (c) How many grams of the chemical would be dissolved in 500 ml of water?

Section 3.3 Converting Between Metric And Imperial Measures

The Imperial system of Measurement is an older system that was common before the Metric system was introduced.

Some Imperial units are still in general use, so you need to be able to convert between the two systems. The list below contains a number of useful conversion facts which you will need in the examples and exercises that follow.

8 km $\approx$ 5 miles

1 m $\approx$ 40 inches

30 cm $\approx$ 1 foot

2.5 cm $\approx$ 1 inch

1 kg $\approx$ 2.2 lbs

1 litre $\approx$ $1\frac{3}{4}$ pints

1 gallon $\approx$ $4\frac{1}{2}$ litres

1 acre $\approx$ $\frac{2}{5}$ hectare

450 g $\approx$ 1 lb

The following list reminds you of some of the relationships in the Imperial System:

1 lb = 16 ounces
1 stone = 14 lb
1 mile = 1760 yards
1 yard = 3 feet
1 foot = 12 inches
1 gallon = 8 pints
1 chain = 22 yards
1 furlong = 220 yards

Also note that 1 acre = 4840 square yards (approximately the area of a football field).

Conversions between metric and imperial units are not precise, so we always round the converted figure, taking the context into account (see Examples 1 and 2 below).

Example 1

While on holiday in the U.S.A, a family see the following road-sign:

NEW YORK 342 miles

How many kilometres are the family from New York?

Solution

Note: 8km ≈ 5 miles

Distance from New York $\approx 342 \times \frac{8}{5}$ kilometres

$\approx$ 547 kilometres

The family are therefore about 547 kilometres from New York.

Example 2

A bottle contains 2.5 litres of milk. How many pints of milk does the bottle contain?

Solution

Note: 1 litre ≈ $1\frac{3}{4}$ pints

Volume of milk $\approx 2.5 \times 1.75$ pints

$\approx$ 4.375 pints

The bottle contains almost $4\frac{1}{2}$ pints of milk.

Example 3

Vera buys 27 litres of petrol for her car. How many gallons of petrol does she buy?

Solution

Note: 1 gallon ≈ 4.5 litres

Quantity of petrol $\approx \dfrac{27}{4.5}$

$\approx$ 6 gallons

Vera buys approximately 6 gallons of petrol.

Skill Exercises: Converting between Metric and Imperial Measures

1. Convert the following distances to cm, giving your answers to 2 significant figures where necessary:

(a) 6 inches (b) 8 inches (c) $7\frac{1}{2}$ inches (d) 8 feet

(e) 4 yards (f) $1\frac{1}{4}$ yards

2. A road-sign in the U.S.A gives distances in miles:

   Produce a version of the sign with the equivalent distances given in kilometres:

SEATTLE	400 miles
AUBURN	384 miles
TACOMA	168 miles
LAKE TAPPS	162 miles
OLYMPIA	148 miles

3. A recipe requires $\frac{1}{2}$ lb of flour. What is the equivalent amount of flour in:

   (a) grams? (b) kilograms? (c) ounces?

4. The capacity of a fuel tank is 30 gallons. What is the capacity of the tank in:

   (a) litres? (b) pints

5. A cow produces an average of 18 pints of milk each time she is milked. Convert this to litres, giving your answer to 1 decimal place.

6. The mass of a parcel is 4 lb 4 oz. Calculate its mass in kilograms, giving your answer to 1 decimal place.

7. Copy and complete the table shown, which can be used to convert speeds between mph and km/h. Where necessary, express your answer to 3 significant figures.

Mph	Km/h
30	
	50
40	
	70
	80
60	
	100
70	
	120

Unit 4: GEOMETRY — PART 1

In this unit you will be:

4.1 Investigating Triangles

- Measuring Angles.
- Classifying Angles.
- Constructing Triangles
- Finding Angles in Triangles.

4.2 Investigating 2-D and 3-D Shapes

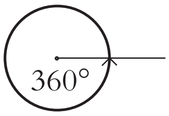
- Naming Shapes.
- Representing Shapes.
- Modelling Shapes.

Section 4.1 Investigating Triangles

Measuring Angles

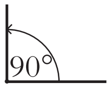
A protractor can be used to measure or draw angles.

Note: The angle around a complete circle is 360°.



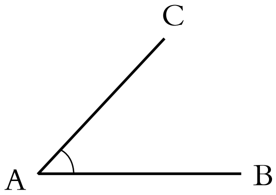
The angle around a point on a straight line is 180°.

A right angle is 90°.



Example 1

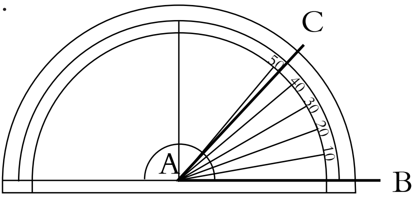
Measure the angle CAB in the triangle shown.



Solution

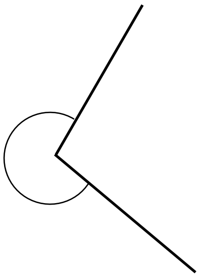
Place a protractor on the triangle as shown.

The angle is measured as 47°.



Example 2

Measure this angle.

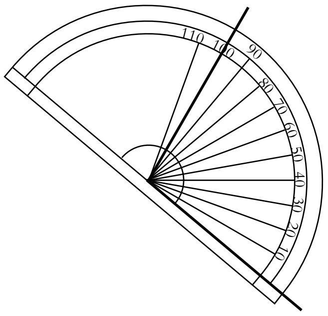


Solution

Using a protractor, the smaller angle is measured as 100°.

So required angle = 360° – 100°

= 260°



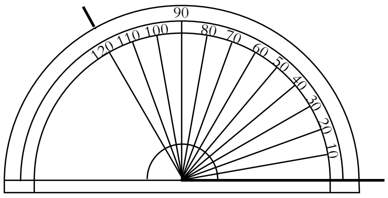
Example 3

Draw angles of:

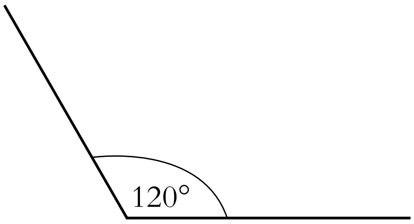
(a) 120° (b) 330°

Solution

(a) Draw a horizontal line. Place a protractor on top of the line and draw a mark at 120°.



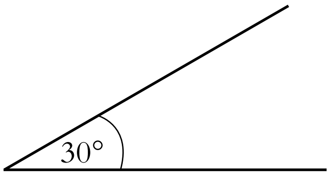
Then remove the protractor and draw the angle.



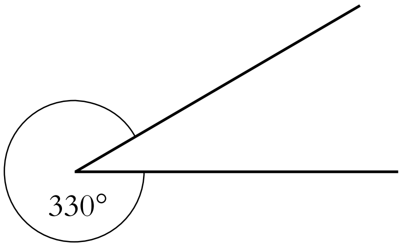
(b) To draw the angle of 330°, first subtract 330° from 360°.

360° – 330° = 30°.

Draw an angle of 30°.



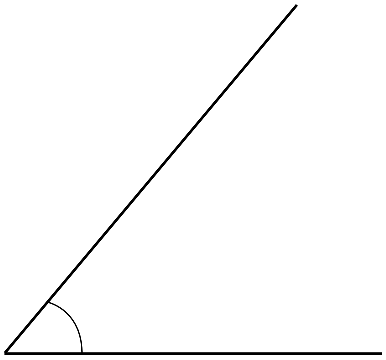
The large angle will be 330°.



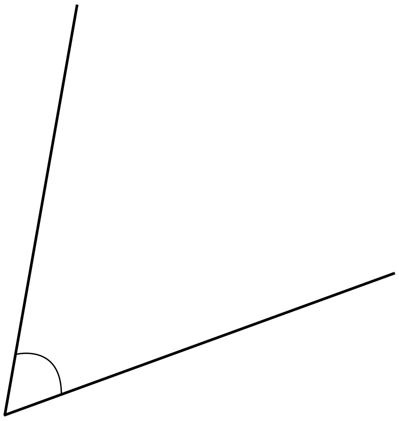
Skill Exercises: Measuring Angles

1. For each of the following angles, first estimate the size of the angle and then measure the angle to see how good your estimate was.

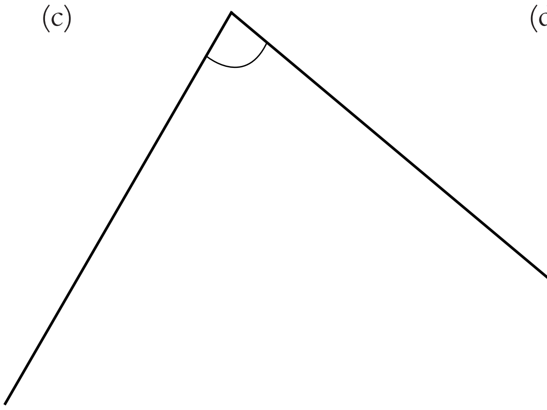
(a)



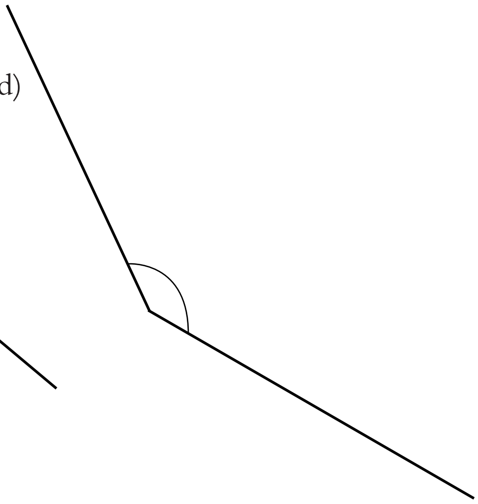
(b)



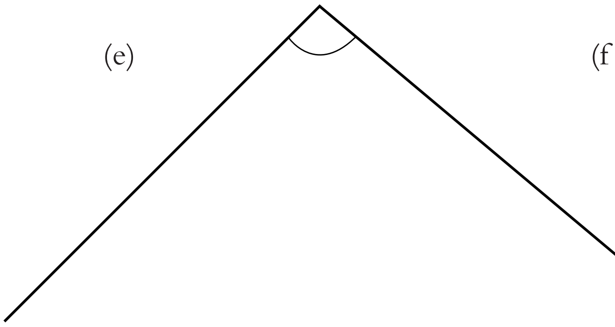
(c)



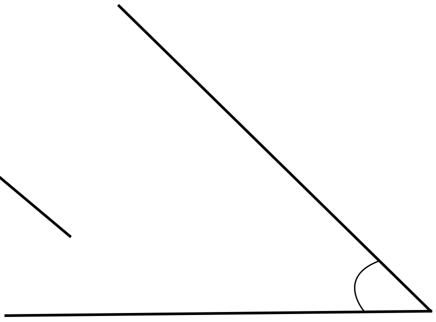
(d)



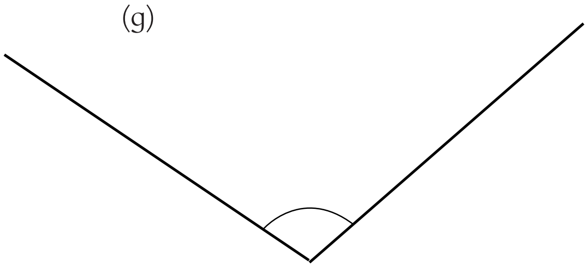
(e)



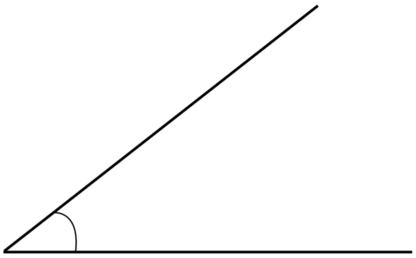
(f)



(g)

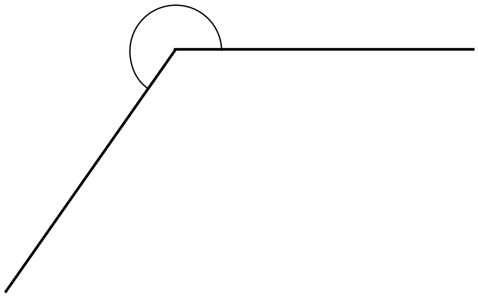


(h)

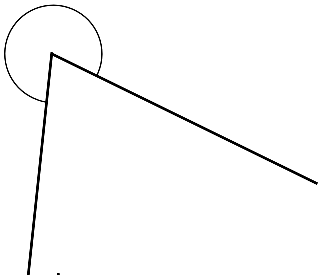


2. Estimate and measure the size of each of the angles.

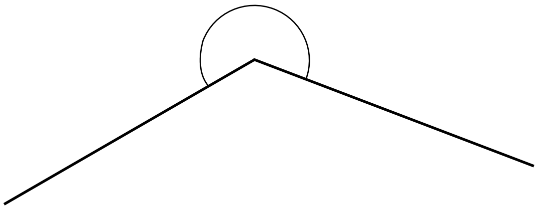
(a)



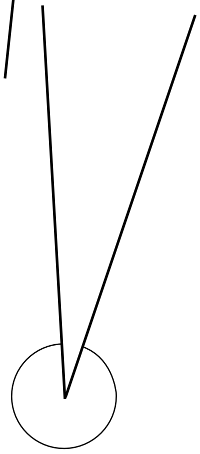
(b)



(c)

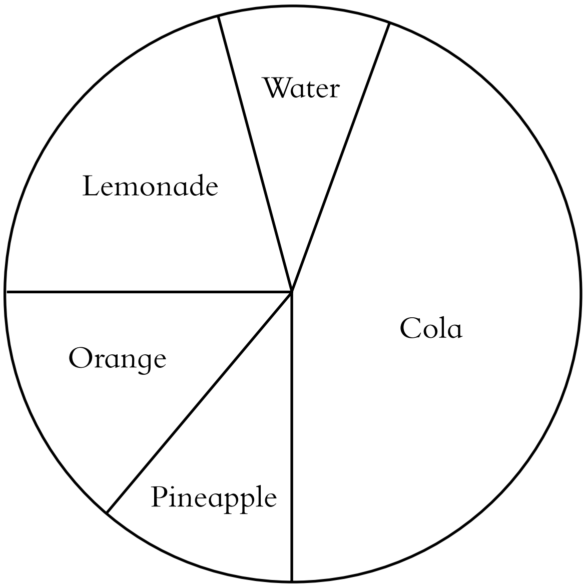


(d)



3. (a) Measure each of the angles in the pie chart.

Favourite drinks for class 9T.



(b) Explain how you can tell that cola is the most popular drink.

(c) What is the second most popular drink?

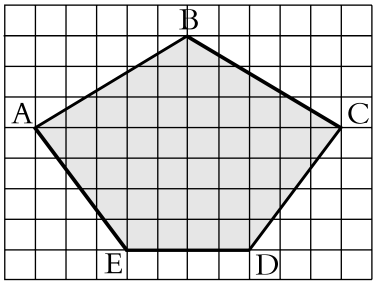
4. Draw the following angles:

(a) 20°	(b) 42°	(c) 80°	(d) 105°
(e) 170°	(f) 200°	(g) 275°	(h) 305°

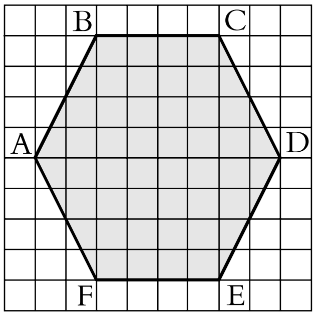
5. In which of these polygons are the angles all the same size?

Find all the angles in each polygon. (You may need to copy the shapes into your book and extend the lines.)

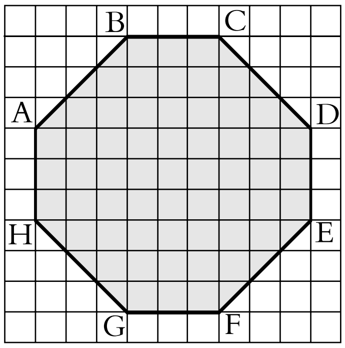
(a)



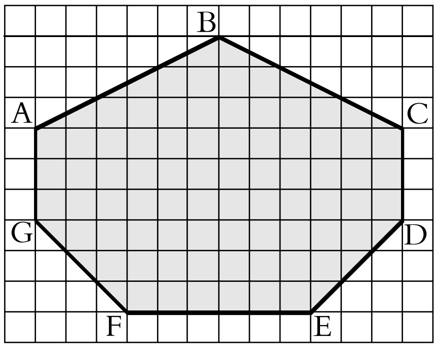
(b)



(c)



(d)



Classifying Angles

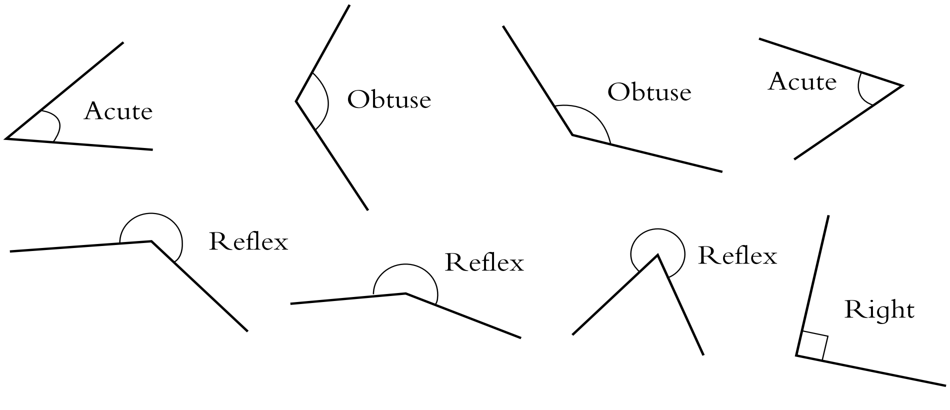
An angle of 90° is a **right** angle.

Angles of less than 90° are **acute** angles.

Angles between 90° and 180° are **obtuse** angles.

Angles between 180° and 360° are **reflex** angles.

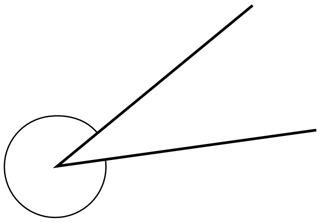
Here are some examples:



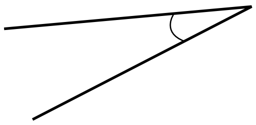
Skill Exercises: Classifying Angles

1. Is each angle below acute, obtuse or reflex?

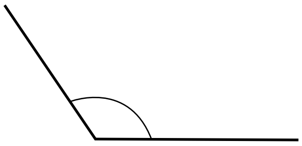
(a)



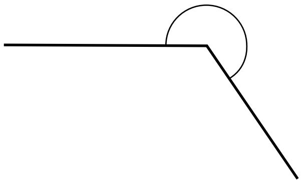
(b)



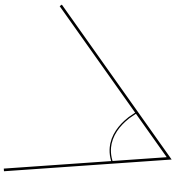
(c)



(d)



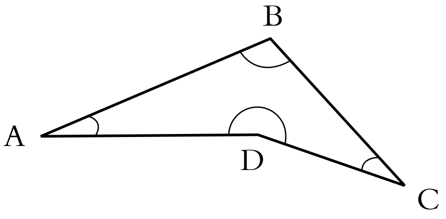
(e)



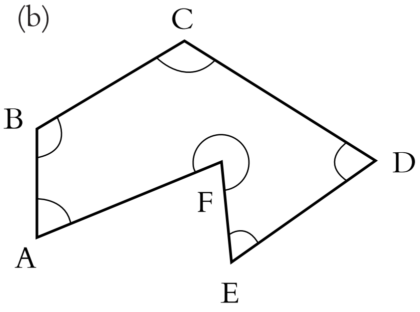
(f)

2. For each shape below state whether the angle at each corner is acute, obtuse or reflex.

(a)



(b)

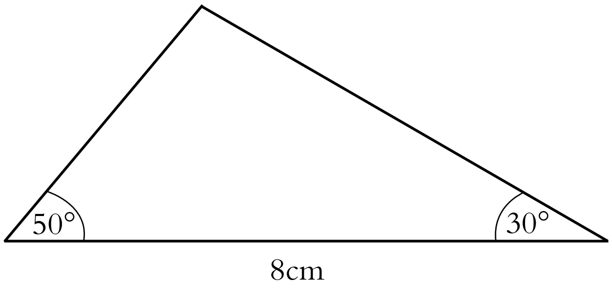


Constructing Triangles

Here you will see how to construct triangles.

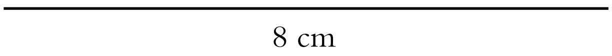
Example 1

Draw this triangle and measure the unknown angle.

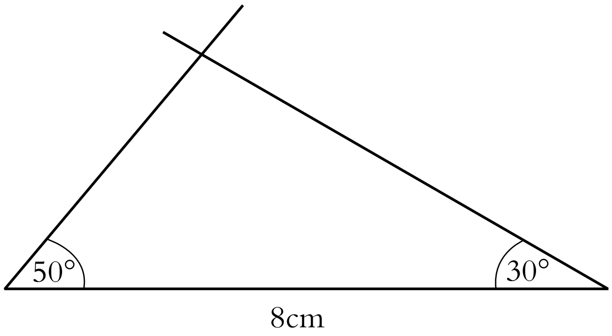


Solution

First drawn the base line of 8 cm.



At each end, use a protractor to draw lines at 50° and 30° to the line.

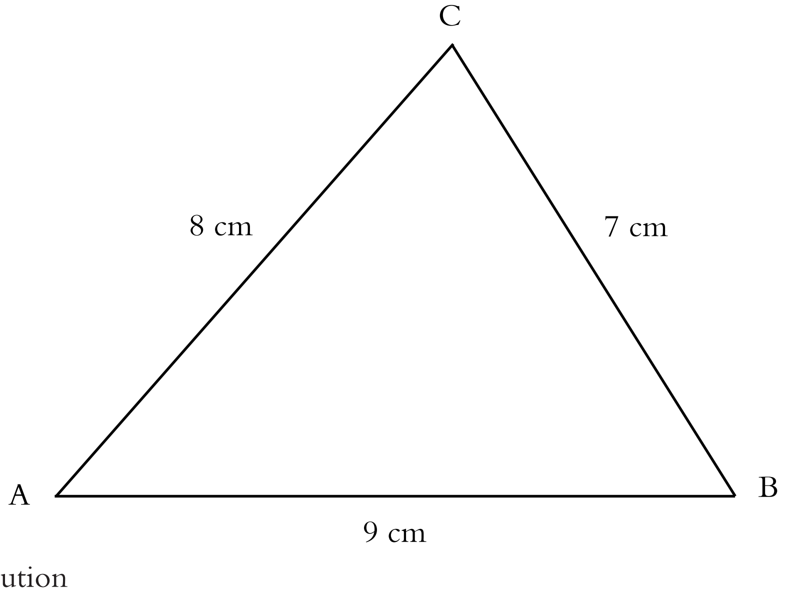


The intersection of these two lines is the third point of the triangle.

This angle measures about 100°.

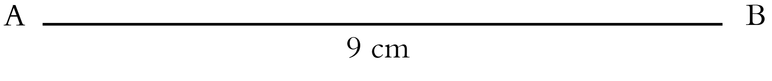
Example 2

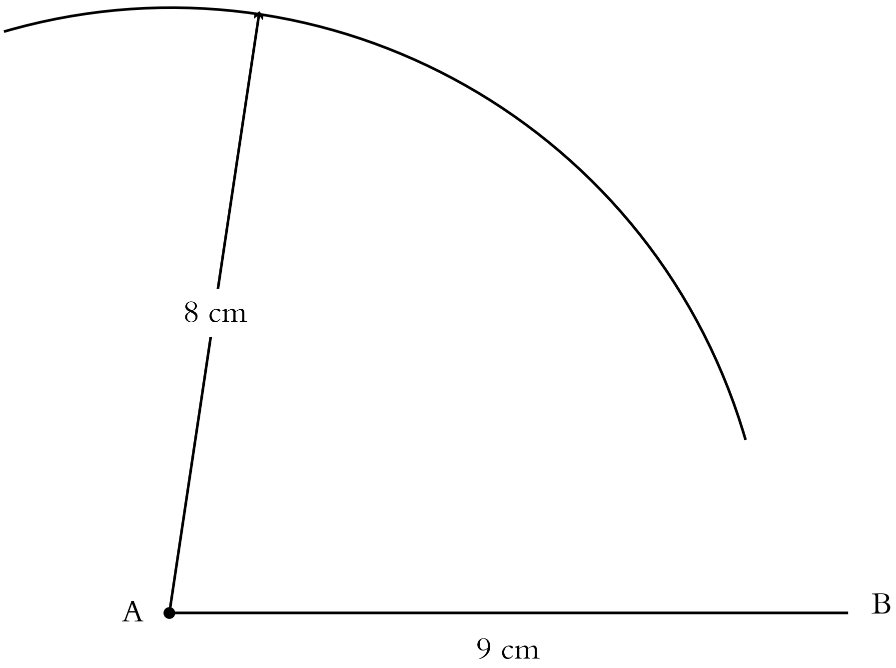
Draw this triangle.



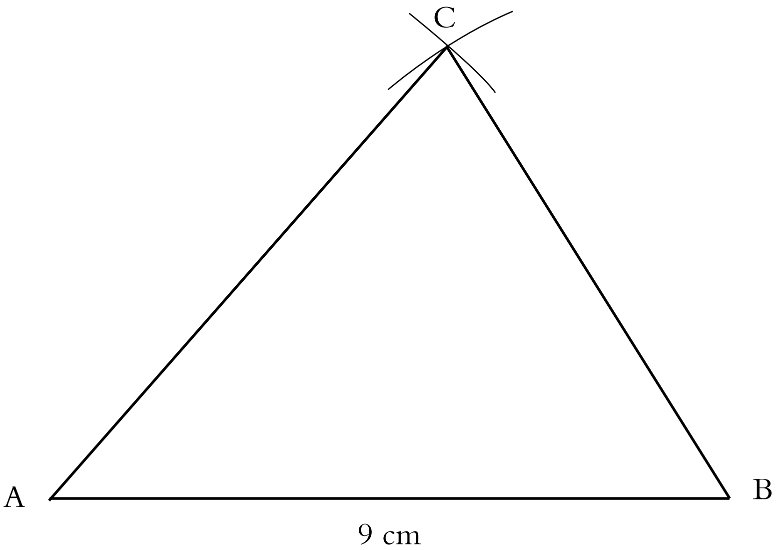
Solution

First draw the base line, AB, of length 9 cm.





Then set your compass so that the pencil tip is 8 cm from the point and drawn an arc with its centre at A, as shown.

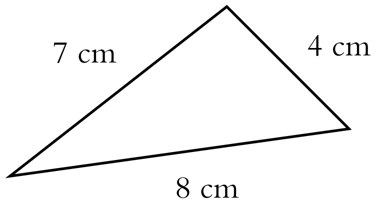


Then draw a similar arc with your compass set at 7 cm and B as the centre. The point where the two arc cross is the third corner of the triangle.

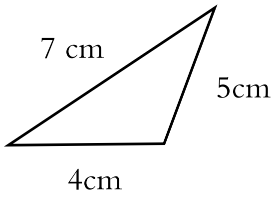
Skill Exercises: Constructing Triangles

1. Draw these triangles accurately. In each triangle, measure the angles and find their total.

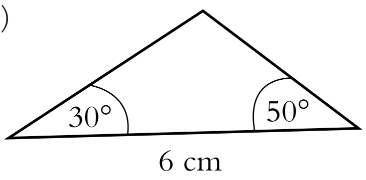
(a)



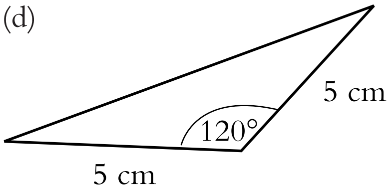
(b)



(c)



(d)

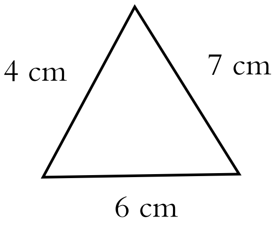


2. Compare your triangles with those drawn by other people in your class. Do your triangles look the same?

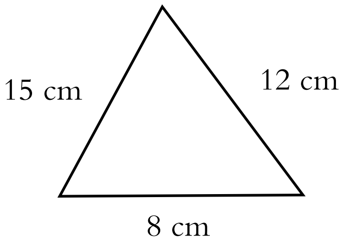
3. Explain why you cannot draw a triangle with sides of lengths 12 cm, 5 cm and 4 cm.

4. Which of these triangles can your draw?

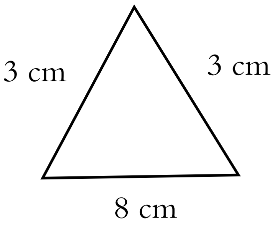
(a)



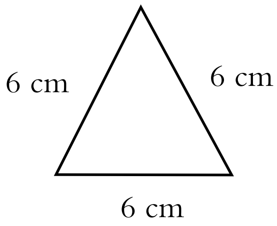
(b)



(c)

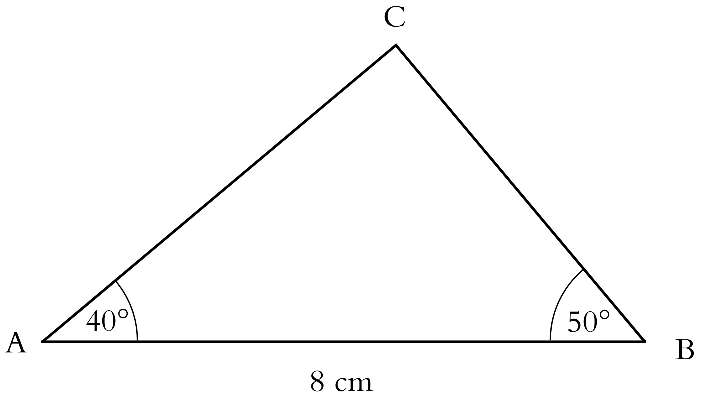


(d)



Draw those that are possible, and measure the angles in them.

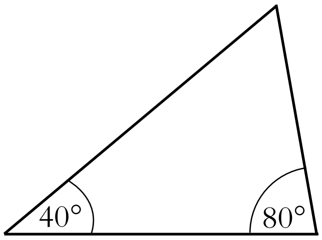
5. (a) Draw the triangle below and measure the lengths of the two sloping sides of the triangle.



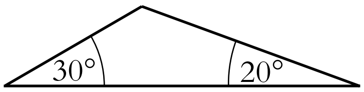
(b) Measure the third angle in the triangle.

6. Draw each triangle below and measure the third angle in each of the triangles.

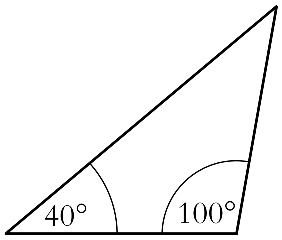
(a)



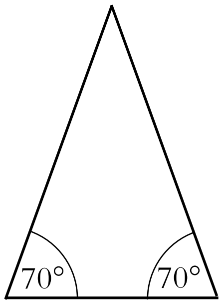
(b)



(c)



(d)

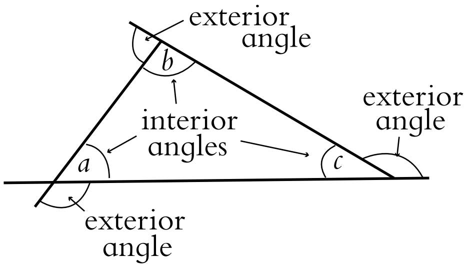


What do you notice?

Finding Angles in Triangles

The interior angles of any triangle will always sum (add up) to 180°.

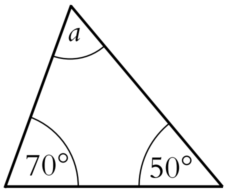
$$\boxed{a + b + c = 180°}$$



Example

Find the angle marked *a* in the diagram opposite.

Solution



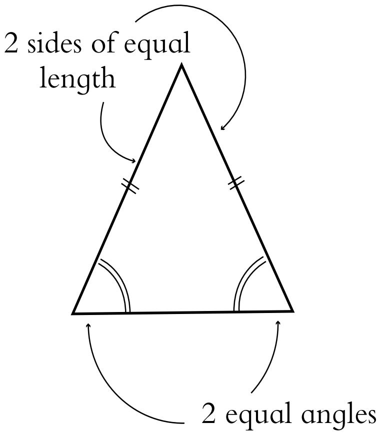
$70° + 50° = 120°$

so $180° – 120° = 60°$

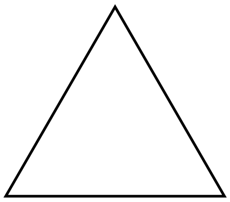
and $a = 60°$

The final part of this section deals with the classification of triangles.

ISOSCELES TRIANGLE



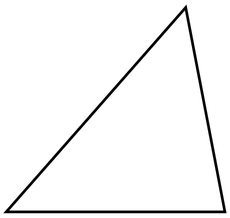
EQUILATERIAL TRIANGLE



All sides are the same length.

All angles are 60°.

SCALENE TRIANGLE



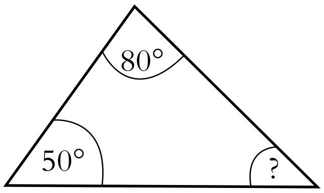
All sides have different lengths.

All angles are of different sizes.

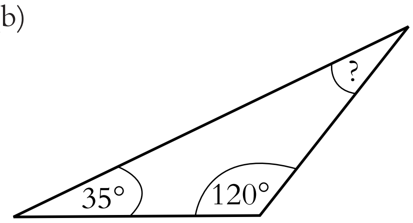
Skill Exercises: Finding Angles in Triangles

1. Find the unknown angle in each triangle:

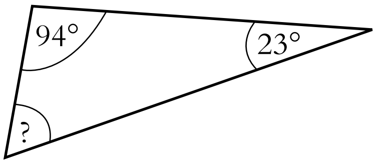
(a)



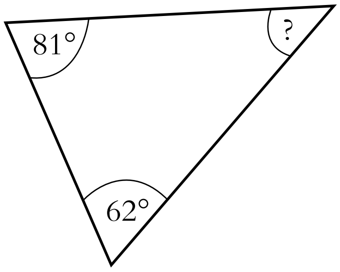
(b)



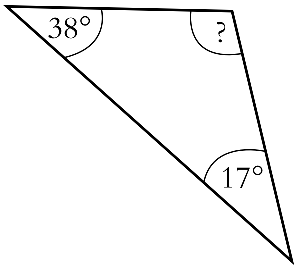
(c)



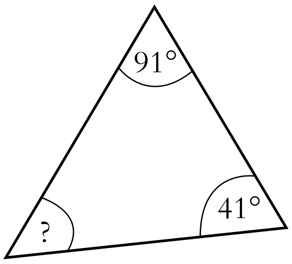
(d)



(e)

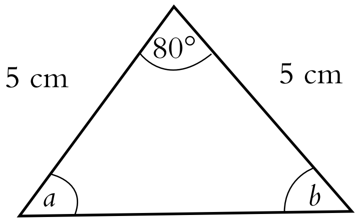


(f)

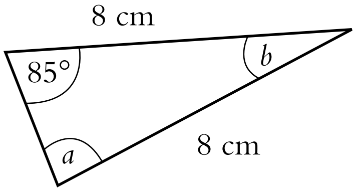


2. Find the unknown angles in each of the following triangles:

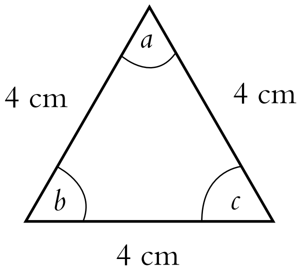
(a)



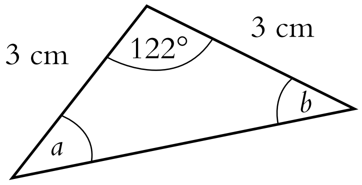
(b)



(c)

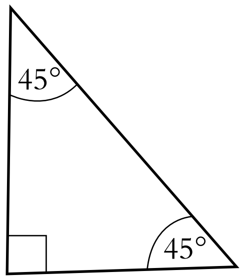


(d)

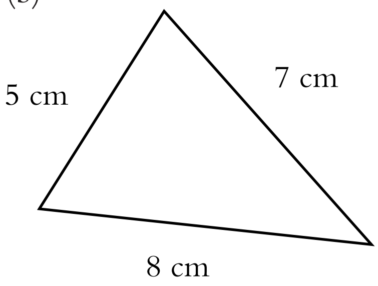


3. State whether each triangle below is isosceles, equilateral or scalene:

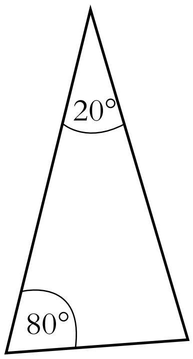
(a)



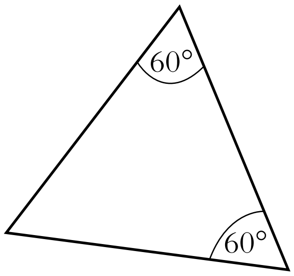
(b)



(c)

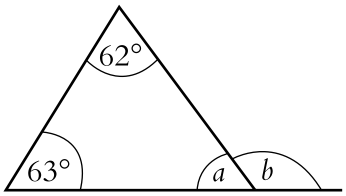


(d)

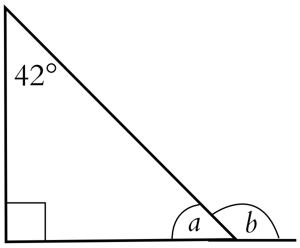


4. For each triangle below, find the interior angle and the marked exterior angle:

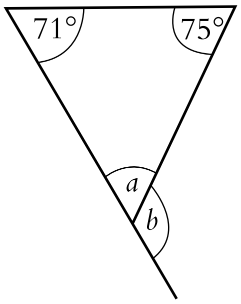
(a)



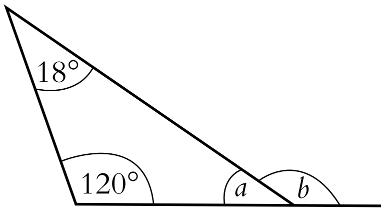
(b)



(c)



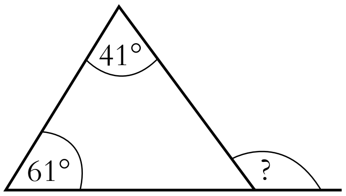
(d)



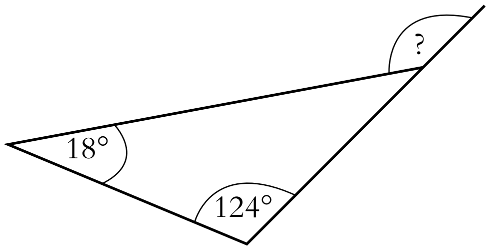
5. Explain how to find the exterior angle without having to calculate an interior angle.

   Find the exterior angles marked on these triangles:

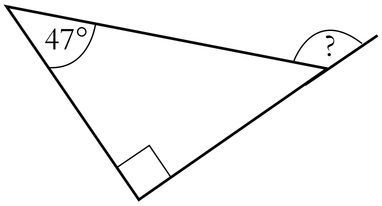
   (a)



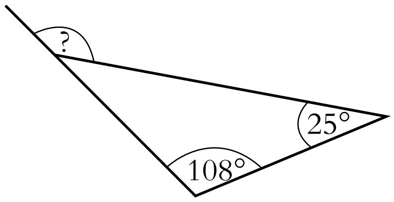
   (b)



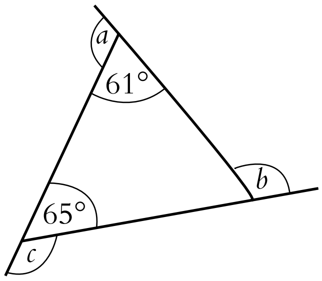
   (c)



   (d)



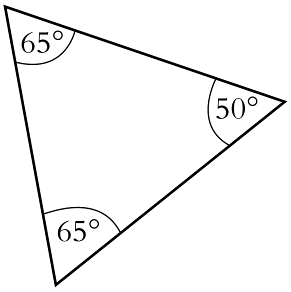
6. Find the total of the three exterior angles for this triangle.



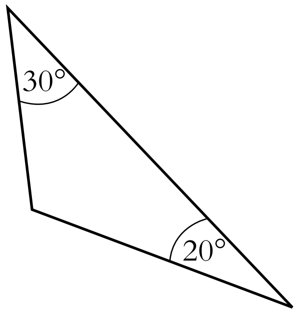
   Do you think you will get the same answer for different triangles? Explain your answer.

7. For each of the following triangles, draw in the exterior angles and find their total:

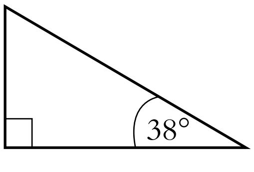
   (a)



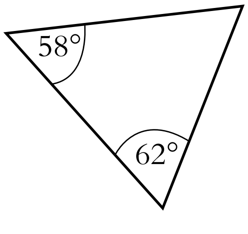
   (b)



   (c)



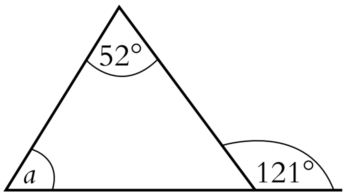
   (d)



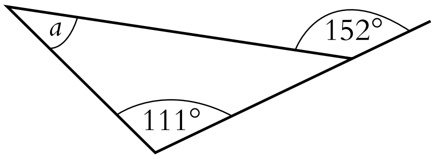
   Comment on your results.

8. Find the unknown angle or angles marked in each of the following diagrams:

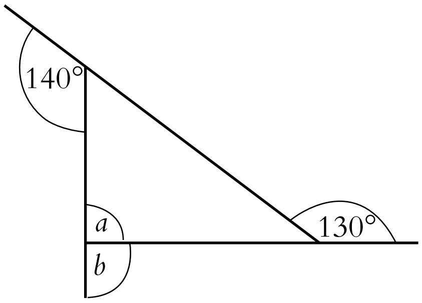
(a)



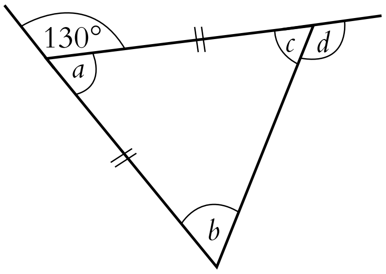
(b)



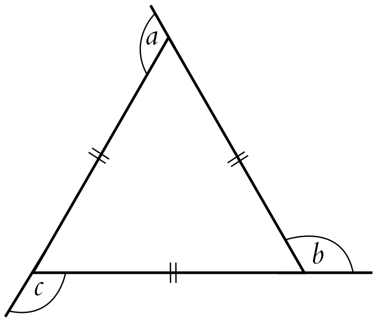
(c)



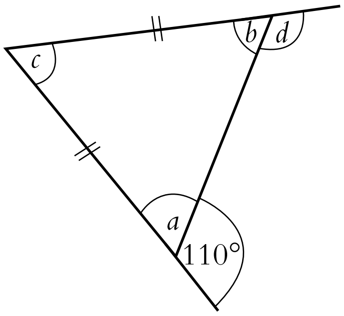
(d)



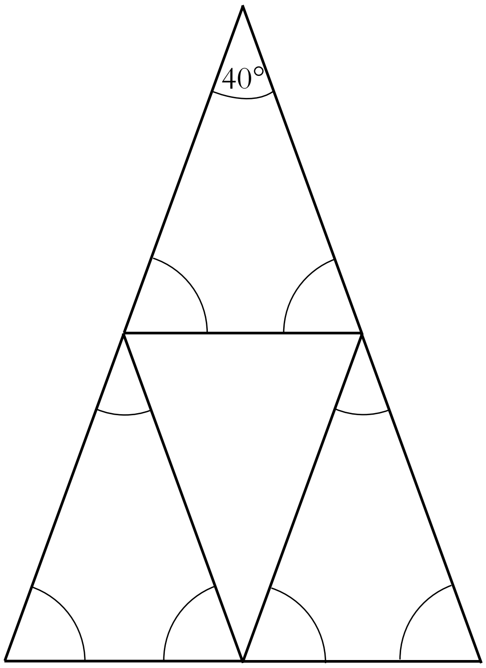
(e)



(f)



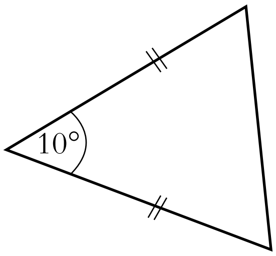
9. Part of a roof is made out of four similar isosceles triangles.



Copy the diagram and mark the sides that have the same lengths.

On your diagram, write in the size of all the marked angles.

10. (a) For this isosceles triangle, find the other two interior angles.



(b) Find the other angles if the 10° increases to 20° and then to 30°.

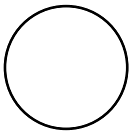
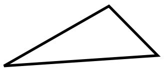
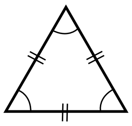
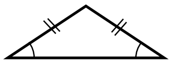
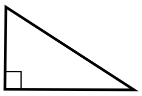
(c) What do you think will happen if the 10° increased to 40°?

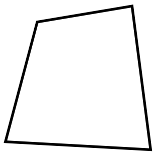
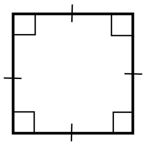
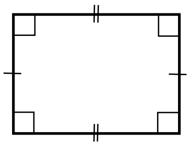
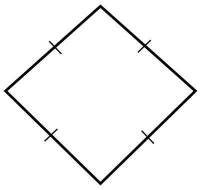
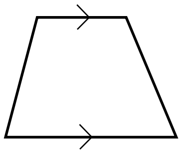
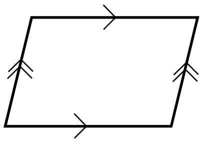
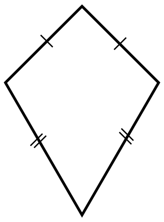
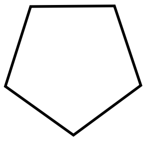
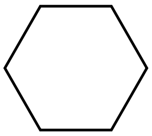
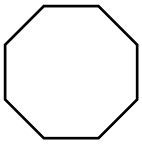
11. One angle of an isosceles triangle is 70°. What are the other angles? (There is more than one solution!)

Section 4.2 Investigating 2-D And 3-D Shapes

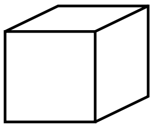
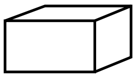
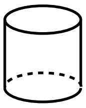
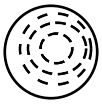
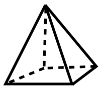
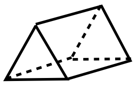
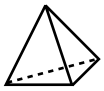
Naming Shapes

You have already met many 2-D shapes; here are some with which you should already be familiar:

NAME	ILLUSTRATION	NOTES
Circle		Symmetrical about any diameter
Triangle		3 straight sides
Equilateral Triangle		3 equal sides and 3 equal angles (= 60°)
Isosceles Triangle		2 equal sides and 2 equal angles
Right-angle Triangle		One angle = 90°

NAME	ILLUSTRATION	NOTES
Quadrilateral		4 straight sides
Square		4 equal sides and 4 right angles
Rectangle		Opposite sides equal and 4 right angles
Rhombus		4 equal sides; opposite sides parallel
Trapezium		One pair of opposite sides parallel
Parallelogram		Both pairs of opposite sides equal and parallel
Kite		Two pairs of adjacent sides equal
Pentagon		5 sides (equal if regular)
Hexagon		6 sides (equal if regular)
Octagon		8 sides (equal if regular)

There are also several 3-D shapes with which you should be familiar:

NAME	ILLUSTRATION	NOTES
Cube		All side lengths equal (square faces), and all angles right angles
Cuboid		Faces are combination of rectangles (and squares); all angles right angles
Cylinder		Circular base
Sphere		All points on surface equidistant from centre
Pyramid (square based)		All slant edges are equal in length in a right pyramid
Prism (triangular)		Cross-section remains the same throughout
Tetrahedron		All four faces are triangular

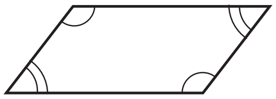
Note that a square is a special case of a rectangle, as it satisfies the definition; similarly, both a square and a rectangle are special cases of a parallelogram, etc.

Example 1

What is the name of the 2-D shape with 4 sides and with opposite angles equal?

Solution

The shape has to be a parallelogram.



Example 2

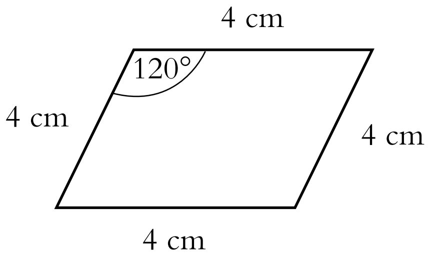
Draw accurately:

(a) a rhombus with sides of length 4 cm and one angle 120°.

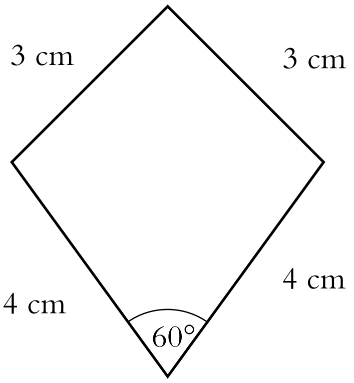
(b) a kite with sides of length 3 cm and 4 cm, and smallest angle 60°. Measure the size of each of the other angles.

Solution

(a)



(b) Note that the smallest angle, 60°, must be between the two longest sides. The other angles are approximately 108°, 108° and 84°.



Skill Exercises: Naming Shapes

1. What could be the name of the 2-dimensional shape with 4 sides, which has all angles of equal sizes?

2. What is the name of a 6-sided, 2-dimensional shape which has sides of equal lengths?

3. Draw a parallelogram with sides of lengths 3 cm and 4 cm and with smallest angle equal to 60°.

4. Can a 4-sided, 2-dimensional shape have 4 sides of equal lengths, and not be a square?

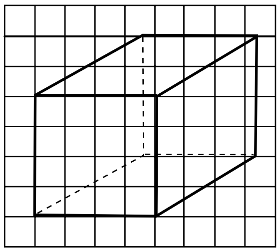
5. Can a 4-sided, 2-dimensional shape have 4 angles of equal size, and not be a square?

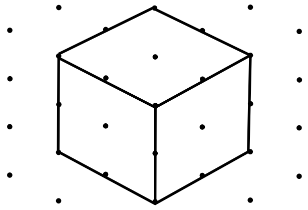
6. Name all possible 4-sided, 2-dimensional shapes that have at least 2 sides of equal lengths.

7. Name all possible 4-sided, 2-dimensional shapes that have at most 2 sides of equal lengths.

Representing Shapes

In this section we explore how to draw 3-D shapes, either on squared paper or on isometric (triangular spotty) paper. Examples of each for a 2 cm cube, are shown below:



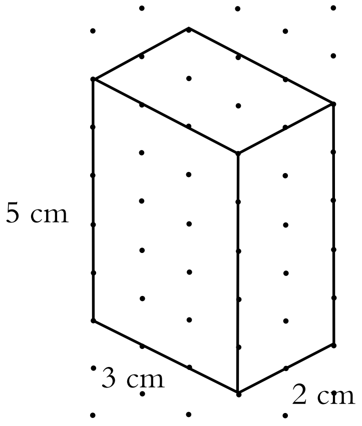


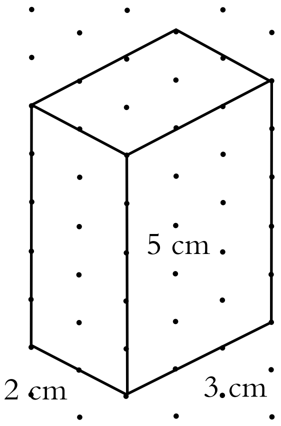
Example 1

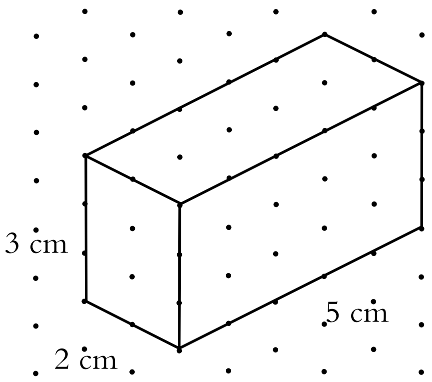
On isometric paper, draw a cuboid with sides of lengths 5 cm, 3 cm and 2 cm.

Solution

The diagrams that follow show three of the possible ways of drawing a 2 cm × 3 cm × 5 cm cuboid.







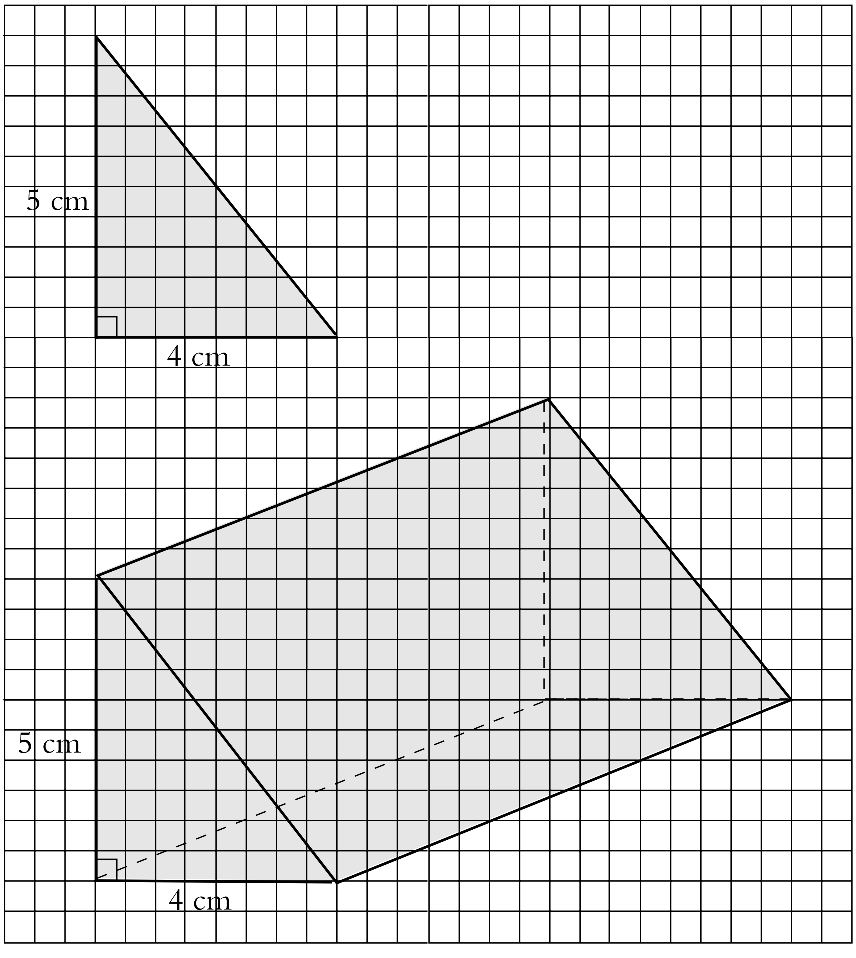
Example 2

A triangular prism has a cross-section that is a right-angled triangle with base 4 cm and height 5 cm. The length of the prism is 8 cm.

Draw the prism.

Solution

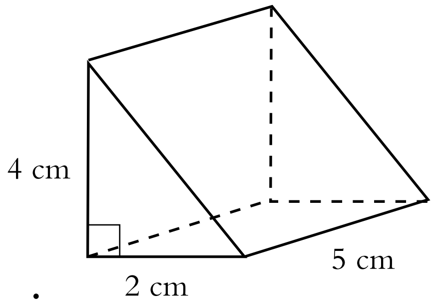
First draw the cross-section of the prism. Then draw two lines of length 8 cm, parallel to each other. Complete the triangle at the other end of the prism.



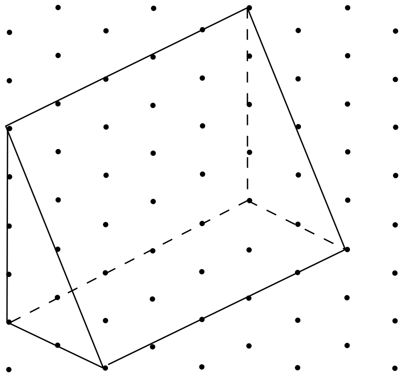
Note: Lines parallel on the object are parallel on the diagram.

Example 3

Draw this prism on isometric paper:



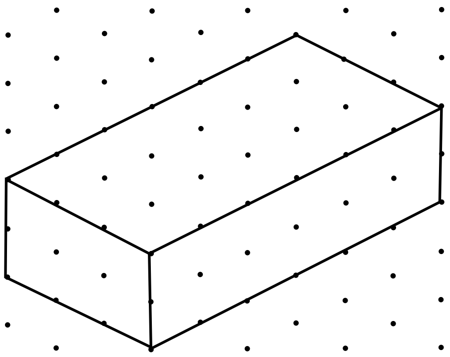
Solution



Skill Exercises: Representing Shapes

(Diagrams to be drawn full size unless scale given.)

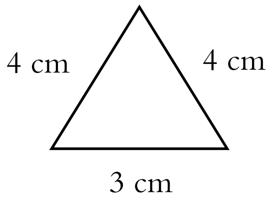
1. On isometric paper, draw a cube with sides of length 4 cm.
2. On isometric paper, draw a cuboid with sides of lengths 3 cm, 2 cm and 4 cm.
3. Three cubes with sides of length 2 cm are put side-by-side to form a cuboid. Draw this cuboid on isometric paper.
4. A cuboid has sides of lengths 3 cm, 6 cm and 2 cm. Draw three possible views of the cuboid on isometric paper.
5. The cuboid shown in the diagram opposite may be cut in half to form two triangular prisms. Draw one of these prisms on isometric paper.



Note: The cut may be made in three different ways.

6. A triangular prism has a cross-section that is a right-angled triangle with base 4 cm and height 3 cm. The length of the prism is 6 cm. Draw the prism on isometric paper.
7. On plain or squared paper, draw a cube with sides of 5 cm.
8. On plain or squared paper, draw a cuboid with sides of lengths 6 cm, 4 cm and 3 cm.
9. A prism has a triangular cross-section with sides of length 6 cm. The length of the prism is 8 cm. Draw the prism on plain paper.
10. The diagram shows the cross-section of a triangular prism. The length of the prism is 5 cm.

    Draw the prism on plain paper.



Modelling Shapes

A net can be folded up to make a solid. The diagram below shows one of the possible nets of a cube:

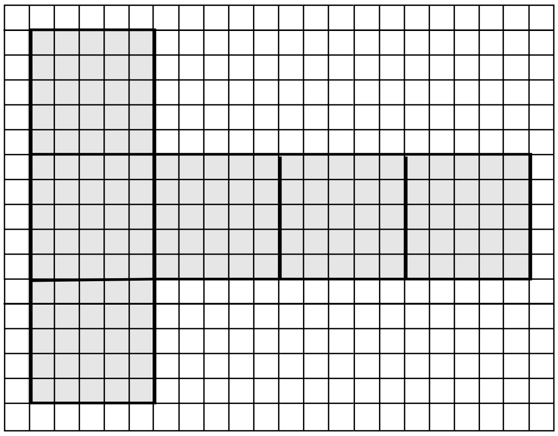
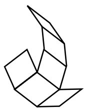
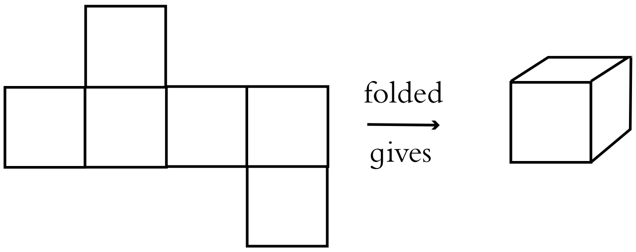


Diagram to show the net partially folded

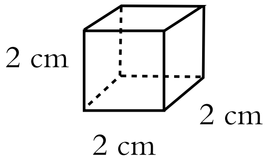


The net of a cube is always made up of 6 squares.



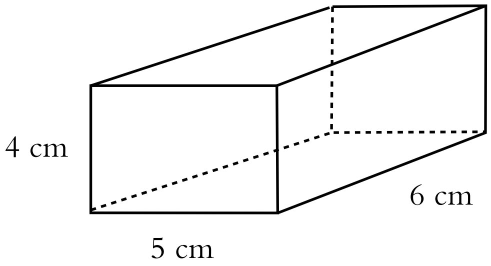
Skill Exercises: Modelling Shapes

1. Use card to make a net for the cube shown. Cut it out, fold it up and glue it to make the cube.



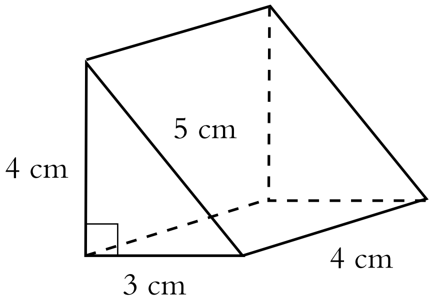
2. Use card to make a net for the cuboid shown.

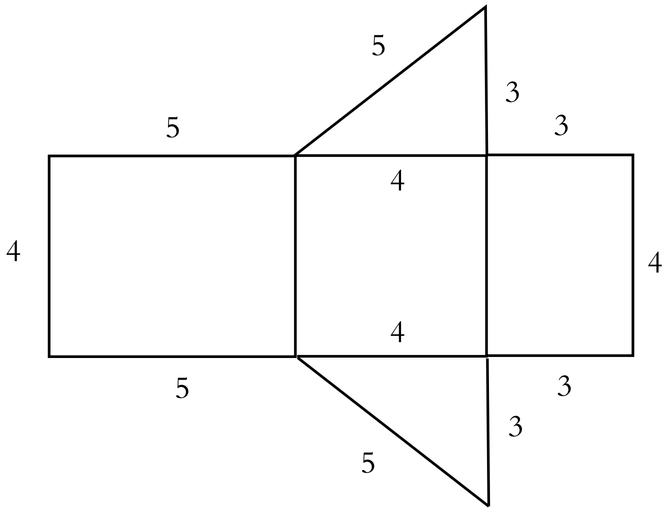
   Cut it out, fold it up and glue it to make the cuboid.



In order to draw the nets of some prisms and pyramids, you will need to construct triangles as well as squares and rectangles.

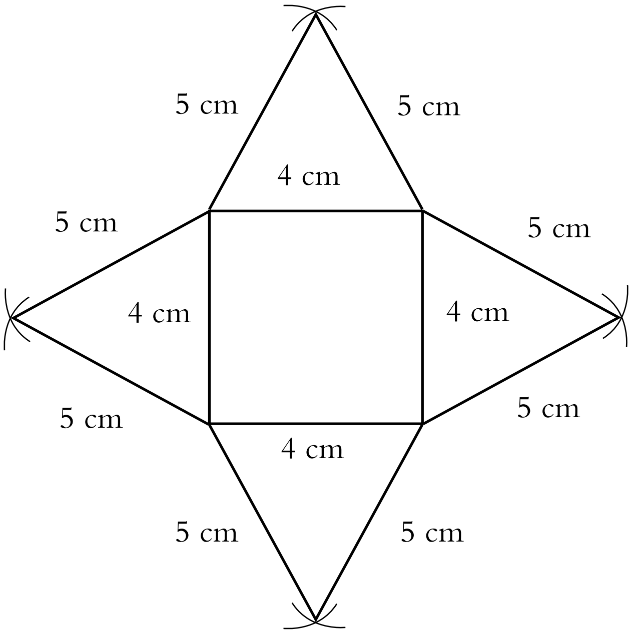
3. Use card to make a net for the prism shown. Cut it out, fold it up and glue to make the prism.





4. The square base of a pyramid has sides of length 4 cm. The triangular faces of the pyramid are all isosceles triangles with two sides of length 5 cm. Use card to make a net for the pyramid. Cut it out, fold it up and glue to make the pyramid.

Note that you will need to use a pair of compasses to find the position of the third corner of each triangle, as shown.



Unit 5: MEASUREMENT – PART 2

In this unit you will be:

5.1 Finding Perimeters, Areas and Volumes

- ◧ Area and Perimeter of a Square.
- ◧ Area and Perimeter of a Rectangle.
- ◧ Area and Perimeter of a Triangle.
- ◧ Area and Circumference of a Circle.
- ◧ Volume of a Cuboid.

5.2 Cubic Measure

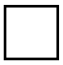
- ◧ Volume of a Cube.
- ◧ Volume of a Cuboid.

Section 5.1 Finding Perimeters, Areas And Volumes

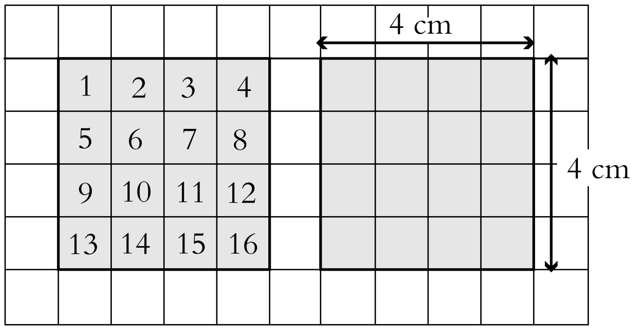
Area and Perimeter of a Square

The area of a square can be found by counting squares or multiplying the length of the sides. The area of a square with sides 1 cm is 1 cm^2.

Area = 1 cm × 1 cm
= 1 cm^2



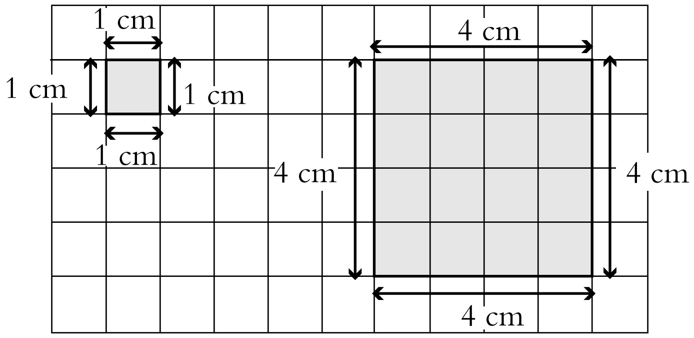
cm^2 means that cm has been multiplied by cm.



Area = 16cm^2

Area = 4 × 4
= 16 cm^2

The perimeter of a square is the total length of the four sides.



Perimeter = 1 + 1 + 1 + 1
= 4 cm

Perimeter = 4 + 4 + 4 + 4
= 16 cm

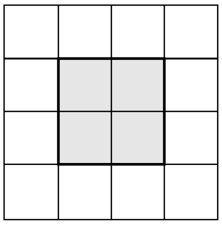
Note also that: 1 m = 100 cm
1 cm = 10 mm

So that, for example: 25 mm = 2.5 cm
8 mm = 0.8 cm
261 cm = 2.61 m
32 cm = 0.32 m
6 cm = 0.06 m

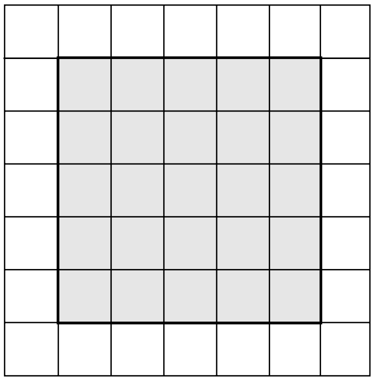
Skill Exercises: Area and Perimeter of a Square

1. Find the area and perimeter of each of these squares:

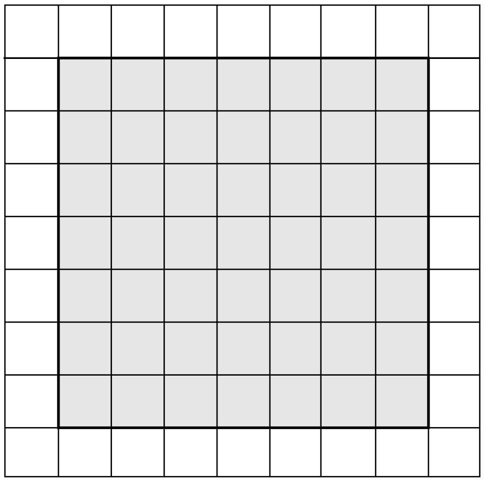
(a)



(b)



(c)



2. Find the area of squares with sides of length:

(a) 10 cm (b) 12 cm (c) 8 cm

(d) 9 cm (e) 15 cm (f) 20 cm

3. Find the perimeter of squares with sides of length:

(a) 13 cm (b) 8 cm (c) 16 cm

(d) 19 cm (e) 9 cm (f) 18 cm

4. Copy and complete each of these statements:

   (a) 3.2 cm = ☐ mm   (b) 10.3 cm = ☐ mm

   (c) 28 mm = ☐ cm   (d) 216 mm = ☐ cm

   (e) 152 cm = ☐ m   (f) 84 cm = ☐ m

   (g) 1.62 m = ☐ cm   (h) 1.7 m = ☐ cm

   (i) 0.82 m = ☐ cm   (j) 0.07 m = ☐ cm

5. A square has sides of length 20 mm. Find the area of the square in:

   (a) mm^2 (b) cm^2

6. The perimeter of a square is 40 cm. How long are its sides?

7. The area of a square is 36 cm^2. How long are its sides?

8. The perimeter of a square is 44 cm. What is its area?

9. The area of a square is 144 cm^2. What is its perimeter?

10. For a 2 cm square the perimeter is 8 cm and the area is 4 cm^2. The perimeter is twice the area.

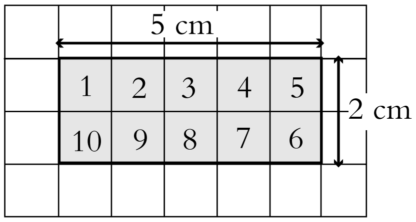
    What are the lengths of the sides of a square for which the perimeter is:

    (a) Equal to the area?

    (b) Half of the area?

Area and Perimeter of a Rectangle

For a rectangle, 5 cm by 2 cm, either count the squares or multiply the lengths. So for example,



The area of this rectangle is 10 cm^2 from counting squares or, alternatively;

$$\begin{aligned} \text{Area} &= 5 \times 2 \\ &= 10\ \text{cm}^2 \end{aligned}$$

Note also that 1 cm is the same as 10 mm, so that a 1 cm square has an area of 1 cm^2 and this can also be written as:

$$1\text{ cm} \times 1\text{ cm} = 10\text{ mm} \times 10\text{ mm}$$

$$\text{i.e.} \quad \boxed{1\text{ cm}^2 = 100\text{ mm}^2}$$

Example

What is 1 m^2 in terms of cm^2?

Solution

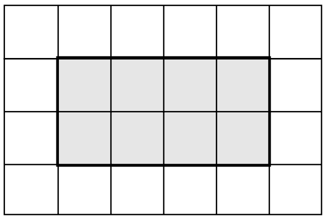
$$1\text{ m} \times 1\text{ m} = 100\text{ cm} \times 100\text{ cm}$$

$$\text{i.e. } 1\text{ m}^2 = 10\,000\text{ cm}^2$$

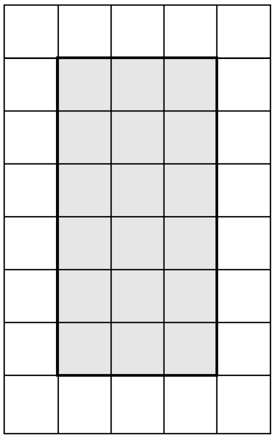
Skill Exercises: Area and Perimeter of a Rectangle

1. Find the areas of these rectangles in cm^2.

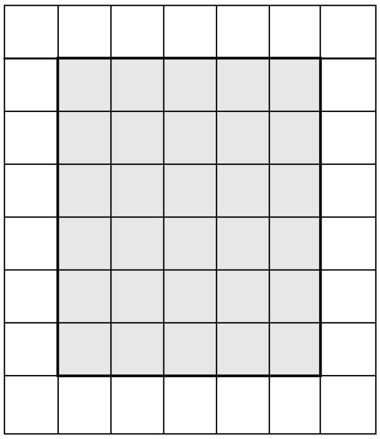
(a)



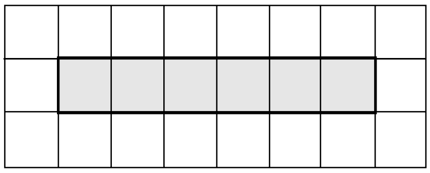
(b)



(c)



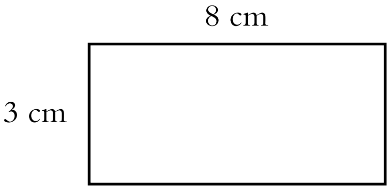
(d)



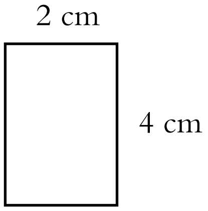
2. Find the perimeters of the rectangles in question 1.

3. Find the area of these rectangles in suitable units. The diagrams have not been drawn accurately.

(a)



(b)



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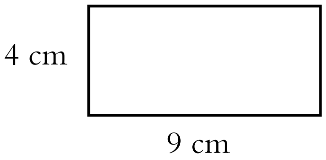

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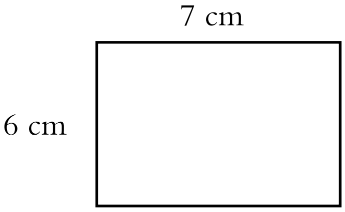

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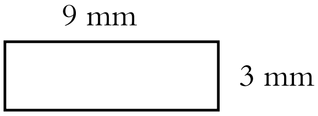
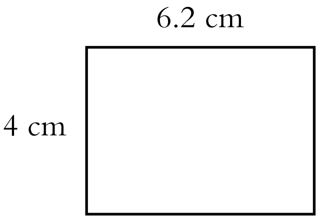


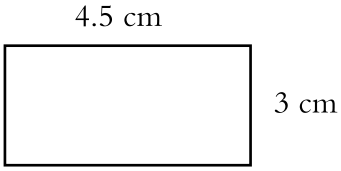
4. Find the perimeters of the rectangles in questions 3.

5. Find the areas and perimeters of these rectangles:

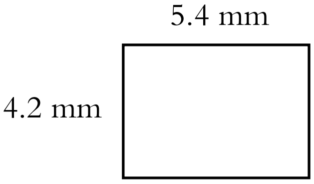
(a)



(b)



(c)



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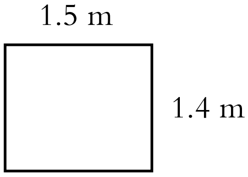

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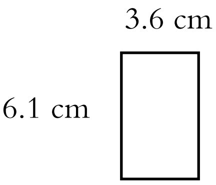

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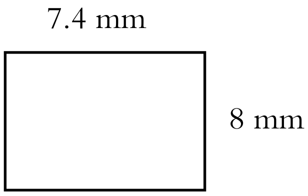
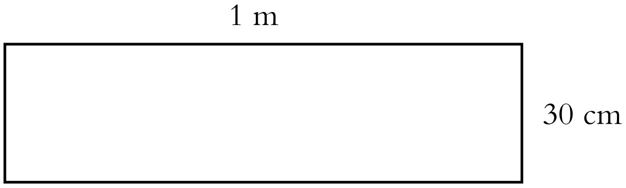
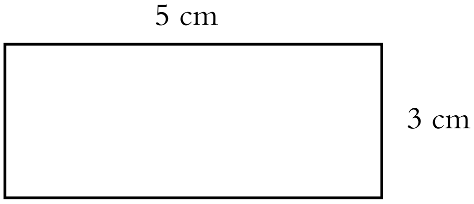


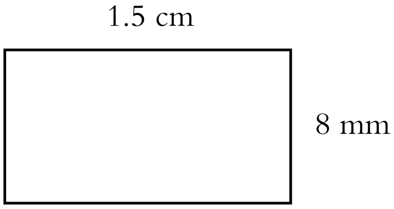
6. Find the area and perimeter of this rectangle:
   (a) in cm^2 and cm.
   (b) in m^2 and m.



7. Find the area of this rectangle in mm^2 and cm^2:



8. Find the perimeter and area of this rectangle making clear which units you have decided to use.



9. A rectangle has an area of 48 cm^2. The length of one side is 6 cm. Find the perimeter of the rectangle.

10. A rectangle has a perimeter of 24 cm and an area of 32 cm^2. What are the lengths of the sides of the rectangle?

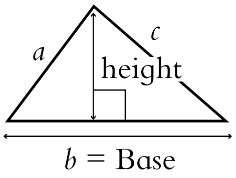
Area and Perimeter of a Triangle

For a triangle,

Area = $\frac{1}{2} \times$ base $\times$ perpendicular height

Perimeter = sum of the lengths of the sides

= $a + b + c$



Example 1

Find the area of the triangle shown.

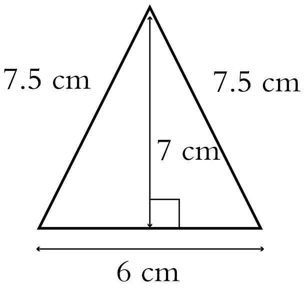
Solution

Area = $\frac{1}{2} \times 6 \times 7$

= 21 cm^2

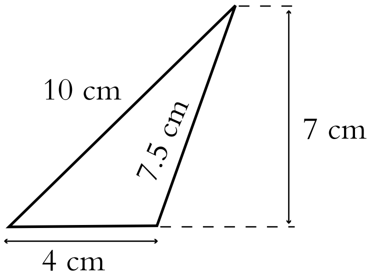
Perimeter = 6 + 7.5 + 7.5

= 21 cm



Example 2

Find the area of the triangle shown.



Solution

Area $= \frac{1}{2} \times 4 \times 7$

$= 14 \text{ cm}^2$

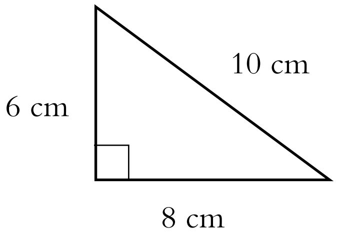
Perimeter $= 4 + 7.5 + 10$

$= 21.5 \text{ cm}$

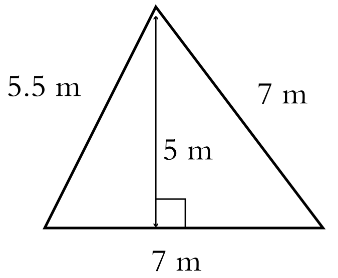
Skill Exercises: Area and Perimeter of a Triangle

1. Find the area of each of these triangles:

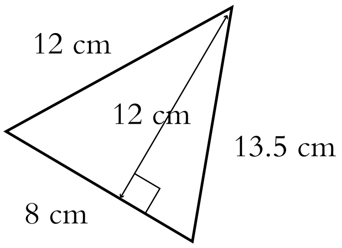
(a)



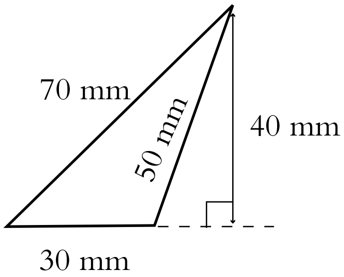
(b)



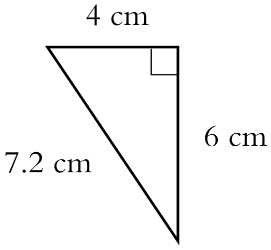
(c)



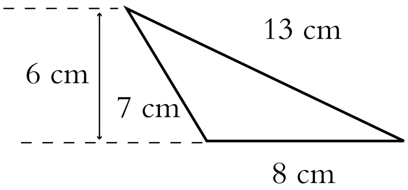
(d)



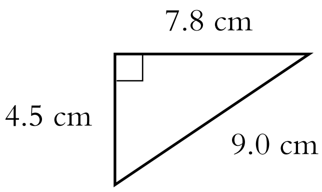
(e)



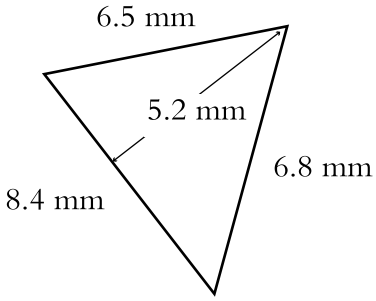
(f)



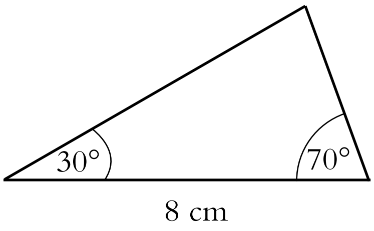
(g)



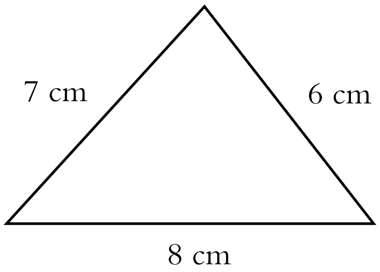
(h)



2. Draw this triangle. Find its area and perimeter to the nearest 0.1 cm^2.



3. Find the area of this triangle:

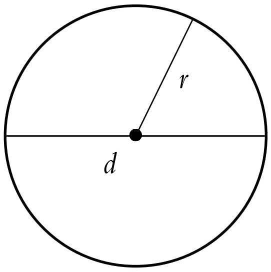


Area and Circumference of a Circle

The perimeter of a circle has a special name. It is called the circumference.

The radius (r) is the distance from the centre of the circle to the outside.

The diameter (d) is the distance from one side of the circle to the other through the centre.



Circumference = πd

or

Circumference = $2\pi r$

Area = πr^2

The symbol π (lower case Greek letter p) represents a special number called 'pi'. The value of π has been calculated to over 1000 million decimal places; its value correct to two decimal places is 3.14.

Example 1

A circle has radius 6 cm. Calculate:

(a) its circumference.

(b) its area.

Solution

(a) Circumference $= 2\pi r$

$= 2\pi \times 6$

$= 37.7$ cm to 3 significant figures.

(b) Area $= \pi r^2$

$= \pi \times 6^2$

$= 113 \text{ cm}^2$ to 3 significant figures.

Example 2

A circle has diameter 7 cm. Calculate:

(a) its circumference.

(b) its area.

Solution

(a) Circumference $= \pi d$

$= \pi \times 7$

$= 22.0$ cm to 3 significant figures.

(b) Radius $= 3.5$ cm

Area $= \pi r^2$

$= \pi \times 3.5^2$

$= 38.5 \text{ cm}^2$ to 3 significant figures.

Example 3

The circumference of a circle is 18.2 cm. Calculate the length of the diameter, *d*, of the circle.

Solution

$$C = \pi d$$

$$18.2 = \pi d$$

$$\frac{18.2}{\pi} = d$$

$d = 5.79$ cm to 3 significant figures.

Example 4

The area of a circle is 22.8 cm^2. Calculate the length of the radius, *r*, of the circle.

Solution

$$\begin{aligned} A &= \pi r^2 \\ 22.8 &= \pi r^2 \\ \frac{22.8}{\pi} &= r^2 \\ r &= \sqrt{\frac{22.8}{\pi}} \\ &= 2.69 \text{ cm to 3 significant figures.} \end{aligned}$$

Skill Exercises: Area and Circumference of a Circle

1. A circle has radius 11 cm. Calculate:
   (a) its diameter.
   (b) its circumference.
   (c) its area.

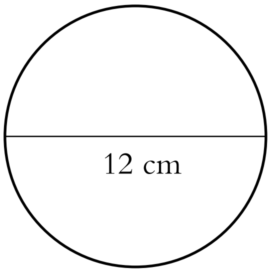
2. Calculate the circumference and area of a circle with radius 8 cm.

3. Calculate the circumference and area of a circle with diameter 19 cm.

4. Copy and complete the following table:

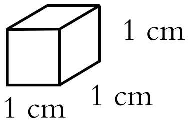
Radius	Diameter	Circumference	Area
	24 cm		
1 cm			
	6 mm		
	9 m		
	23 km		

5. Determine the circumference and area of the circle shown:



Section 5.2 Volume Of A Cuboid

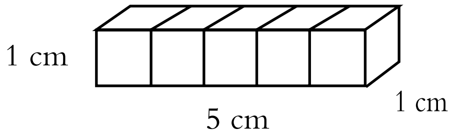
Cubic Measure



The volume of this cube is 1 cm^3 (1 cubic centimetre).

Example 1

What is the volume of this solid:

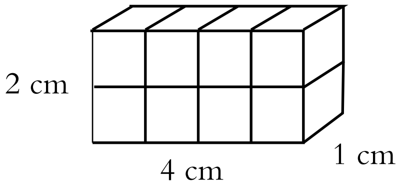


Solution

The solid contains 5 cubes of side 1 cm, so the volume is 5 cm^3.

Example 2

What is the volume of this solid:



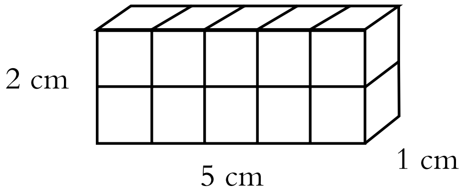
Solution

This solid contains 8 cubes of side 1 cm, so the volume is 8 cm^3.

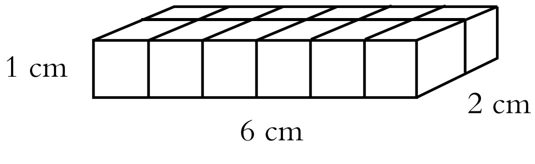
Skill Exercises: Cubic Measure

1. What is the volume of each of these cuboids:

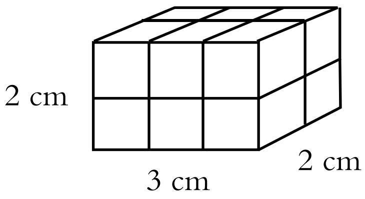
(a)



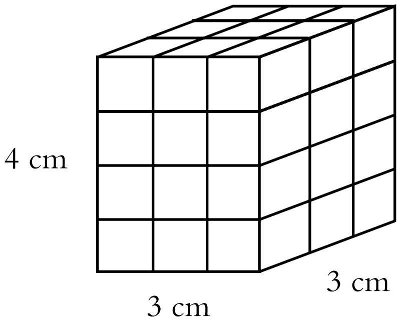
(b)



(c)

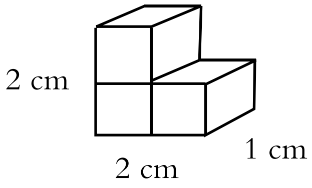


(d)

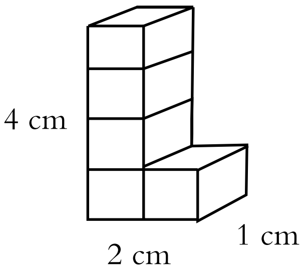


2. What is the volume of each of these solids:

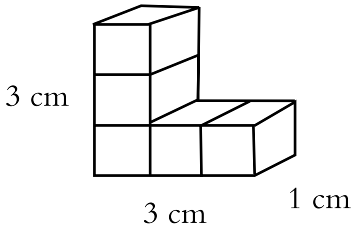
(a)



(b)



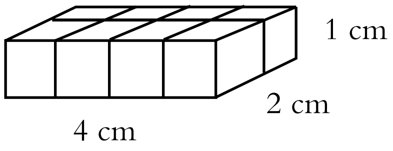
(c)



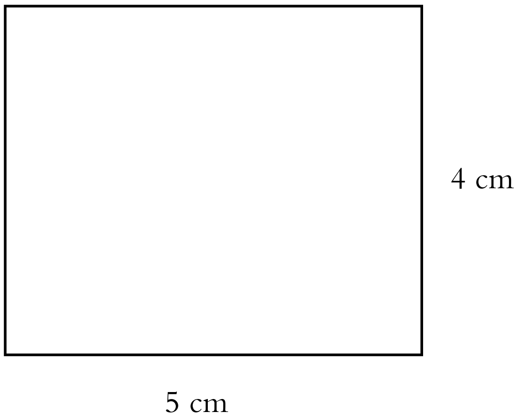
3. The diagram shows the cubes that are used to make the first layer of a cuboid:

   (a) How many cubes are there in the first layer?

   (b) What is the volume of the cuboid if it is made up of six layers?



4. A cuboid is built from 1 cm cubes on top of this rectangular base:



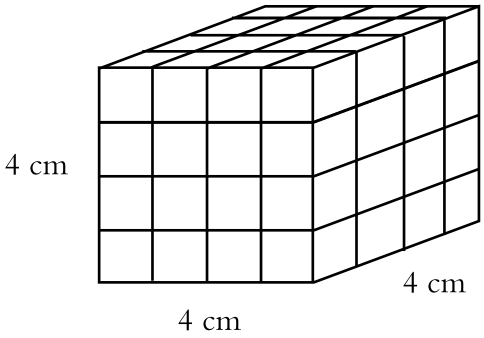
   (a) How many cubes are there in the first layer?

   (b) If there are 4 layers, what is the volume of the cuboid?

5. The diagram below shows a large cube made from 1 cm cubes.

   (a) How many small cubes are in each layer of the large cube?

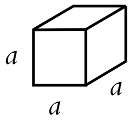
   (b) What is the volume of the large cube?



Volume of a Cube

Volume of a cube $= a \times a \times a$

$= a^3$

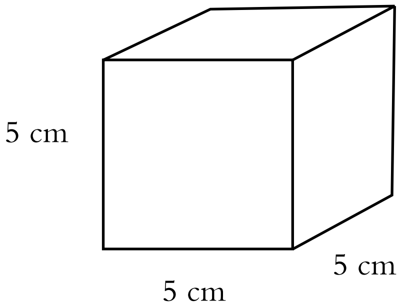


where a is the length of each side of the cube.

Note: If the sides of the cube are measured in cm, the volume will be measured in cm^3.

Example 1

What is the volume of this cube:



Solution

Volume $= 5^3$

$= 5 \times 5 \times 5$

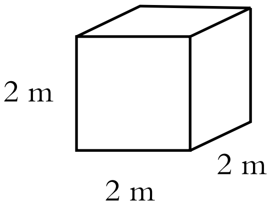
$= 125 \text{ cm}^3$

Example 2

What is the volume of this cube in:

(a) m^3?

(b) cm^3?



Solution

(a) Volume $= 2^3$

$= 2 \times 2 \times 2$

$= 8 \text{ m}^3$

(b) Remember that 1 m = 100 cm, so 2 m = 200 cm.

Volume $= 200^3$

$= 200 \times 200 \times 200$

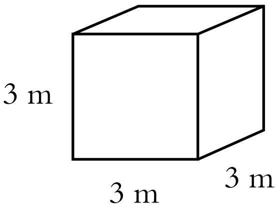
$= 8\ 000\ 000 \text{ cm}^3$

$$\boxed{1\text{m}^3 = 1\ 000\ 000 \text{ cm}^3}$$

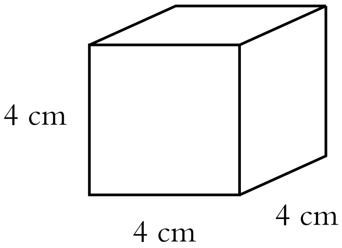
Skill Exercises: Volume of a Cube

1. What is the volume of each of these cubes:

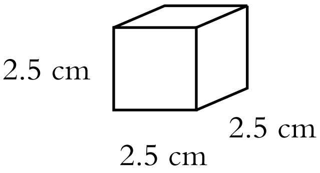
(a)



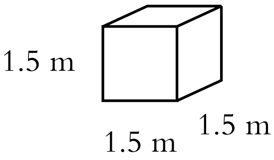
(b)



(c)



(d)



2. A cube has sides of length 30 cm. What is the volume of the cube in:

   (a) cm^3? (b) m^3?

3. A large box is a cube with sides of length 80 cm. Smaller boxes, which are also cubes, have sides of lengths 20 cm.

   (a) What is the volume of the large box?

   (b) What is the volume of a small box?

   (c) How many small boxes will fit in the large box?

4. A cube has sides of length $\frac{1}{2}$ m.

   Calculate the volume of the cube:

   (a) in m^3, giving your answer as a fraction.

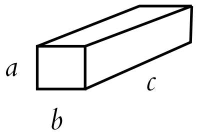
   (b) in m^3, giving your answer as a decimal.

   (c) in cm^3.

5. A cube has sides of length 10 cm. Calculate the volume of the cube in:

   (a) cm^3. (b) m^3.

Volume of a Cuboid

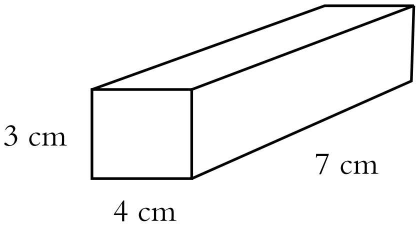


$$\text{Volume} = a \times b \times c = abc$$

where a, b and c are the lengths of the sides of the cuboid.

Example 1

Calculate the volume of the cuboid:



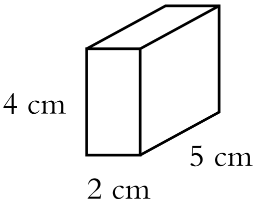
Solution

$$\text{Volume} = 3 \times 4 \times 7 = 84\ cm^3$$

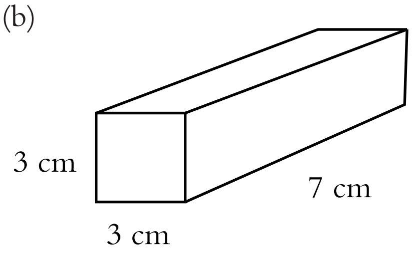
Skill Exercises: Volume of a Cuboid

1. Calculate the volume of each of these cuboids:

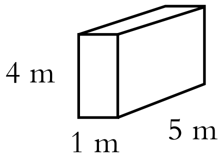
(a)



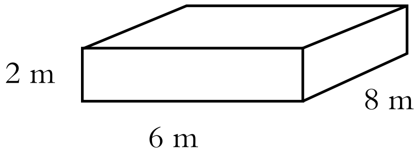
(b)



(c)



(d)

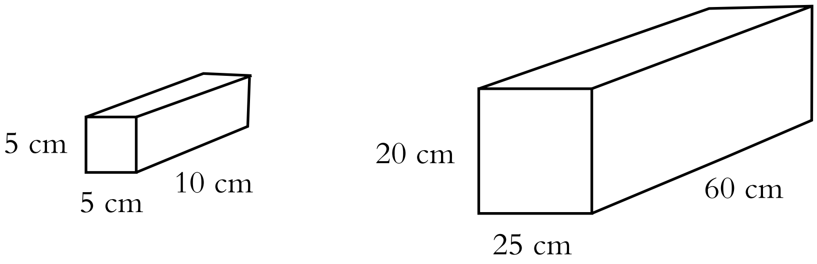


2. A cuboid has sides of length 5 m, 3 m and 1 m. What is the volume of the cuboid in:

   (a) m^3?

   (b) cm^3?

3. The diagram shows a large box and a small box, both of which are cuboids.



   (a) Calculate the volume of the large box.

   (b) Calculate the volume of the small box.

   (c) How many of the small boxes would fit in the large box?

Unit 6: TRIGONOMETRY

In this unit you will be:

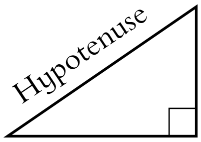
6.1 Using Pythagorean Triples to Solve Problems

- ◧ Pythagoras' Theorem.
- ◧ Calculating the Length of the Hypotenuse.
- ◧ Calculating the Length of the Other Side.
- ◧ Using Pythagoras' Theorem.

Section 6.1 Using Pythagorean Triples To Solve Problems

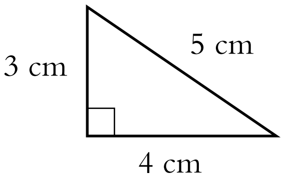
Pythagoras' Theorem

Pythagoras' Theorem relates the length of the hypotenuse of a right-angled triangle to the lengths of the other two sides.



The hypotenuse is always the longest side; it is always the side opposite the right angle.

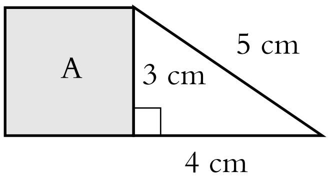
The diagram opposite shows a right-angled triangle. The length of the hypotenuse is 5 cm and the other two sides have lengths 3 cm and 4 cm.



In this diagram, a square, A, has been drawn on the 3 cm side.

Area of square A = 3×3

= 9 cm^2



In this diagram, a second square, B, has been drawn on the 4 cm side.

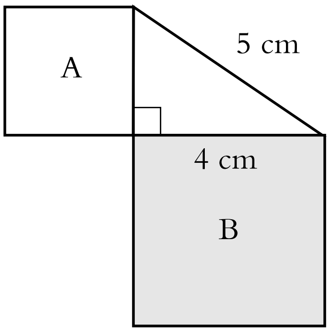
Area of square B = 4×4

= 16 cm^2

Squares A and B together have total area:

Area A + Area B = 9 +16

= 25 cm^2



Finally, a third square, C, has been drawn on the 5 cm side.

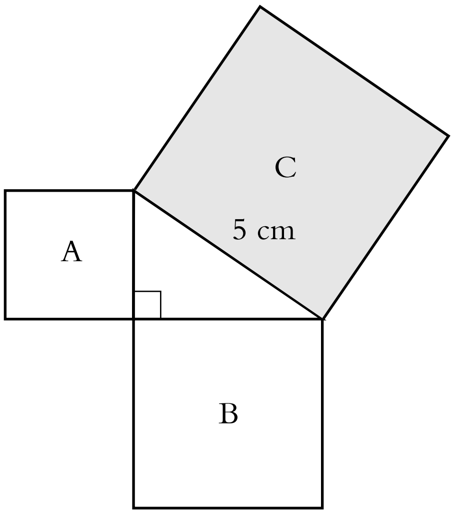
Area of square C = 5×5

= 25 cm^2

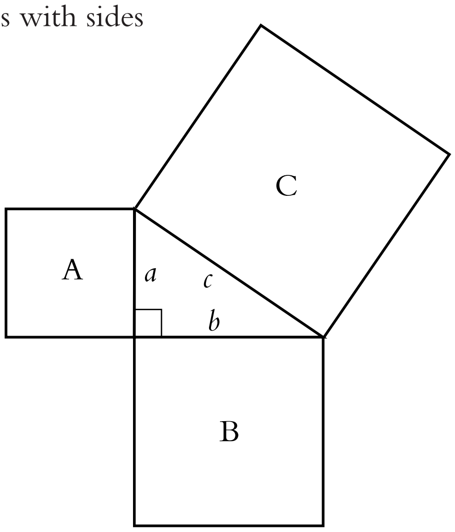
We can see that

Area A + Area B = Area C

This formula is always true for right-angled triangles.



We now look at right angles triangles with sides a, b and c, as shown opposite.



$$
\begin{aligned}
\text{Area A} &= a \times a \\
&= a^2 \\
\text{Area B} &= b \times b \\
&= b^2 \\
\text{Area C} &= c \times c \\
&= c^2
\end{aligned}
$$

So,

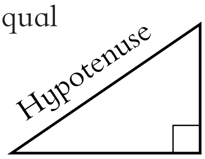
$$\text{Area A} + \text{Area B} = \text{Area C}$$

gives us the formula

$$\boxed{a^2 + b^2 = c^2}$$

for all right-angled triangles.

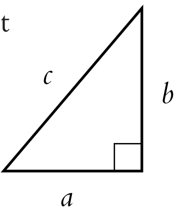
Pythagoras' Theorem states that, for any right-angled triangle, the area of the square on the hypotenuse is equal to the sum of the areas of the squares on the two shorter sides.



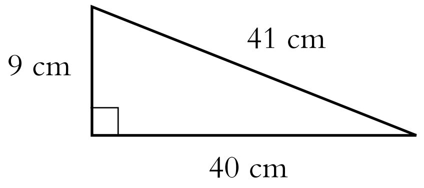
If we use the letters a, b and c for the sides of a right-angled triangle, then Pythagoras' Theorem states that

$$a^2 + b^2 = c^2$$

where c is the length of the hypotenuse.



Example 1



Verify Pythagoras' Theorem for the right-angled triangle opposite.

Solution

Here $a = 9\text{cm}$, $b = 40$ cm, $c = 41$ cm

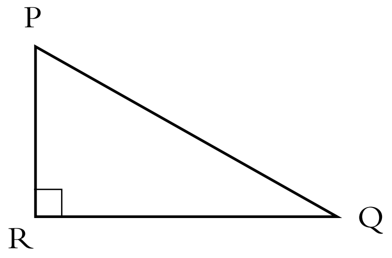
$$\begin{array}{rcccccc} & a^2 & = 9^2 & = & 9 \times 9 & = & 81 \\ & b^2 & = 40^2 & = & 40 \times 40 & = & 1600 \\ \hline a^2 + b^2 & & & & & = & 1681 \\ & c^2 & = 41^2 & = & 41 \times 41 & = & 1681 \end{array}$$

So $a^2 + b^2 = c^2$ for this triangle.

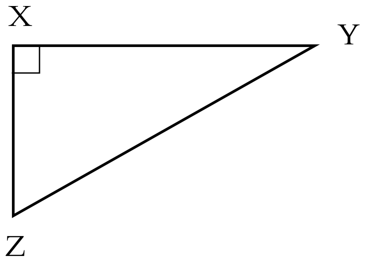
Skill Exercises: Pythagoras' Theorem

1. Which side is the hypotenuse if each of the following right-angled triangles:

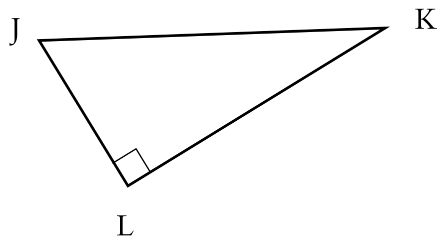
(a)



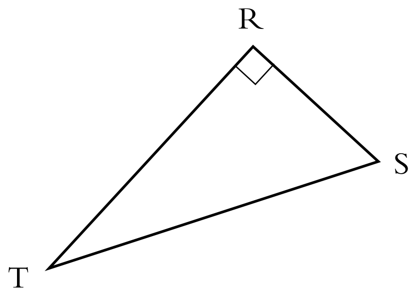
(b)



(c)

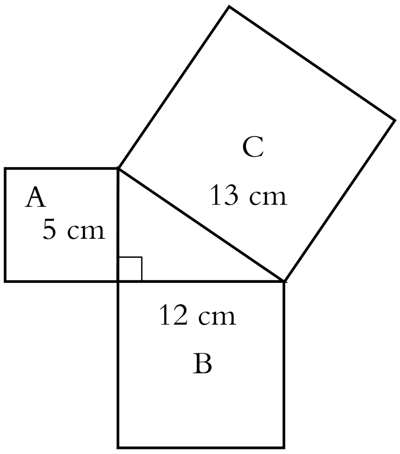


(d)

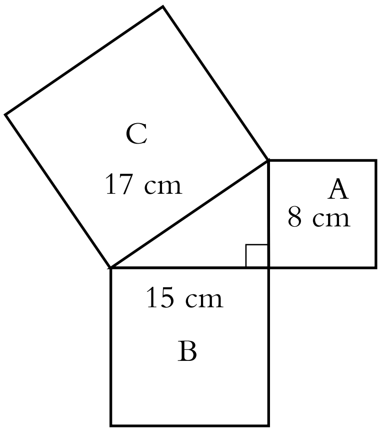


2. For each of the following three diagrams:
   - (i) calculate the area of square A.
   - (ii) calculate the area of square B.
   - (iii) calculate the sum of area A and area B.
   - (iv) calculate the area of square C.
   - (v) check that: area A + area B = area C.

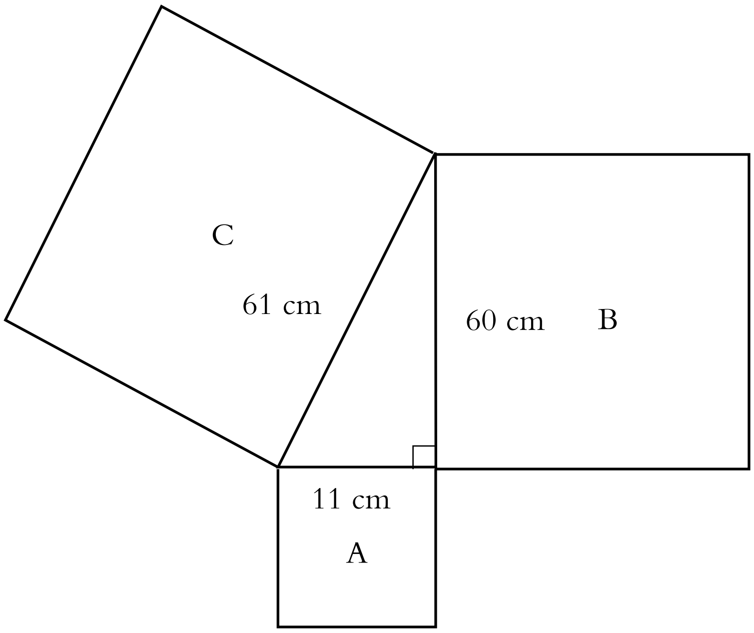
(a)



(b)

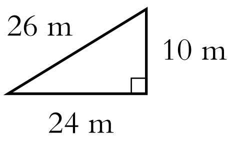


(c)

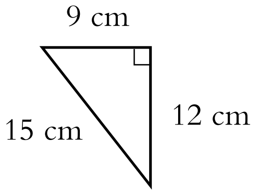


3. Using the method shown in Example 1, check Pythagoras' Theorem for the right angled triangles below:

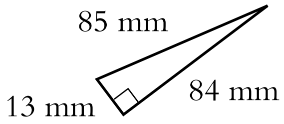
(a)



(b)



(c)



4. The whole numbers 3, 4 and 5 are called a **Pythagorean triple** because $3^2 + 4^2 = 5^2$. A triangle with sides of lengths 3 cm, 4cm and 5 cm is right-angled.

   Use Pythagoras' Theorem to determine which of the sets of number below are Pythagorean triples:

   (a) 15, 20, 25 (b) 10, 24, 26

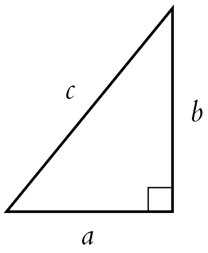
   (c) 11, 22, 30 (d) 6, 8, 9

Calculating the Length of the Hypotenuse

Pythagoras' Theorem states that, for a right-angled triangle,

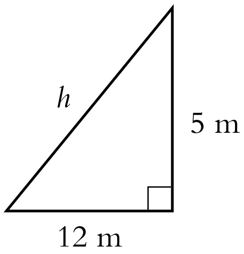
$$c^2 = a^2 + b^2$$

With this result it is very easy to calculate the length of the hypotenuse of a right-angled triangle.



Example 1

Calculate the length of the hypotenuse of a triangle in which the other two sides are of lengths 12m and 5m.



Solution

Let h be the length of the hypotenuse.

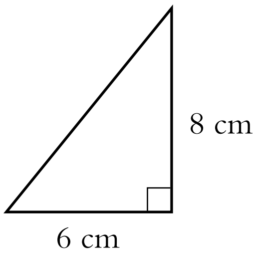
By Pythagoras' Theorem:

$$h^2 = 12^2 + 5^2$$
$$h^2 = 144 + 25$$
$$h^2 = 169$$
$$h = \sqrt{169}$$
$$h = 13$$

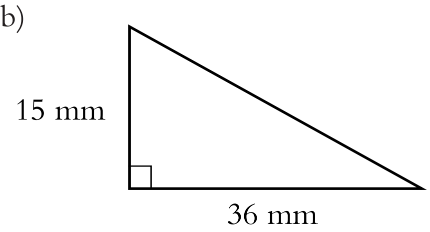
Skill Exercises: Calculating the Length of the Hypotenuse

1. Calculate the length of the hypotenuse of each of these triangles:

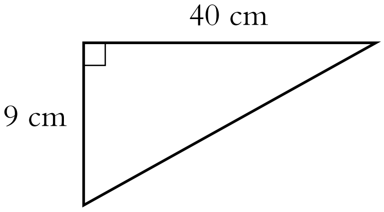
(a)



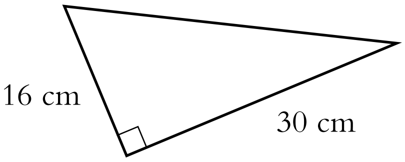
(b)



(c)



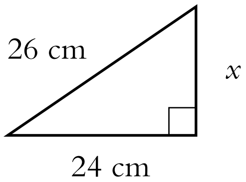
(d)



Calculating the Length of the Other Side

Example 1

Calculate the length of the side marked x in the following triangle:



Solution

By Pythagoras' Theorem:

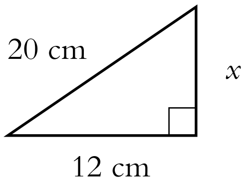
$$\begin{aligned} x^2 + 24^2 &= 26^2 \\ x^2 + 576 &= 676 \\ x^2 &= 676 - 576 \\ x^2 &= 100 \\ x &= \sqrt{100} \\ x &= 10 \end{aligned}$$

The length of side x is 10 cm.

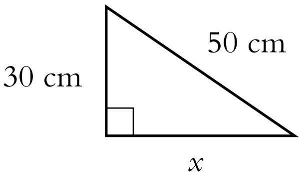
Skill Exercises: Calculating the Length of the Other Side

1. Calculate the length of the side marked x in each of the following triangles:

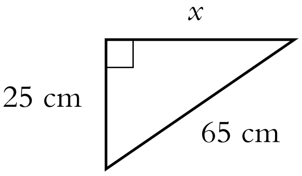
(a)



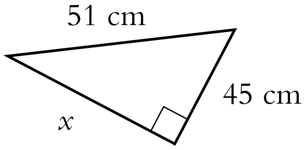
(b)



(c)



(d)



Using Pythagoras' Theorem

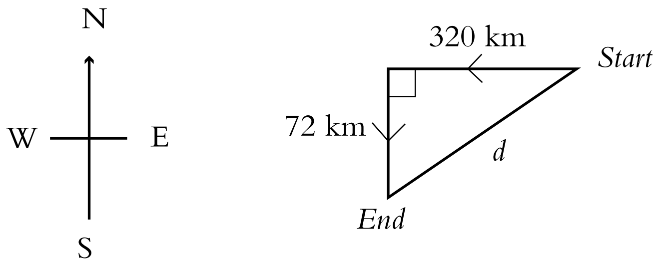
When we use Pythagoras' Theorem to solve problems in context the first key step is to draw a right-angled triangle.

Example 1

A ships sails 320 km due west and then 72 km due south. At the end of this journey, how far is the ship from its starting point?

Solution

The first step is to draw a diagram showing the ship's journey. The distance from the starting point has been labelled d.



Now use Pythagoras' Theorem:

$$d^2 = 320^2 + 72^2$$

$$d^2 = 102\,400 + 5184$$

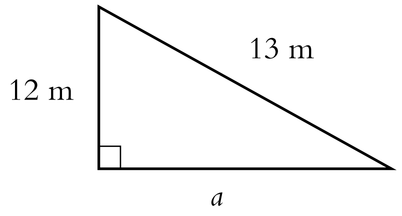
$$d^2 = 107\,584$$

$$d = \sqrt{107\,584}$$

$$d = 328 \text{ km}$$

Example 2

The top of a 13 m long fireman's ladder is resting on a windowsill of an office building. If the windowsill is 12 m above the ground, how far out from the base of the building is the foot of the ladder?



Solution

$13^2 = a^2 + 12^2$

$169 = a^2 + 144$

$169 - 144 = a^2$

$25 = a^2$

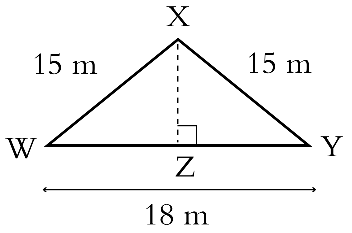
$a = \sqrt{25}$

$a = 5$ m

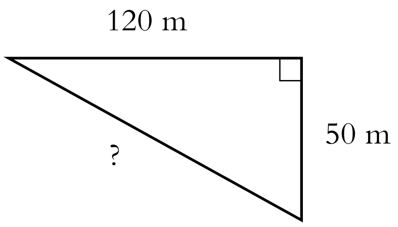
Skill Exercises: Using Pythagoras' Theorem

1. A room should have a rectangular floor, with sides of lengths 4 m and 3 m. A builder wants to check that the room is a perfect rectangle and measures the two diagonals of the room, which should be the same length. How long should each diagonal be?

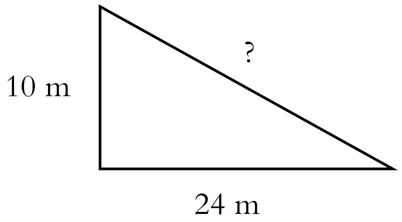
2. The diagram shows part of the framework of a warehouse roof.
   (a) Calculate the length of WZ.
   (b) Calculate the height of the roof (XZ).



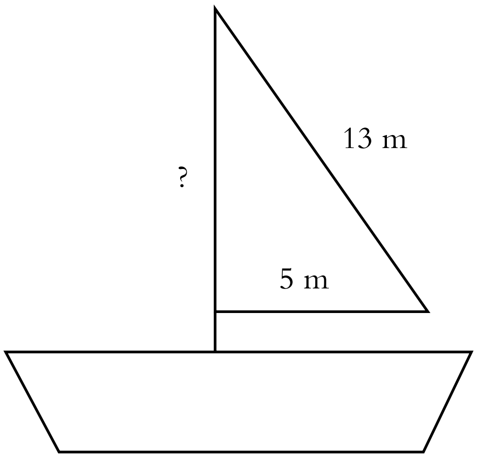
3. A new piece of road cuts off a dangerous right-angled bend. How long is the new piece of road?



4. Uale wanted to fence off a corner of his plantation. Two sides of the plantation were 10 m and 24 m. How long did the new piece of fence need to be?



5. A sail is made for a boat. If two of the edges are 13 m and 5 m, what is the length of the other side?



Unit 7: NUMBER — PART 2

In this unit you will be:

7.1 Calculating Percentages

7.2 Converting Numbers

- ◧ Decimals into Fractions.
- ◧ Fractions into Decimals.
- ◧ Decimals, Fractions and Percentages.

7.3 Applying the Order of Operations

Section 7.1 Calculating Percentages

The word 'percentage' means 'per hundred'. In this section we look at how percentages can be used as an alternative to fractions or decimals.

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

$$50\% = \frac{50}{100} = \frac{1}{2}$$

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

Example 1

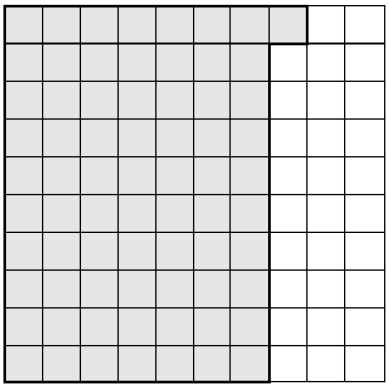
Draw diagrams to show:

(a) 71% (b) 20% (c) 5%

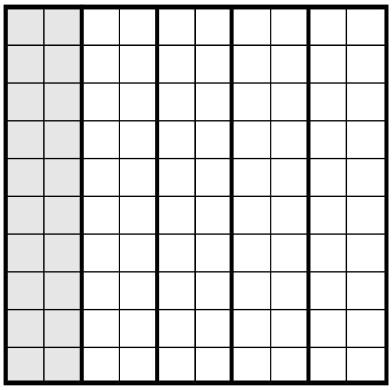
Solution

These percentages can be shown by shading a suitable fraction of a 10 by 10 square shape.

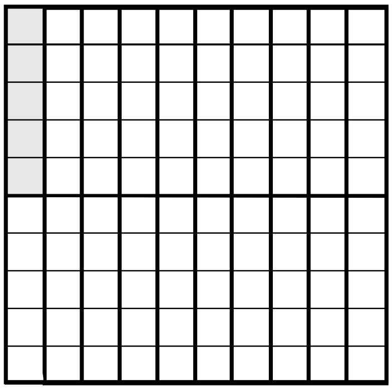
(a) $71\% = \frac{71}{100}$ so, $\frac{71}{100}$ of a shape needs to be shaded:



(b) $20\% = \frac{20}{100} = \frac{1}{5}$, so, $\frac{1}{5}$ of a shape needs to be shaded:



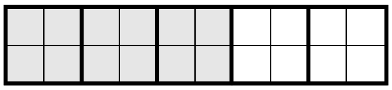
(c) 5% $= \frac{5}{100} = \frac{1}{20}$, so $\frac{1}{20}$ of a shape needs to be shaded:



Example 2

(a) What percentage of this shape is shaded?

(b) What percentage of this shape is not shaded?



Solution

(a) $\frac{12}{20}$ of the shape is shaded, and

$$\frac{12}{20} = \frac{6}{10}$$

$$= \frac{60}{100}$$

so 60% is shaded.

(b) 100 – 60 = 40, so 40% is not shaded.

Example 3

Find:

(a) 5% of 100 kg (b) 20% of 40 m (c) 5% of $80

Solution

(a) 5% of 100 kg $= \frac{5}{100} \times 100$

$= 5$ kg

(b) 20% of 40 m $= \frac{20}{100} \times 40$

$= 8$ m

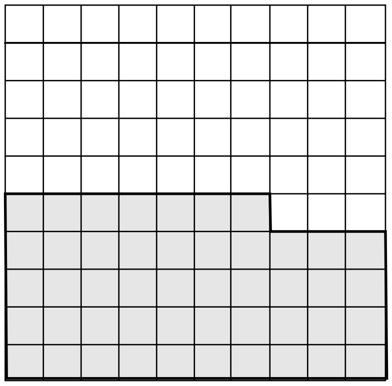
(c) 25% of \$80 $= \frac{25}{100} \times 80$

$=$ \$20

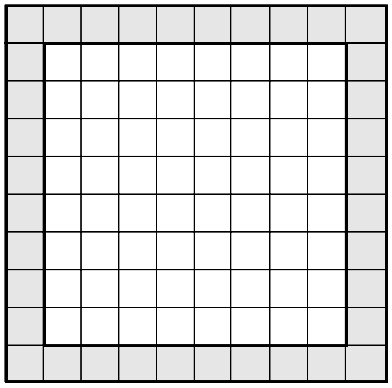
Skill Exercises: Calculating Percentages

1. For each diagram, state the percentage that is shaded:

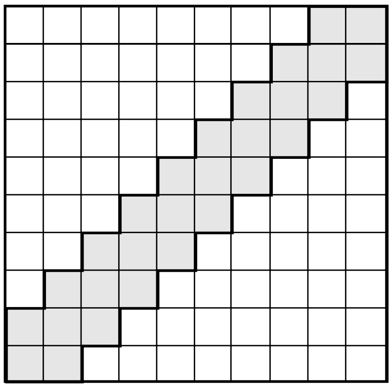
(a)



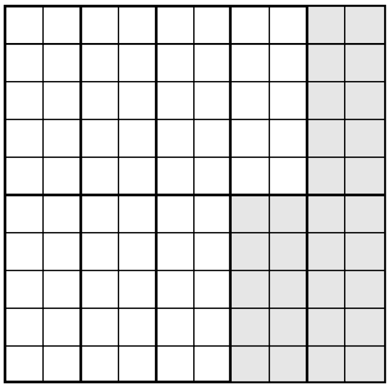
(b)



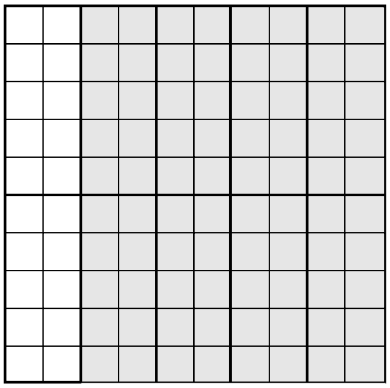
(c)



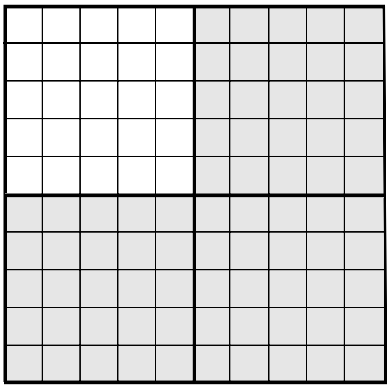
(d)



(e)



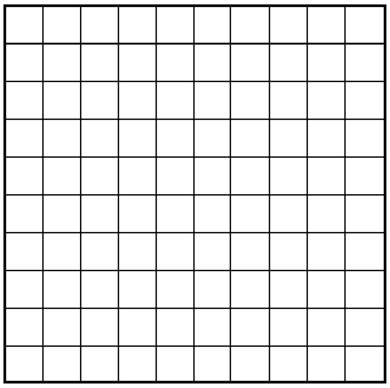
(f)



2. For each diagram in question 1, state the percentage that is not shaded.

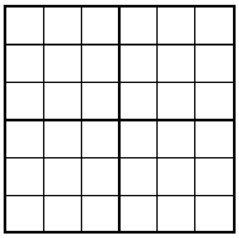
3. If 76% of a rectangle is shaded, what percentage is not shaded?

4. Make four copies of this diagram and shade the percentage stated:
   - (a) 23%
   - (b) 50%
   - (c) 79%
   - (d) 87%

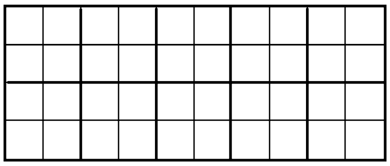


5. Copy each diagram and shade the percentage stated:

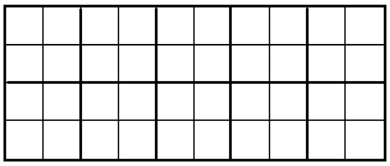
(a) 25%



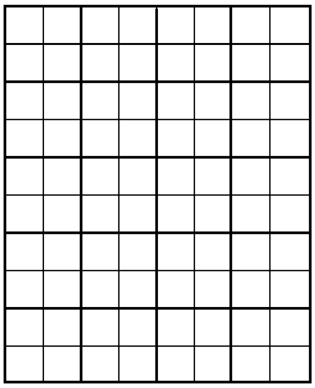
(b) 30%



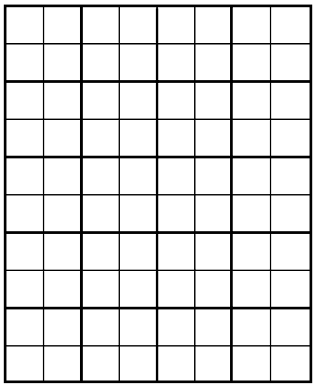
(c) 90%



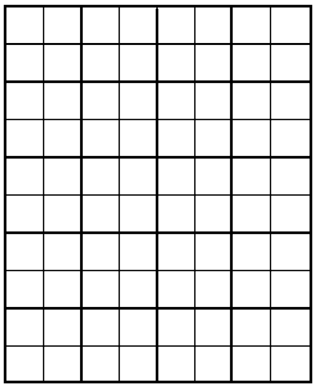
(d) 5%



(e) 15%

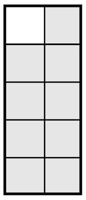


(f) 65%

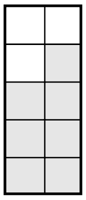


6. State the shaded percentage of each shape:

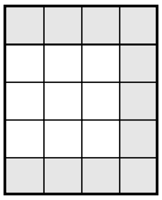
(a)



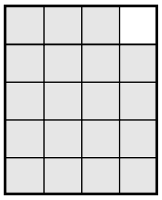
(b)



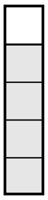
(c)



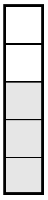
(d)



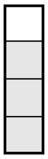
(e)



(f)



(g)



7. If 35% of the class are girls, what percentage are boys?

8. If 88% of the class pass a maths test, what percentage fail the test?

9. Calculate:

(a) 50% of \$200	(b) 30% of 500 kg
(c) 60% of 50 sene	(d) 5% of \$2
(e) 15% of 10 kg	(f) 25% of 120 m
(g) 2% of \$400	(h) 26% of \$2
(i) 20% of \$300	(j) 75% of 200 kg

10. Ben and Adam spend their Saturdays cleaning cars. They agree that Adam will have 60% of the money they earn and Ben will have the rest.
    (a) What percentage of the money will Ben have?
    (b) How much do they each have if they earn \$25?
    (c) How much do they each have if they earn \$30?

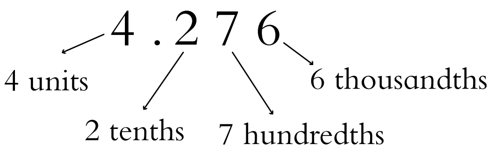
Section 7.2 Converting Numbers Between The Forms

Decimals into Fractions

In this section we revise ideas of decimals and work on writing decimals as fractions.

Recall that the number

means



The table below shows how to write the fractions you need to know in order to write decimals as fractions:

Decimal	Words	Fraction
0.1	1 tenth	$\frac{1}{10}$
0.01	1 hundredth	$\frac{1}{100}$
0.001	1 thousandth	$\frac{1}{1000}$

Example 1

Write these numbers in order, with the smallest first:

0.7, 0.17, 0.77, 0.71, 0.701, 0.107

Solution

Note: It is easier to see this if we first write all the numbers to 3 decimal places:

i.e. 0.700, 0.170, 0.770, 0.710, 0.701, 0.107

The required order is:

0.107, 0.17, 0.7, 0.701, 0.71, 0.77

Example 2

Write these numbers as fractions, where possible giving them in their simplest form:

(a) 0.7 (b) 0.09 (c) 0.004

(d) 0.47 (e) 0.132 (f) 1.75

Solution

(a) $0.7 = \frac{7}{10}$ (b) $0.09 = \frac{9}{100}$

(c) $0.004 = \frac{4}{1000} = \frac{1}{250}$ (d) $0.47 = \frac{47}{100}$

(e) $0.132 = \frac{132}{1000} = \frac{33}{250}$ (f) $1.75 = \frac{175}{100} = \frac{7}{4}$

Remember that fractions larger than 1, are called **improper** fractions.

Skill Exercises: Decimals into Fractions

1. What is the value of 7 in each of these numbers:

   (a) 0.714 (b) 0.070 (c) 7.042
   (d) 0.007 (e) 0.471 (f) 0.157

2. Write each list of numbers in order with the smallest first:

   (a) 0.61, 0.16, 0.601, 0.106, 0.661, 0.616
   (b) 0.47, 0.82, 0.4, 0.78, 0.28
   (c) 0.32, 0.23, 0.2, 0.301, 0.3
   (d) 0.17, 0.19, 0.9, 0.91, 0.79

3. Write each of these decimals as a fraction, giving them in their simplest form:

   (a) 0.1 (b) 0.9 (c) 0.3 (d) 0.07
   (e) 0.25 (f) 0.001 (g) 0.05 (h) 0.003
   (i) 0.017 (j) 0.71 (k) 0.87 (l) 0.201

4. Write each of these decimals as a fraction and simplify where possible:

   (a) 0.4 (b) 0.08 (c) 0.54 (d) 0.006
   (e) 0.012 (f) 0.162 (g) 0.048 (h) 0.84
   (i) 0.328 (j) 0.014 (k) 0.006 (l) 0.108

5. Write down the missing numbers:

   (a) $0.6 = \frac{?}{5}$ (b) $0.14 = \frac{?}{50}$ (c) $0.18 = \frac{?}{50}$

   (d) $0.008 = \frac{?}{125}$ (e) $0.012 = \frac{?}{250}$ (f) $0.016 = \frac{?}{125}$

6. Write these numbers as improper fractions in their simplest form:

   (a) 1.2 (b) 3.02 (c) 4.12

   (d) 3.62 (e) 4.008 (f) 5.015

7. Calculate, giving your answers as decimals and as fractions:

   (a) $0.7 + 0.6$ (b) $0.8 - 0.3$ (c) $0.71 + 0.62$

   (d) $8.21 - 0.31$ (e) $0.06 + 0.3$ (f) $1.7 + 0.21$

   (g) $8.06 - 0.2$ (h) $0.42 - 0.002$

8. Write the missing numbers as decimals and convert them to fractions in their simplest form:

   (a) $0.20 + ? = 0.81$ (b) $0.42 + ? = 0.53$

   (c) $0.91 - ? = 0.47$ (d) $0.92 - ? = 0.58$

9. Convert these decimals into fractions:

   (a) 0.0001 (b) 0.0009

   (c) 0.00021 (d) 0.123491

10. Convert these decimals into fractions in their simplest form:

   (a) 0.00008 (b) 0.02222 (c) 0.00102

   (d) 0.000004 (e) 0.000224 (f) 0.0000002

Fractions into Decimals

In this section we consider how to write fractions as decimals.

Example 1

Write these fractions as decimals:

(a) $\frac{7}{10}$ (b) $\frac{81}{100}$ (c) $\frac{9}{1000}$ (d) $\frac{407}{1000}$

Solution

(a) $\frac{7}{10} = .07$ (b) $\frac{81}{100} = 0.81$

(c) $\frac{9}{1000} = 0.009$ (d) $\frac{407}{1000} = 0.407$

Example 2

Write these fractions as decimals:

(a) $\frac{2}{5}$ (b) $\frac{3}{50}$ (c) $\frac{6}{25}$ (d) $\frac{5}{4}$ (e) $\frac{7}{250}$

Solution

In each case, determine the equivalent fraction with the denominator as either 10, 100 or 1000. The fractions can then be written as decimals.

(a) $\frac{2}{5} = \frac{4}{10} = 0.4$ (b) $\frac{3}{50} = \frac{6}{100} = 0.06$

(c) $\frac{6}{25} = \frac{24}{100} = 0.24$ (d) $\frac{5}{4} = \frac{125}{100} = 1.25$

(e) $\frac{7}{250} = \frac{28}{1000} = 0.028$

Example 3

(a) Calculate $18 \div 5$, then write $\frac{18}{5}$ as a decimal.

(b) Calculate $5 \div 8$, then write $\frac{5}{8}$ as a decimal.

Solution

(a) $18 \div 5 = 3.6$, since $\begin{array}{r} 3.6 \\ 5\overline{)18.{}^{3}0} \end{array}$

$$\text{So } \frac{18}{5} = 18 \div 5$$

$$= 3.6$$

(b) $5 \div 8 = 0.625$, since $\begin{array}{r} 0.625 \\ 8\overline{)5.0{}^{2}0{}^{4}0} \end{array}$

$$\text{So } \frac{5}{8} = 5 \div 8$$

$$= 0.625$$

Skill Exercises: Fractions into Decimals

1. Write these fractions as decimals:

(a) $\frac{3}{10}$ (b) $\frac{7}{100}$ (c) $\frac{9}{1000}$ (d) $\frac{13}{100}$

(e) $\frac{131}{1000}$ (f) $\frac{47}{1000}$ (g) $\frac{21}{100}$ (h) $\frac{183}{1000}$

(i) $\frac{19}{100}$ (j) $\frac{19}{1000}$ (k) $\frac{11}{100}$ (l) $\frac{81}{1000}$

2. Calculate the missing numbers:

(a) $\frac{?}{2} = \frac{5}{10}$ (b) $\frac{?}{20} = \frac{35}{100}$ (c) $\frac{?}{25} = \frac{8}{100}$

(d) $\frac{?}{4} = \frac{25}{100}$ (e) $\frac{2}{?} = \frac{4}{100}$ (f) $\frac{6}{?} = \frac{12}{1000}$

(g) $\frac{8}{?} = \frac{32}{100}$ (h) $\frac{7}{?} = \frac{28}{100}$

3. Write these fractions as decimals:

(a) $\frac{1}{2}$ (b) $\frac{4}{5}$ (c) $\frac{9}{50}$ (d) $\frac{3}{25}$

(e) $\frac{3}{20}$ (f) $\frac{3}{500}$ (g) $\frac{1}{250}$ (h) $\frac{7}{20}$

(i) $\frac{61}{200}$ (j) $\frac{18}{25}$ (k) $\frac{9}{125}$ (l) $\frac{1}{4}$

4. Write these improper fractions as decimals:

(a) $\frac{12}{10}$ (b) $\frac{212}{100}$ (c) $\frac{5218}{1000}$

(d) $\frac{2008}{100}$ (e) $\frac{2008}{1000}$ (f) $\frac{418}{10}$

5. Write these improper fractions as decimals:

(a) $\frac{7}{2}$ (b) $\frac{21}{20}$ (c) $\frac{33}{20}$

(d) $\frac{31}{25}$ (e) $\frac{16}{5}$ (f) $\frac{1001}{500}$

6. Write as a fraction and as a decimal:
   - (a) $3 \div 5$
   - (b) $3 \div 8$
   - (c) $25 \div 4$
   - (d) $16 \div 5$
   - (e) $26 \div 4$
   - (f) $30 \div 8$

7. (a) Calculate $7 \div 8$

   (b) Write $\frac{7}{8}$ as a decimal.

8. (a) Calculate $41 \div 5$

   (b) Write $\frac{41}{5}$ as a decimal.

9. Write $\frac{1}{8}$ as a decimal by using division.

10. Write $\frac{13}{16}$ as a decimal.

Decimals, Fractions and Percentages

In this section we concentrate in converting between decimals, fractions and percentages.

Example 1

Write these percentages as decimals:

(a) 72% (b) 3%

Solution

(a) $72\% = \frac{72}{100} = 0.72$

(b) $3\% = \frac{3}{100} = 0.03$

Example 2

Write these decimals as percentages:

(a) 0.71 (b) 0.4 (c) 0.06

Solution

(a) $0.71 = \frac{71}{100}$

$= 71\%$

(b) $0.4 = \frac{4}{10}$

$= \frac{40}{100}$

$= 40\%$

(c) $0.06 = \frac{6}{100}$

$= 6\%$

Example 3

Write these percentages as fractions in their simplest form:

(a) 90% (b) 20% (c) 5%

Solution

(a) $90\% = \frac{90}{100}$

$= \frac{9}{10}$

(b) $20\% = \frac{20}{100}$

$= \frac{1}{5}$

(c) $5\% = \frac{5}{100}$

$= \frac{1}{20}$

Example 4

Write these fractions as percentages:

(a) $\frac{1}{2}$ (b) $\frac{2}{5}$ (c) $\frac{7}{20}$

Solution

(a) $\frac{1}{2} = \frac{50}{100}$

$= 50\%$

(b) $\frac{2}{5} = \frac{40}{100}$

$= 40\%$

(c) $\frac{7}{20} = \frac{35}{100}$

$= 35\%$

Skill Exercises: Decimals, Fractions and Percentages

1. Write these percentages as decimals:

   (a) 42% (b) 37% (c) 20%

   (d) 5% (e) 8% (f) 10%

   (g) 22% (h) 3% (i) 15%

2. Write these decimals as percentages:

(a) 0.14 (b) 0.72 (c) 0.55

(d) 0.4 (e) 0.03 (f) 0.9

(g) 0.18 (h) 0.04 (i) 0.7

3. Write these percentages as fractions in their simplest forms:

(a) 50% (b) 30% (c) 80%

(d) 70% (e) 15% (f) 25%

(g) 64% (h) 98% (i) 56%

4. Write these fractions as percentages:

(a) $\frac{7}{100}$ (b) $\frac{18}{100}$ (c) $\frac{3}{50}$ (d) $\frac{17}{50}$

(e) $\frac{3}{20}$ (f) $\frac{7}{25}$ (g) $\frac{3}{5}$ (h) $\frac{7}{10}$

(i) $\frac{3}{4}$ (j) $\frac{1}{20}$ (k) $\frac{1}{2}$ (l) $\frac{3}{25}$

5. Copy and complete this table:

Fraction	Decimal	Percentage
	0.04	
		10%
$\frac{1}{2}$		
		45%
$\frac{7}{50}$		
	0.84	

6. There are 200 students in a school hall, eating lunch. Of these students 124 have chosen chips as part of their lunch.

(a) What fraction of the students have chosen chips?

(b) What percentage of the students have chosen chips?

(c) What percentage of the students have not chosen chips?

7. In a survey, $\frac{9}{10}$ of the students in a school said that maths was their favourite subject. What percentage of the students did not say that maths was their favourite subject?

8. In a Year 9 class, $\frac{3}{4}$ of the students can swim more than 400 m and only $\frac{1}{10}$ of the students can not swim more than 200 m.

   What percentage of the class can swim:

   (a) more than 400 m?

   (b) less than 200 m?

   (c) a distance between 200 m and 400 m?

9. In the school shop students can choose chips, talo or rice. One day 50% choose chips and 26% choose talo.

   (a) What percentage choose rice?

   (b) What fraction of the students choose rice?

10. In a car park, 40% of the cars are red and $\frac{7}{20}$ of the cars are blue.

   (a) What percentage are blue?

   (b) What percentage are neither red nor blue?

   (c) What percentage are red or blue?

   (d) What fraction are red?

   (e) What fraction are neither red nor blue?

   (f) What fraction are red or blue?

Section 7.3 Applying The Order Of Operations

Some calculations have a number of operations.

$5 + 3 \times (6 - 4)^2$ has four operations.

Some operations must be done before others.

The word BEDMAS gives the order.

B	Bracket	First work out anything inside the brackets
E	Exponents	Next work out numbers with exponents
D	Division	Next work out any division and
M	Multiplication	multiplication in order from left to right
A	Addition	Finally work out any addition and
S	Subtraction	subtraction in order from left to right

Example

Evaluate the following:

(a) $5 + 3 \times (6 - 4)^2$ (b) $5 \times 4 \div 10 + 8$ (c) $8 \div (7 - 3) + 5^2 - 10$

Solution

$$\begin{aligned}
\text{(a)}\quad 5 + 3 \times (6 - 4)^2 &= 5 + 3 \times 2^2 && \text{(first – brackets)}\\
&= 5 + 3 \times 4 && \text{(next – exponent)}\\
&= 5 + 12 && \text{(next – multiplication)}\\
&= 17 && \text{(last – addition)}
\end{aligned}$$

$$\begin{aligned}
\text{(b)}\quad 5 \times 4 \div 10 + 8 &= 20 \div 10 + 8 && \text{(first – multiplication in order)}\\
&= 2 + 8 && \text{(next – division)}\\
&= 10 && \text{(last – addition)}
\end{aligned}$$

$$\begin{aligned}
\text{(c)}\quad 8 \div (7 - 3) + 5^2 - 10 &= 8 \div 4 + 5^2 - 10 && \text{(first – brackets)}\\
&= 8 \div 4 + 25 - 10 && \text{(next – exponent)}\\
&= 2 + 25 - 10 && \text{(next – division)}\\
&= 27 - 10 && \text{(next – addition in order)}\\
&= 17 && \text{(last – subtraction)}
\end{aligned}$$

Skill Exercises: Order of Operations

Evaluate the following:

(a) $7 \times 5 + 2$

(b) $4 \times 7 \div 2$

(c) $8 \times (4 - 3)$

(d) $16 - 5 \times 2$

(e) $4^2 - 2 \times 3$

(f) $5 \times 4 + 6 \div 2$

(g) $(12 \times 5) \div 10 + 2$

(h) $9 \times 8 \times 2 \div 4$

(i) $5 + 4^2$

(j) $2 + 2 \times 2 \div 2 + (2 + 2^2)$

Unit 8: PROBABILITY

In this unit you will be:

8.1 Exploring Chance Events

- ◧ The Language of Probability.
- ◧ Probability Activities.

Section 8.1 Exploring Chance Events

The Language of Probability

Probability is the chance that something will happen. This chance is given as a number between 0 and 1.

If an event is certain to happen, the probability is 1.

If an event is impossible, the probability is 0.

If an event may happen, the probability is a fraction between 0 and 1.

Example 1

(a) What is the probability that the tide will come in tomorrow?

(b) What is the probability that it will snow tomorrow?

(c) What is the probability that tomorrow is Wednesday?

Solution

(a) Tides usually come in two times a day. It is certain to happen. The probability is 1.

P (tide comes in tomorrow) = 1

(b) It has never snowed in Samoa. The probability is 0.

P (snow tomorrow) = 0.

(c) There are seven days in the week but only one Wednesday.

To work out a probability two values are needed.

1. The number of favourable outcomes (the ones you want).
2. The sample space or all possible outcomes (the ones that could happen).

$$P = \frac{\text{number of favourable outcomes}}{\text{number of possible outcomes}}$$

$$= \frac{\text{(one favourable outcome = Wed)}}{\text{Possible outcomes = Mon, Tue, Wed, Thu, Fri, Sat, Sun}}$$

$$= \frac{1}{7}$$

Example 2

Sila and Sega are playing a game of mini-lotto. They have a bag with eight balls in it. The balls are numbered from 1 to 8. A ball is drawn at random from the bag and then put back before a second ball is drawn.

(a) What is the probability that the first ball is the number 5?

(b) What is the probability that the second ball drawn is an even number?

Solution

(a) Sample space {1, 2, 3, 4, 5, 6, 7, 8}

Number of possible outcomes = 8

Favourable outcomes {ball 5}

Number of favourable outcomes = 1

There is a shorthand way of writing probability statements. Instead of writing the probability that the first number is 5, we usually write P(5).

$$P(5) = \frac{\text{number of favourable outcomes}}{\text{number of possible outcomes}}$$

$P(5) = \frac{1}{8}$

(b) Sample space {1, 2, 3, 4, 5, 6, 7, 8}

Number of possible outcomes = 8

Favourable outcomes {balls 2, 4, 6, 8} (even numbers)

Number of favourable outcomes = 4

$$\begin{aligned} P(\text{even number}) &= \tfrac{4}{8} \\ &= \tfrac{1}{2} \end{aligned}$$

Skill Exercises: The Language of Probability

Work out the following probabilities. List the sample space and the favourable outcomes for each question as in the examples.

1. A basket contains four Vailima and three Coke bottle tops. Find:
   (a) The probability of randomly drawing a Coke bottle top.
   (b) The probability of randomly drawing a Vailima bottle top.
   (c) P(neither a Vailima nor a Coke bottle top).

2. A marble is drawn at random from a bag which contains nine yellow marbles and six white marbles. Find:
   (a) P(yellow marble)
   (b) P(white marble)
   (c) P(neither white nor yellow)

3. Find the probability that a card drawn at random from a pack of 52 cards is:
   (a) a red card.
   (b) a black card.
   (c) a picture card.
   (d) a red picture card.
   (e) a black picture card.
   (f) a red card but not a picture card.
   (g) a black card but not a picture card.
   (h) an ace.
   (i) a heart.
   (j) the five of clubs.
   (k) a diamond picture card.
   (l) a spade but not a picture card.

4. Find the probability that a letter drawn at random from the English alphabet is:
   (a) a vowel.
   (b) a consonant.
   (c) either a vowel or a consonant.

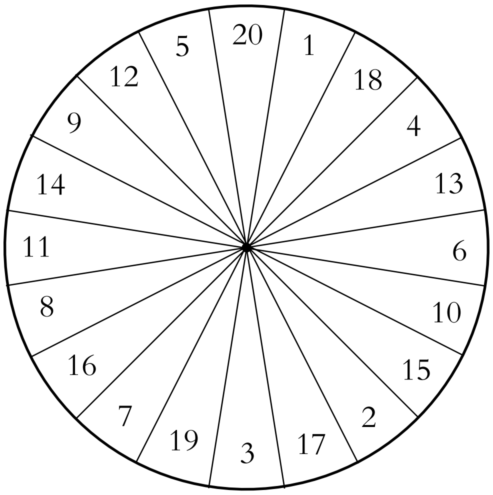
5. Find the probability that a day of the week drawn at random will:
   (a) start with the letter T.
   (b) start with the letter S.
   (c) start with the letter W.
   (d) start with the letter P.

Probability Activities

Skill Exercises: Probability

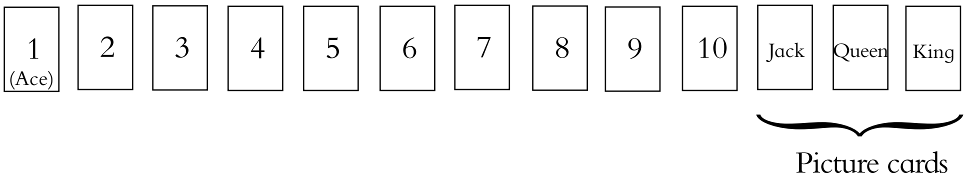
Here is a simplified diagram of a dart board, showing only the 20 sectors for the numbers 1–20 (and not doubles, trebles, 25 or 50).

Suppose you throw one dart at the board, and that if your dart misses the board you have another throw until you are successful.



1. Assuming that your dart is equally likely to land in any sector of the board, what is the probability of obtaining, with one dart:
   (a) 20?
   (b) an even number?
   (c) 18, 19 or 20?
   (d) a number which is a multiple of 3?
   (e) a prime number?

2. In a pack of playing cards, there are 13 cards (Ace, 2, 3, . . ., Jack, Queen, King) in each of the 4 suits (Diamonds ♦, Hearts ♥, Clubs ♣, Spades ♠)



   (a) How many cards are there, in total, in a pack of playing cards?
   (b) What is the probability, when taking a card at random from a complete pack of playing cards, of obtaining:
      (i) the Queen of Hearts?
      (ii) a Club?
      (iii) any King?
      (iv) the Ace (1) of Hearts or the Ace of Diamonds?
      (v) a Heart and a picture card?

3. This activity is a lottery-type game for the whole class.

   In this lottery, each pupil chooses a lottery 'card' that has two different digits on it from the digits

   1 2 3 4 5 6

   (For example, (1, 2) or (1, 6), etc.).

   An unbiased dice is thrown twice (repeating the second throw if identical digits are thrown), giving the winning pair of numbers.

   Check how many pupils in your class:

   (a) get both digits the same as the winning pair of numbers.

   (b) Get just one digit the same as one of the winning numbers.

   Repeat the game several times, and use the data to estimate the probability of:

   (c) winning.

   (d) getting one digit the same.

   These should be reasonably close to the theoretical probabilities.

   (e) List all the possible outcomes, i.e. pairs of digits (in any order).

   (f) As each outcome is equally like, what is the probability of winning if you have one 'card'?

   (g) Suppose the winning numbers are 1 and 2. How many outcomes have only 1 or 2 (but not both digits) on them? What is the probability of getting just one digit the same?

Unit 9: ALGEBRA — PART 2

In this unit you will be:

Section 9.1 Writing Simple Mathematical Expressions

In algebra, letters are used in place of numbers. This is useful when a number is not known.

Example 1

Write mathematical expressions for the following:

(a) Sani thinks of a number and increases it by 4.

(b) The product of a number and 6 is 12.

(c) 2 more than a number.

(d) 6 is taken from a number to give 4.

(e) A number is divided by 3, giving 5.

Solution

(a) Let n be the number $n + 4$

(b) Let n be the number $n \times 6 = 12$

(c) Let n be the number $n + 2$

(d) Let n be the number $n - 6 = 4$

(e) Let n be the number $\frac{n}{3} = 5$

Skill Exercises: Writing Simple Mathematical Expressions

1. Match up the answer from Column A with the mathematical sentences in Column B. Let n be the number(s).

	Column A	Column B	
1.	A number increases by 4	$9 + n$	a.
2.	The sum of a number and 8	$n - 3$	b.
3.	6 is taken away from a number	$n + 5$	c.
4.	7 minus the number	$n + 7$	d.
5.	9 more than a number	$8 + n$	e.
6.	A number decreases by 7	$n + 4$	f.
7.	The sum of a number and 5	$n - 7$	g.
8.	A number minus 5	$n - 5$	h.
9.	A number increases by 7	$n - 6$	i.
10.	A number take away 3	$7 - n$	j.

2. Write these sentences as mathematical sentences. Let '*c*' be the number:
    (a) A number added to 10.
    (b) A number decreased by 12.
    (c) One quarter of a number.
    (d) Eight subtracted from a number.
    (e) Eleven times a number.
    (f) A number multiplied by 12.
    (g) A number with ten added to it.
    (h) A number with 15 subtracted from it.
    (i) Three divided by a number.
    (j) Four is added to a number, then divided by 2.

Section 9.2 Solving Simple Equations

An equation is an algebraic expression with an 'equals'(=) sign. Solving means finding the value of a variable that makes the sentence true.

Example 1

(a) $w + 7 = 26$

(b) $y - 6 = 4$

(c) $3p = 15$

(d) $\frac{m}{5} = 8$

Solution

(a) Let w be the number. i.e. $w + 7 = 26$

To solve for w:

$$\begin{aligned} w + 7 &= 26 \\ w + 7 - 7 &= 26 - 7 \quad \text{(subtract 7 from both sides)} \\ w &= 19 \end{aligned}$$

To see that you have the correct answer (value) check that the right hand side (RHS) equals the left hand side (LHS).

$$\begin{aligned} \text{If} \quad w &= 19 \\ w + 7 &= 26 \\ 19 + 7 &= 26 \end{aligned}$$

(b)

$$\begin{aligned} y-6 &= 4 \\ y-6+6 &= 4+6 \quad \text{(add 6 to both sides)} \\ y &= 10 \end{aligned}$$

(c) Let p be the number

$$\begin{aligned} 3p &= 15 \\ \frac{3p}{3} &= \frac{15}{3} \quad \text{(divide both sides by 3)} \\ p &= 5 \end{aligned}$$

Multiplication and Division are opposite operations.

(d)

$$\begin{aligned} \frac{m}{5} &= 8 \\ \frac{m}{5} \times 5 &= 8 \times 5 \quad \text{(multiply both sides by 5)} \\ m &= 40 \end{aligned}$$

Skill Exercises: Solving Simple Equations

1. (a) $b - 12 = 4$ (b) $m + 7 = 12$
   (c) $y - 9 = 5$ (d) $k - 21 = 7$
   (e) $x + 12 = 23$ (f) $w - 13 = 21$
   (g) $b - 9 = 9$ (h) $x + 14 = 23$
   (i) $x + 12 = 17$ (j) $21 = m + 5$
   (k) $5x - 2 = 18$ (l) $4n - 8 = 20$
   (m) $20 + 5y = 5$ (n) $m - 5 = 10$
   (o) $b - 12 = 8$ (p) $7y + y = 64$
   (q) $20 - m = 5$ (r) $9w - 10 = 17$
   (s) $15 - 3x = 6$ (t) $12 + 2n = 14$

Section 9.3 Plotting Points On The Cartesian Plane

The Cartesian Plane is a grid on which graphs can be drawn. Points on the plane are represented by pairs of numbers.

Example

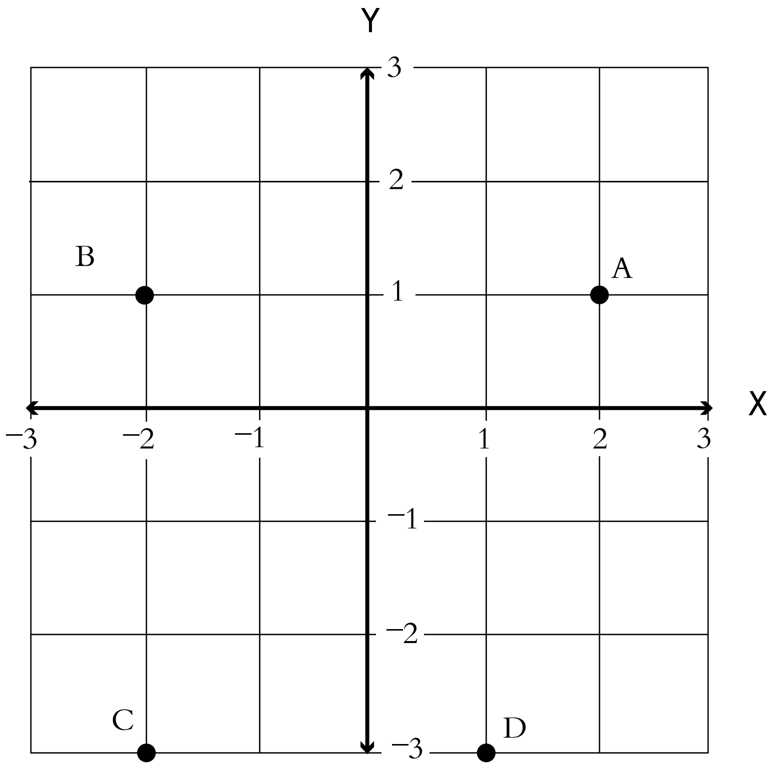
On the grid mark, the following points:

A (2, 1) B (–2, 1) C (–3, –2) D (1, –3)

Solution

The first number shows how many squares to move horizontally (left or right) from the centre.

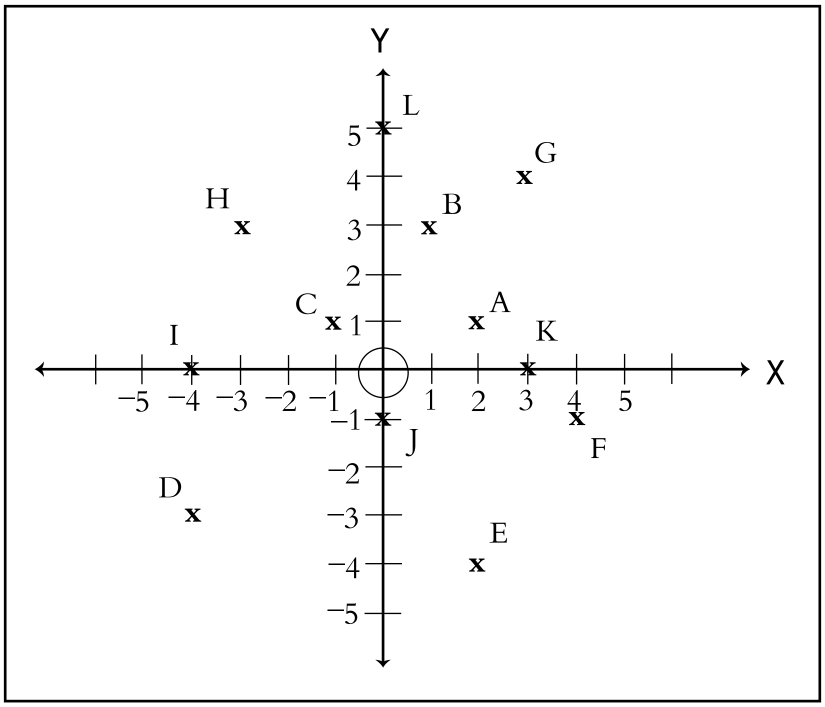
The second number shows how many squares to move vertically (up or down).



Skill Exercises: Plotting Points

1. Write the co-ordinates of the points A to L on the Cartesian Plane.

   e.g. A (2, 1)



2. Draw and label your own set of axes from –5 to 5. Mark these points on them:

   A = (3, 2) B = (0, 0) C = $(2, {}^{-}3)$
   D = $({}^{-}5, {}^{-}4)$ E = $({}^{-}1, 4)$ F = $(0, {}^{-}3)$
   G = (2, 0) H = $({}^{-}4, 0)$ I = (0, 1)
   J = (5, 5) K = $(5, {}^{-}5)$ L = $(3, {}^{-}4)$
   M = $({}^{-}3, 2)$ N = $({}^{-}2, {}^{-}4)$

Unit 10: GEOMETRY — PART 2

In this unit you will be:

10.1 Exploring Shapes using:

- ◧ Angles on a Line and Angles at a Point.
- ◧ Parallel and Intersecting Lines.
- ◧ Reflection and Translation.

Section 10.1 Exploring Shapes

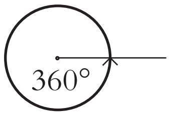
Angles on a Line and Angles at a Point

Remember that

(a) angles on a line add up to 180°

and

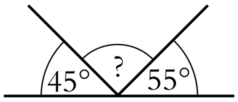
(b) angles at a point add up to 360°.



These are two important results which help when finding the size of unknown angles.

Example 1

What is size of the angle marked?



Solution

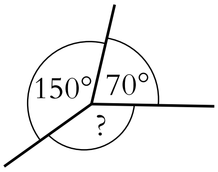
45 ° + 55° = 100°

So angle = 180° – 100°

= 80°

Example 2

What is the size of the angle marked?



Solution

70° + 150° = 220°

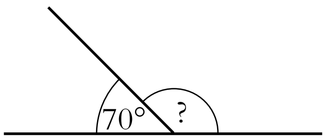
So angle = 360° – 220°

= 140°

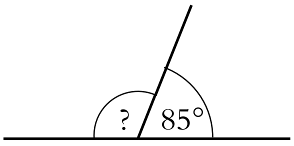
Skill Exercises: Angles on a Line and Angles at a Point

1. Calculate the unknown angle in each of the following diagrams:

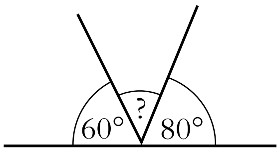
(a)



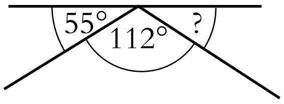
(b)



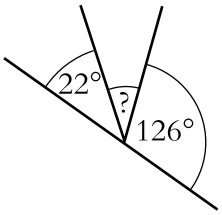
(c)



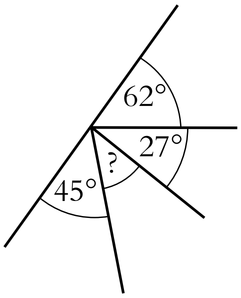
(d)



(e)

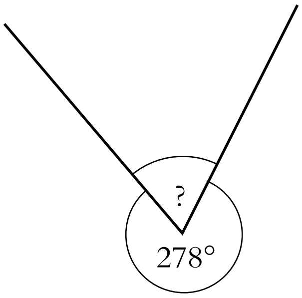


(f)

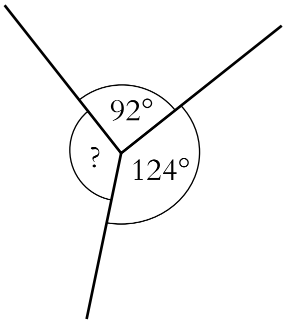


2. Calculate the unknown angle in each diagram:

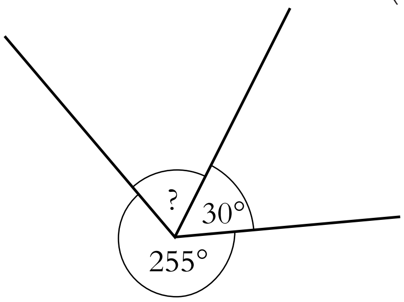
(a)



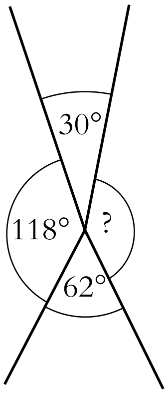
(b)



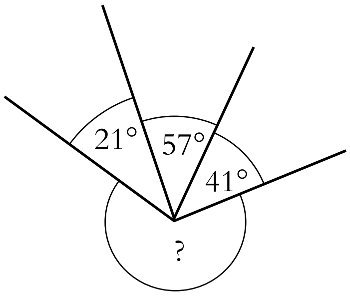
(c)



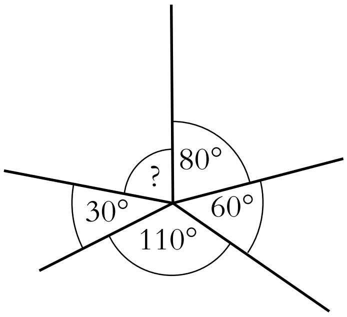
(d)



(e)

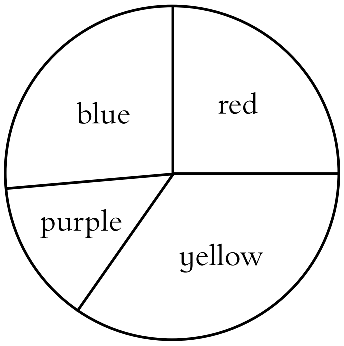


(f)



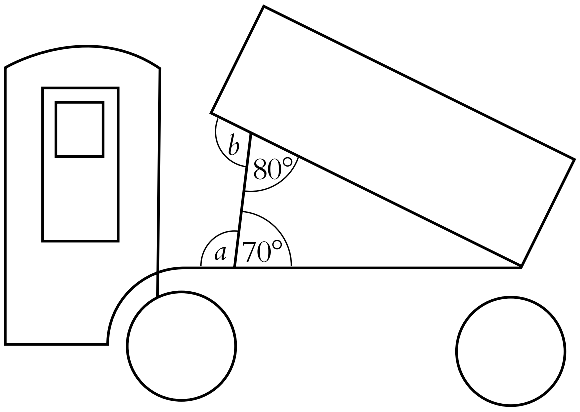
3. Some of the angles in the pie chart have been calculated:

Red	90°
Blue	95°
Purple	50°



What is the angle for yellow?

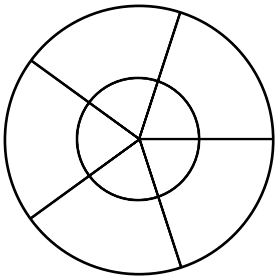
4. The picture shows a tipper truck.



(a) Find the angles marked *a* and *b*.

(b) The 80° angle decreases to 75° as the tipper tips further.What happens to angle *b*?

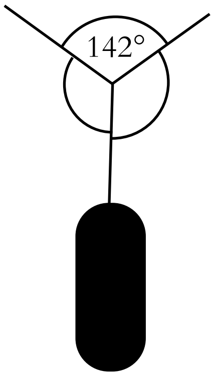
5. The diagram shows a playground roundabout viewed from above. Five metal bars are fixed to the centre of the roundabout as shown. The angles between the bars are all the same size.



(a) What size are the angles?

(b) What size would the angles be if there were nine metal bars instead of five?

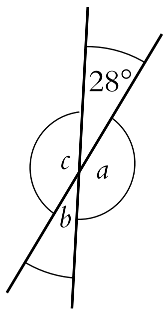
6.



A boy hangs a punchbag on a washing line.

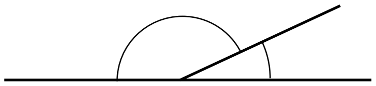
Find the unknown angles if both angles are the same size.

7. The diagram shows two straight lines.
   Find the angles *a*, *b* and *c*.
   What do you notice?



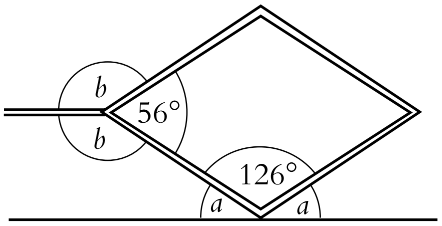
8. In the diagram the large angle is four times bigger than the smaller angle.

   Find the two angles.

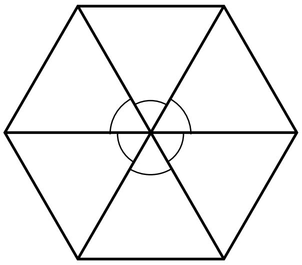


9. The picture shows a jack, that can be used to lift up a car.

   Find the angles marked *a* and *b*.



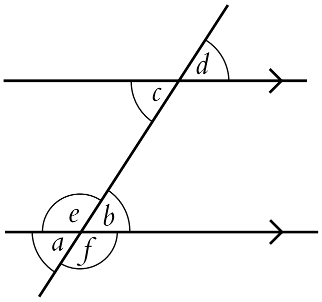
10. The diagram shows a regular hexagon.
    (a) Find the size of each of the angles marked at the centres of the hexagon.
    (b) What would these angles be if the polygon was a decagon (10 sides)?
    (c) If the angles were 30°, how many sides would the polygon have?



Parallel and Intersecting Lines

When a line intersects (or crosses) a pair of parallel lines, there are some simple rules that can be used to calculate unknown angles.

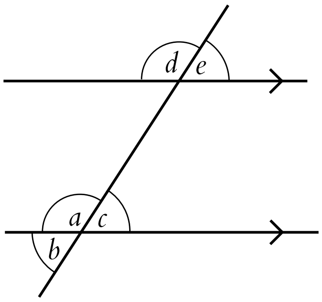
The arrows on the lines indicate that they are parallel.



$a = b$ (and $c = d$, and $e = f$)	These are called **vertically opposite** angles.
$a = c$ (and $b = d$)	These are called **corresponding** angles.
$b = c$	These are called **alternate** angles.
$a + e = 180°$ (because adjacent angles on a straight line add up to 180°)	These are called **supplementary** angles.
Note also, that $c + e = 180°$	(allied or supplementary angles)

Example 1

In the diagram opposite, find the unknown angles if $a = 150°$.



Solution

To find b:

$$a + b = 180° \quad \text{(angles on a straight line, supplementary angles)}$$
$$150° + b = 180°$$
$$b = 30°$$

To find c:

$$c = b \quad \text{(vertically opposite angles or angles on a straight line)}$$
$$c = 30°$$

To find d:

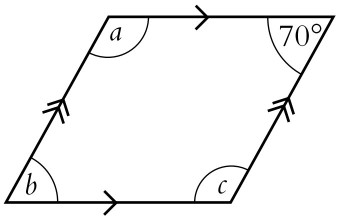
$$\begin{aligned} d &= a \quad \text{(corresponding angles)} \\ d &= 150^\circ \end{aligned}$$

To find e:

$$\begin{aligned} e &= c \quad \text{(corresponding angles)} \\ e &= 30^\circ \end{aligned}$$

Example 2

Find the size of the unknown angles in the parallelogram shown in this diagram:



Solution

To find a:

$$\begin{aligned} a + 70 &= 180^\circ \quad \text{(allied or supplementary angles)} \\ a &= 110^\circ \end{aligned}$$

To find b:

$$\begin{aligned} b + a &= 180^\circ \quad \text{(allied or supplementary angles)} \\ b + 110^\circ &= 180^\circ \\ b &= 70^\circ \end{aligned}$$

To find c:

$$\begin{aligned} c + 70^\circ &= 180^\circ \quad \text{(allied or supplementary angles)} \\ c &= 110^\circ \end{aligned}$$

or

$$\begin{aligned} c &= 360^\circ - (a + b + 70^\circ) \quad \text{(angle sum of a quadrilateral)} \\ &= 360^\circ - 250^\circ \\ &= 110^\circ \end{aligned}$$

or

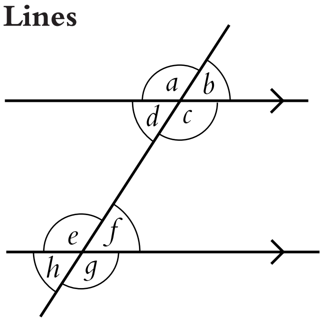
$$c = a \quad \text{(opposite angles of a parallelogram are equal)}$$

Skill Exercises: Parallel and Intersecting Lines

1. Which angles in the diagram are the same size as:

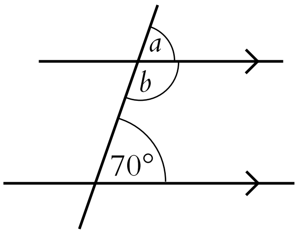
   (a) a?

   (b) b?

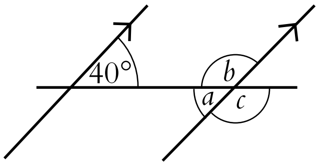


2. Find the size of each of the angles marked with letters in the diagram below, giving reasons for your answers:

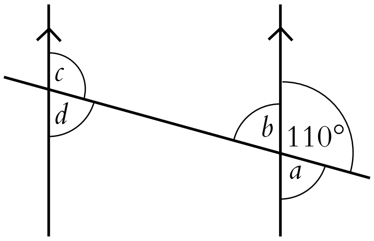
(a)



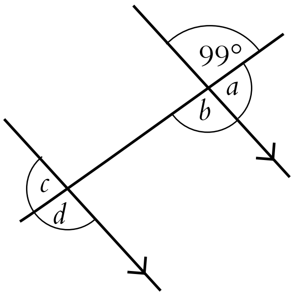
(b)



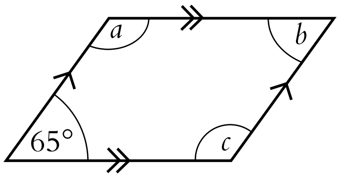
(c)



(d)



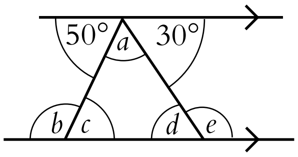
3. Find the size of the three unknown angles in the parallelogram opposite:



4. One angle in a parallelogram measures 36°. What is the size of each of the other three angles?

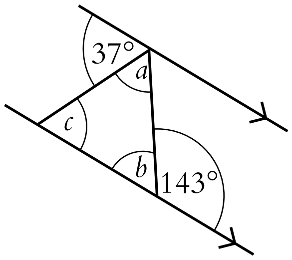
5. One angle in a rhombus measures 133°. What is the size of each of the other three angles?

6. Find the sizes of the unknown angles marked with letters in the diagram:

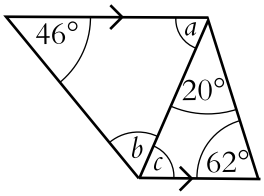


7. (a) In the diagram opposite, find the sizes of the angles marked in the triangle. Give reasons for your answers.

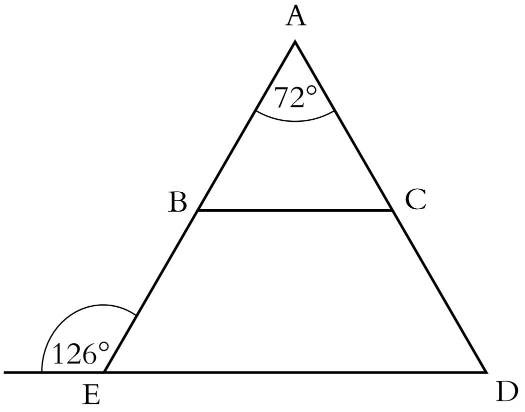
   (b) What special name is given to the triangle in the diagram?



8. The diagram shows a bicycle frame. Find the sizes of the unknown angles *a*, *b* and *c*.



9.



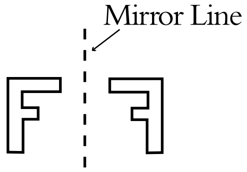
BCDE is a trapezium.

(a) Find the sizes of all the unknown angles, giving reasons for your answers.

(b) What is the special name given to this type of trapezium?

Reflection and Translation

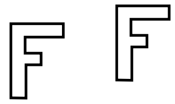
A reflection is a 'flip' of a shape. It produces a mirror image which has been turned over.



A A'

(original) (image after reflection)

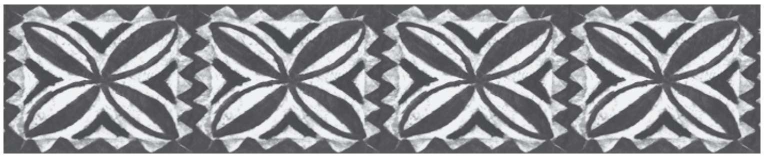
A translation is a 'slide' of a shape, to the left or right, up or down. The image is not 'flipped' or turned.



A A'

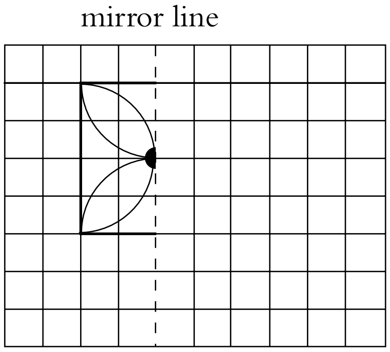
(original) (image of translation)

Traditional Samoan designs shown both reflection and translation.

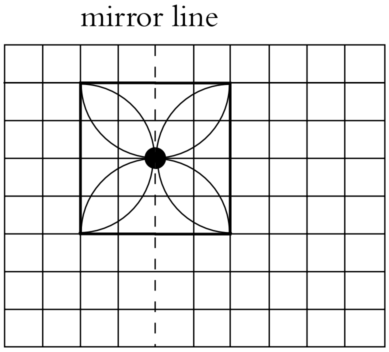


Example 1

Draw the reflection of the shape in the mirror line.

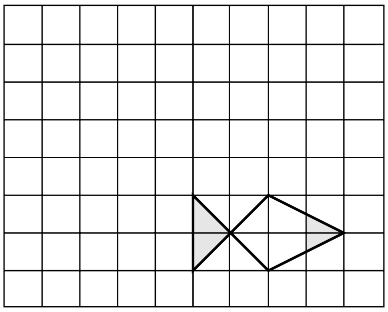


Solution



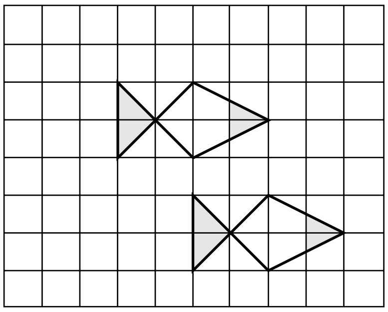
Example 2

Translate the shape 2 units left and 3 units up.



Solution

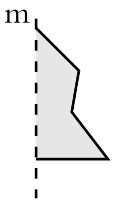
Each corner of the shape has moved 2 squares left and 3 squares up.



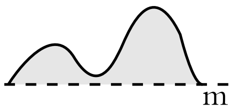
Skill Exercises: Reflection and Translation

1. Draw the reflection of these shapes in the mirror line m:

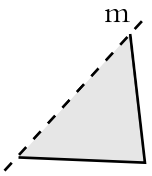
(a)



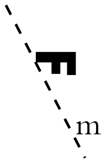
(b)



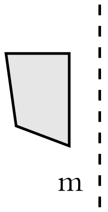
(c)



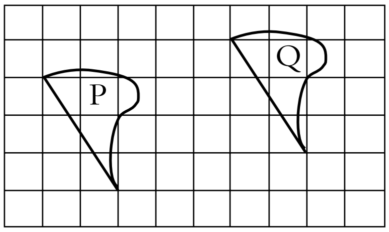
(d)



(e)



2. (a) The shape is translated from position P to position Q.



(i) How many squares to the right has it been translated?

(ii) How many squares up has it been translated?

(b) The shape is translated from position Q to position P.

(i) How many squares to the left has it been translated?

(ii) How many squares down has it been translated?

3. Describe, in words, the translations:

(a) A to B

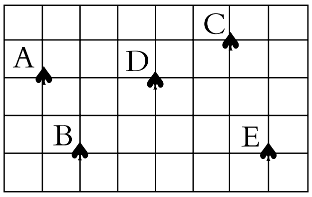
(b) B to C

(c) C to D

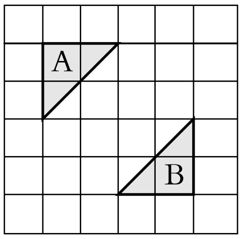
(d) D to E

(e) B to E

(f) D to A



4. Copy this diagram, and then draw all the following translations:



(a) Translate A:

    (i) 2 units to the right

    (ii) 2 units down

    (iii) 2 units to the right and 2 units down

(b) Translate B:

    (i) 2 units to the left

    (ii) 2 units up

    (iii) 2 units up and 2 units to the left.

(c) You will now have eight triangles on your diagram. What shape is the outline of the completed diagram?

Unit 11: STATISTICS

In this unit you will be:

11.1 Exploring Data through

- ◧ Collecting and Displaying Data.
- ◧ Carrying out Investigations.

Section 11.1 Exploring Data

Collecting and Displaying Data

In this section, we will see how data is collected and organised, using a tally chart and then displayed, using:

Pictograms

Bar charts

Pie charts.

Note: An hypothesis is an idea that you want to investigate to see if it is true or false. For example, you might think that most people in your school get there by bus.You could investigate this using a survey. A tally chart can be used to record your data.

Example

The pupils in a class were asked how they got to school.

Method of Travel	Tally	Frequency
Walk	卌 ||||	9
Bike	|||	3
Car	卌 |	6
Bus	卌 卌 ||	12
	TOTAL	30

Illustrate this date, using:

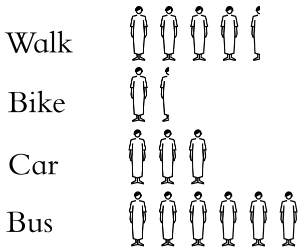
(a) a pictogram.

(b) a bar chart.

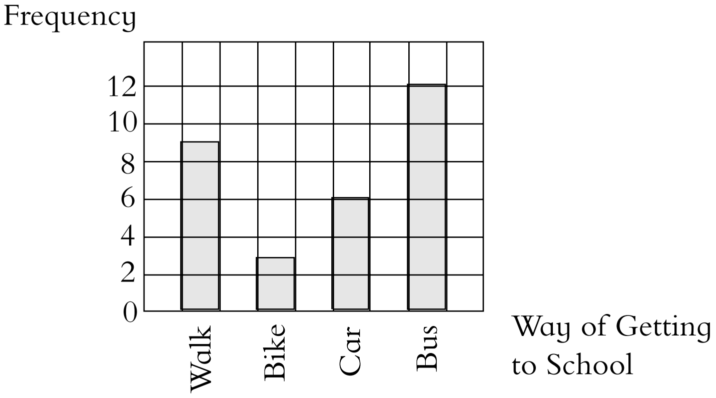
(c) a pie chart.

Solution

(a) If 🧍 is taken to represent two people, then the pictogram looks like



(b) A bar chart for the data is illustrated below:



(c) To illustrate the data with a pie chart, you need to find out what angle is equivalent to one pupil. Since there are 360° in a circle and 30 pupils,

$$\text{angle per pupil} = \frac{360°}{30} = 12°$$

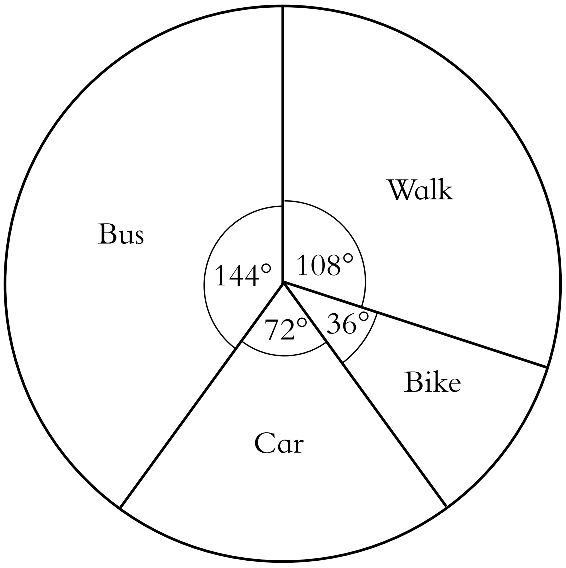
To find the angle for walk, when there are nine pupils, it is simply

$$9 \times 12° = 108°$$

The complete calculations are shown below:

Method of Travel	Frequency	Calculation	Angle
Walk	9	$9 \times \frac{360}{30} =$	108°
Bike	3	$3 \times \frac{360}{30} =$	36°
Car	6	$6 \times \frac{360}{30} =$	72°
Bus	12	$12 \times \frac{360}{30} =$	144°
		TOTAL	360°

The corresponding pie chart is shown below:



From the date we can see that:

The most common way of getting to school is by bus (this is called the mode),

The least popular way of getting to school is by bike.

Skill Exercises: Collecting and Displaying Data

1. The students in a class were asked to state their favourite potato chips. The results are given in the tally chart below:

Flavour	Tally	Frequency
Ready Salted	𝍸	
Salt and Vinegar	𝍸 ||||	
Cheese and Onion	𝍸 ||	
Prawn Cocktail	|||	
Smokey Bacon	𝍸 |	
	TOTAL	

(a) Copy and complete the table.

(b) Represent the data on a bar chart.

(c) Draw a pictogram for this data.

(d) Copy and complete the following table and draw a pie chart.

Flavour	Frequency	Calculation	Angle
Ready Salted	5	$\frac{5}{30} \times 360° =$	60°
		TOTAL	

(e) What flavour is the most popular?

2. (a) Do you think salt and vinegar chips will be the most popular chips in your class?

   (b) Carry out a favourite potato chips survey for your class. Present the results in a bar chart and state which flavour is the mode.

   (c) Was your hypothesis in (a) correct?

3. 'More students in my class travel to school by bus than by any other method.'
   - (a) Collect data to test this hypothesis.
   - (b) Present your data in a suitable diagram.
   - (c) Was the original hypothesis correct?

4. Is the pop group that is most popular with the boys in your class the same as the pop group that is most popular with the girls?
   - (a) Write down a hypothesis that will enable you to answer this question.
   - (b) Collect suitable data from your class.
   - (c) Present your data using a suitable diagram.
   - (d) Was the hypothesis correct?

5. (a) State a hypothesis about one of the following for your class:

Favourite rugby team

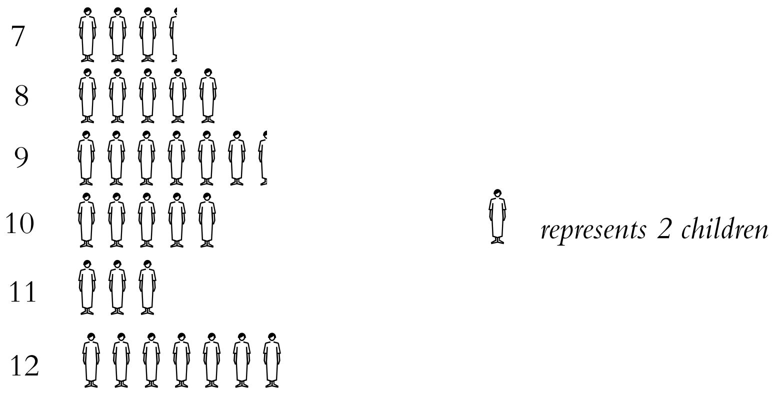
Favourite pop group

Favourite movie

Favourite cartoon character

   - (b) Collect data for your class and display it using suitable diagrams.
   - (c) Was your hypothesis correct?

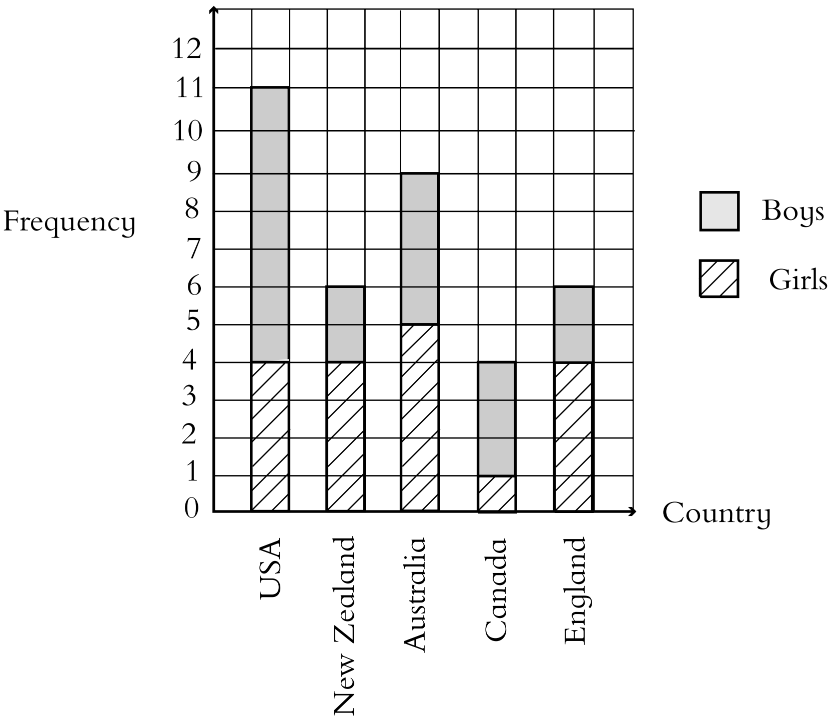
6. The ages of the children that belong to a junior tennis club are illustrated in the pictogram:



(a) What is the most common age?

(b) Draw a pie chart to illustrate this information.

7. The bar chart gives information about the country that students would most like to visit.



Answer the following questions:

(a) How many girls would like to visit the U.S.A?

(b) How many students would like to visit England?

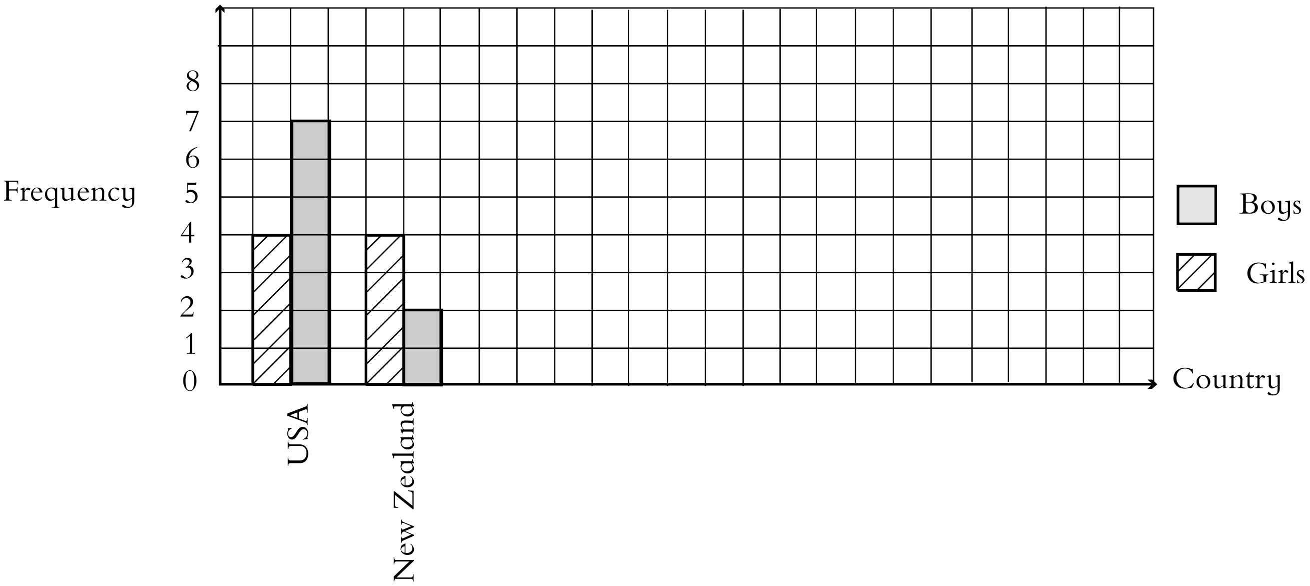
(c) Is England more popular with girls or boys?

(d) How many girls would like to visit Australia?

(e) What country is the most popular destination with the boys?

(f) What country is the most popular destination with the girls?

Another way of drawing the same bar chart has been started below. Copy and complete this chart.

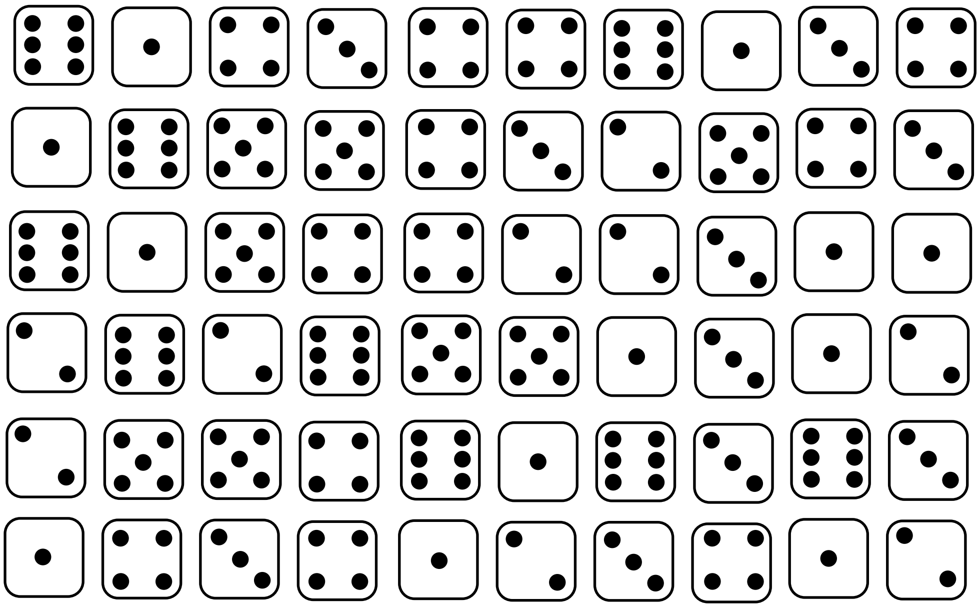


8. Draw a bar chart to illustrate the following data on the favourite colours of a group of students.

	Girls	Boys
Yellow	𝍸 ||	𝍸 ||
Red	𝍸	𝍸 |||
Black	|	||||
Purple	||||	||
Green	|||	𝍸 ||
Blue	||||	𝍸 |
Pink	𝍸 |	

9. Tana thinks that the dice in a Monopoly set is unfair because he never gets a six when he wants one. He decides to test the dice and rolls it 60 times.

   The diagram shows what happened.



   (a) Show his results on a table, then draw a bar chart.

   (b) Do you think his dice is fair?

10. Carry out your own experiment with a dice like Tana did in question 9.

   (a) Do you think your dice is fair?

Carrying out Investigations

There are probably things that you wish to find out for yourself. When you have found out the answer you could put them in a report so that other people will also know those answers. Your knowledge of statistics can help you when you prepare your report. This is called conducting an investigation. There are clear steps in the process:

(a) Decide exactly what it is you wish to know.

(b) Decide what information you need in order to answer your question.

(c) Decide how you will get and record that information.

(d) Decide how you will analyse and interpret the information.

(e) Decide how you will report on the result of your investigation.

Skill Exercises: Carrying out Investigation

1. Collect data on the colours of cars parked in your village, road or a nearby car park. Illustrate the data in a bar chart.
2. Collect data on the main foods that the students in your class have for lunch. Draw a pie chart to illustrate your result.

Unit 1: ANSWERS – NUMBER – PART 1

Section 1.1 Using The Four Mathematical Operations (+, −, ×, ÷)

(Pg.7) Skill Exercises: Adding and Subtracting Integers

(a) 9 (b) 10 (c) 8 (d) $^{-}4$

(e) 3 (f) 6 (g) 0 (h) 0

(i) 3 (j) $^{-}3$ (k) 1 (l) $^{-}2$

(m) 7 (n) 0 (o) 0 (p) 5

(q) 1 (r) 2 (s) 2 (t) 16

(Pg.7) Skill Exercises: Multiplying Integers

1. (a) 18 (b) $^{-}8$ (c) 12 (d) $^{-}6$
   (e) $^{-}6$ (f) 15 (g) 100 (h) $^{-}100$
   (i) 40 (j) $^{-}60$
2. (a) $^{-}6$ (b) 25 (c) 10 (d) 14
   (e) $^{-}18$ (f) 4 (g) $^{-}64$ (h) 21
   (i) 21 (j) $^{-}21$

(Pg.8) Skill Exercises: Dividing Integers

1. (a) $^{-}2$ (b) 4 (c) $^{-}3$ (d) 3
   (e) $^{-}3$ (f) 3 (g) 3 (h) $^{-}9$
   (i) $^{-}3$ (j) 3
2. (a) $^{-}2$ (b) $^{-}2$ (c) 2 (d) $^{-}5$
   (e) $^{-}9$ (f) $^{-}8$ (g) 3 (h) $^{-}10$
   (i) 9 (j) $^{-}10$

(Pg.9) Skill Exercises: Equivalent Fractions

(a) $\frac{6}{18}$ (b) $\frac{12}{18}$ (c) $\frac{3}{12}$ (d) $\frac{6}{12}$

(e) $\frac{9}{12}$ (f) $\frac{5}{25}$ (g) $\frac{10}{25}$ (h) $\frac{15}{25}$

(i) $\frac{20}{25}$ (j) $\frac{9}{24}$ (k) $\frac{6}{14}$ (l) $\frac{12}{21}$

(m) $\frac{8}{18}$ (n) $\frac{15}{27}$ (o) $\frac{9}{6}$ (p) $\frac{10}{16}$

(q) $\frac{56}{70}$ (r) $\frac{21}{70}$ (s) $\frac{21}{30}$ (t) $\frac{90}{100}$

(Pg.10) Skill Exercises: Simplifying Fractions

(a) $\frac{1}{2}$ (b) $\frac{1}{2}$ (c) $\frac{1}{2}$ (d) $\frac{1}{3}$

(e) $\frac{2}{3}$ (f) $\frac{3}{4}$ (g) $\frac{1}{3}$ (h) $\frac{1}{2}$

(i) $\frac{2}{3}$ (j) $\frac{4}{5}$ (k) $\frac{3}{4}$ (l) $\frac{2}{3}$

(m) $\frac{1}{2}$ (n) $\frac{5}{8}$ (o) $\frac{4}{5}$ (p) $\frac{3}{5}$

(q) $\frac{7}{10}$ (r) $\frac{3}{10}$ (s) $\frac{9}{20}$ (t) $\frac{19}{20}$

(Pg.11) Skill Exercises: Adding and Subtracting Fractions (Same Denominator)

1. (a) $\frac{4}{5}$ (b) $\frac{3}{4}$ (c) $\frac{5}{7}$ (d) $\frac{2}{3}$

(e) $\frac{5}{6}$ (f) $\frac{4}{5}$ (g) $\frac{8}{11}$ (h) $\frac{2}{3}$

(i) $\frac{6}{7}$ (j) $\frac{14}{15}$

2. (a) $\frac{1}{5}$ (b) $\frac{2}{11}$ (c) $\frac{2}{5}$ (d) $\frac{3}{8}$

(e) $\frac{1}{2}$ (f) $\frac{3}{5}$ (g) $\frac{2}{3}$ (h) $\frac{1}{2}$

(i) $\frac{1}{4}$ (j) $\frac{2}{3}$

(Pg.12) Skill Exercises: Finding Lowest Common Multiples

(a) 6 (b) 15 (c) 12 (d) 10

(e) 28 (f) 8 (g) 21 (h) 6

(i) 35 (j) 24

(Pg.13) Skill Exercises: Adding and Subtracting Fractions (Different Denominators)

1. (a) $\frac{14}{15}$ (b) $\frac{29}{30}$ (c) $\frac{24}{35}$ (d) $\frac{7}{8}$

(e) $\frac{9}{20}$ (f) $\frac{17}{21}$ (g) $\frac{13}{15}$ (h) $\frac{19}{20}$

(i) $\frac{17}{24}$ (j) $\frac{16}{21}$

2. (a) $\frac{1}{12}$ (b) $\frac{3}{8}$ (c) $\frac{17}{63}$ (d) $\frac{13}{18}$

(e) $\frac{7}{10}$ (f) $\frac{11}{42}$ (g) $\frac{1}{10}$ (h) $\frac{1}{6}$

(i) $\frac{5}{12}$ (j) $\frac{9}{35}$

(Pg.14) Skill Exercises: Writing Mixed Numbers and Improper Fractions

1. (a) $\frac{7}{2}$ (b) $\frac{7}{4}$ (c) $\frac{13}{5}$ (d) $\frac{13}{8}$

(e) $\frac{11}{3}$ (f) $\frac{21}{4}$ (g) $\frac{15}{2}$ (h) $\frac{38}{7}$

(i) $\frac{53}{3}$ (j) $\frac{29}{12}$

2. (a) $2\frac{1}{2}$ (b) $1\frac{3}{4}$ (c) $1\frac{1}{2}$ (d) $1\frac{2}{5}$

(e) $1\frac{1}{6}$ (f) $2\frac{3}{4}$ (g) $1\frac{2}{3}$ (h) $1\frac{1}{7}$

(i) $1\frac{1}{4}$ (j) $1\frac{6}{11}$

(Pg.16) Skill Exercises: Multiplying Fractions

1. (a) $\frac{2}{15}$ (b) $\frac{15}{32}$ (c) $\frac{1}{3}$ (d) $\frac{21}{32}$
(e) $\frac{3}{20}$ (f) $\frac{1}{4}$ (g) $\frac{9}{16}$ (h) $\frac{3}{10}$
(i) $\frac{3}{10}$ (j) 2 (k) $4\frac{1}{8}$ (l) $14\frac{17}{20}$
(m) $3\frac{8}{9}$ (n) $4\frac{19}{24}$

2. (a) $\frac{3}{8}$ (b) 8 (c) $\frac{15}{32}$ (d) $\frac{1}{4}$
(e) $4\frac{1}{8}$ (f) 3

(Pg.17) Skill Exercises: Finding Reciprocals of Fractions

1. (a) 3 (b) $\frac{5}{3}$ (c) $\frac{3}{2}$ (d) $\frac{8}{3}$
(e) $\frac{5}{4}$ (f) $\frac{8}{7}$ (g) $\frac{5}{2}$ (h) $\frac{4}{3}$
(i) $\frac{7}{3}$ (j) $\frac{9}{4}$

2. (a) $\frac{3}{4}$ (b) $\frac{5}{7}$ (c) $\frac{4}{5}$ (d) $\frac{2}{5}$
(e) $\frac{2}{9}$ (f) $\frac{3}{8}$ (g) $\frac{5}{16}$ (h) $\frac{4}{9}$
(i) $\frac{3}{10}$ (j) $\frac{4}{5}$

(Pg.18) Skill Exercises: Dividing with Fractions

1. (a) $1\frac{1}{3}$ (b) $\frac{9}{10}$ (c) $\frac{15}{16}$ (d) $1\frac{1}{2}$
(e) 2 (f) $\frac{3}{20}$ (g) $\frac{3}{4}$ (h) $1\frac{5}{16}$
(i) $2\frac{2}{5}$ (j) $1\frac{1}{2}$

2. (a) $1\frac{1}{5}$ (b) $\frac{15}{28}$ (c) $\frac{3}{10}$ (d) $6\frac{1}{2}$

(e) $11\frac{3}{7}$ (f) $4\frac{27}{32}$ (g) $\frac{1}{4}$ (h) $\frac{5}{21}$

(i) $1\frac{2}{3}$ (j) $1\frac{17}{22}$

(Pg.19) Skill Exercises: Adding and Subtracting Decimals

1. (a) 9.63 (b) 20.85 (c) 24.71 (d) 23.08
(e) 31.20 (f) 21.01 (g) 20.58 (h) 4.33
(i) 11.76 (j) 11.05
2. (a) 2.2 (b) 16.1 (c) 5.7 (d) 3.08
(e) 3.6 (f) 6.14 (g) 5.04 (h) 14.53
(i) 9.11 (j) 14.68

(Pg.20) Skill Exercises: Multiplying Decimals

(a) 4.44 (b) 1.9 (c) 14.16 (d) 0.708
(e) 118 (f) 43.56 (g) 0.018 (h) 1.16
(i) 0.172 (j) 86

(Pg.21) Skill Exercises: Dividing with Decimals

(a) 9 (b) 14 (c) 29 (d) 12
(e) 4.1 (f) 6.1 (g) 73 (h) 23
(i) 1.04 (j) 1.16

(Pg.21) Skill Exercises: Practical Problems – Decimals

1. 5.1 km 2. 6.7 cm 3. 4.94 km 4. 1.88 m
5. 62.5 m 6. 0.32 m 7. 1.27 m 8. 0.65 m
9. 33.53 litres 10. $8.80

Section 1.2 Rounding Numbers

(Pg.22) Skill Exercises: Rounding Numbers

1. 2 groups of 4, 1 group of 5
2. \$27.80 or \$28.00
3. 2000 (100 × 20)
4. 30 (600 ÷ 20)
5. 4000 (100 × 40)
6. 10 (300 ÷ 30)
7. 70 sene
8. \$1.10
9. \$49.00
10. \$11.00

Section 1.3 Evaluating Exponents

(Pg.24) Skill Exercises: Evaluating Exponents

1. (a) 4^4 (b) 2^4 (c) $5^2 \times 6^2$ (d) $2^3 \times 3^2$
   (e) $10^3 \times 5$ (f) 8^4 (g) $2^3 \times 3^2$ (h) $2^3 \times 6^2$
   (i) $5^2 \times 4^3$ (j) $5^3 \times 2^2$
2. (a) 27 (b) 3 (c) 16 (d) 81
   (e) 5 (f) 9 (g) 64 (h) 100
   (i) 49 (j) 81

Section 1.4 Finding Square Numbers And Square Roots

(Pg.25) Skill Exercises: Finding Square Numbers and Square Roots

1. (a) 49 (b) 144 (c) 81 (d) 100
   (e) 400 (f) 10 000
2. (a) 2 (b) 6 (c) 16 (d) 7
   (e) 10 (f) 1

Unit 2: ANSWERS – ALGEBRA – PART 1

Section 2.1 Simplifying Algebraic Expressions

(Pg.28) Skill Exercises: Addition and Subtraction

1. (a) $8x$ (b) $10a$ (c) $7p$ (d) $11c$
(e) $9m$ (f) $16k$ (g) $19w$ (h) $11n$
(i) $11g$ (j) $2d$ (k) $2t$ (l) $3b$
(m) $3r$ (n) 0 (o) $12x$ (p) $6p$
(q) $4a$ (r) $16z$ (s) c (t) $4m$

2. (a) $5n + 4y$ (b) $3y$ (c) $10x$ (d) $7y + 6g$
(e) $7a - 8b$ (f) $2a$ (g) $10xy$ (h) $11n$
(i) $8g$ (j) $3z + 5x$ (k) $7a - 12$ (l) $8r + 4s$
(m) $7a$ (n) $8d +3s$ (o) $10a$ (p) $7m - 7n$
(q) $4ab$ (r) $22x - 7y$ (s) $5cd + 7a$ (t) $10ak - 9$

(Pg.29) Skill Exercises: Multiplication

1. (a) $10m$ (b) $20c$ (c) $7bd$ (d) $^{-}15f$
(e) $40sy$ (f) $28ay$ (g) $80a^2b$ (h) $30ps^2$
(i) a^2b (j) a^2b^3 (k) $18r$ (l) $12ac$
(m) $^{-}6ms$ (n) $6m^2$ (o) $22k^2$ (p) $^{-}8a^2$
(q) $6a^2b^2$ (r) $9q^3r^2$ (s) $^{-}3w^2y^2$ (t) $32a$

2. (a) $12a^2$ (b) $16y^2x$ (c) $^{-}40f^2$ (d) $^{-}10h^3$
(e) $^{-}16a^2c$ (f) $^{-}3d^3a^2$ (g) $^{-}21p^2d$ (h) $^{-}6k^2lm^2$
(i) $^{-}m^3pz$ (j) $12f$ (k) $^{-}20s^2$ (l) $^{-}42p^3$
(m) $^{-}27a^2$ (n) $^{-}33s^2$ (o) $^{-}49w^2$ (p) $^{-}18y^2z$
(q) $^{-}15a^2c$ (r) $^{-}q^2r^2p$ (s) $12d^2$ (t) $^{-}6p^3$

(Pg.30) Skill Exercises: Division

(a) 3 (b) 4 (c) 3 (d) 2

(e) $4p$ (f) $2q$ (g) $\frac{1}{2}$ (h) $\frac{1}{2}h$

(i) $\frac{1}{4}y$ (j) $\frac{1}{2}b$

Section 2.2 Expanding And Factoring Algebraic Expressions

(Pg.31) Skill Exercises: Expanding

1. (a) $4a + 4b$ (b) $9m + 6$ (c) $12g + 6h$

(d) $12y + 4z$ (e) $8a + 14c$ (f) $5dw + 12w$

(g) $8db + b^2$ (h) $8x + 6xy$ (i) $8ak + 6ac$

(j) $3axy + x^2y$ (k) $12r - 20t$ (l) $6f - 24h$

(m) $10w - 3w^2$ (n) $36g - 9q$ (o) $32kp - 56k$

2. (a) $5xy + 15sx$ (b) $12d + 36p$ (c) $28bc - 21c$

(d) $33f - 22$ (e) $9eh - hw$ (f) $35sy - 21vy$

(g) $48bq - 40cq$ (h) $48rx - 12fx$ (i) $12m - 5m^2$

(j) $18df - 42d$ (k) $21bm - 7bn$ (l) $10g + 15bg$

(m) $40f - 10g$ (n) $20k + 5k^2$ (o) $48z - 72$

(Pg.32) Skill Exercises: Factorising

(a) $4(s - 3y)$ (b) $3(w + 3m)$ (c) $4(3 - n)$

(d) $5(2k + 3r)$ (e) $4(f - 6v)$ (f) $6(3b + r)$

(g) $9(j - 3)$ (h) $4n(4m + 1)$ (i) $7b(a - 3)$

(j) $bc(a + 1)$ (k) $5y(5x - 1)$ (l) $3a(5b + 1)$

(m) $5(4 - 3g)$ (n) $3p(3q + 8)$ (o) $7g(2f - 3)$

(p) $yz(x + 2)$ (q) $4j(5h + 1)$ (r) $2q(r + 1)$

(s) $25(4 - d)$ (t) $12b(4g - 3)$

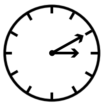
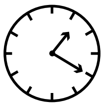
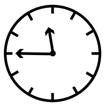
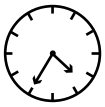
Unit 3: ANSWERS – MEASUREMENT – PART 1

Section 3.1 Carrying Out Practical Measuring Tests

(Pg.38) Skill Exercises: Estimating and Measuring (Metric Units)

1–7. Check answers with teacher.

8.

	(a)	(b)	(c)	(d)
Time on a clock	 afternoon			 afternoon
Digital time	3.10 pm	1.20 am	11.45 am	4.35 pm
Twenty four hour time	1510	0120	1145	1635
Time in words	Ten past three in the afternoon	Twenty past one at night	Fifteen minutes to twelve in the morning	Twenty five to five in the afternoon

9. (a) 1 hour 40 minutes

   (b) 8.30 pm

   (c) Yes – total time for 3 programmes = 175 minutes (2 hours 55 minutes)

Section 3.2 Converting Between Metric Measures

(Pg.40) Skill Exercises: Converting between Metric Measures

1. (a) 40 mm (b) 70 mm (c) 260 mm
(d) 8350 mm (e) 62 mm (f) 147 mm
(g) 92.5 mm (h) 0.4 mm (i) 6 cm
(j) 8 cm (k) 34 cm (l) 945 cm
(m) 8.7 cm (n) 26.2 cm (o) 6.79 cm
(p) 0.6 cm

2. (a) 700 cm (b) 1800 cm (c) 3600 cm
(d) 90 400 cm (e) 430 cm (f) 5390 cm
(g) 2838 cm (h) 9 cm (i) 8 m
(j) 5 m (k) 7.6 m (l) 21.5 m
(m) 3.65 m (n) 0.57 m (o) 0.776 m
(p) 0.06 m

3. (a) 5000 m (b) 11 000 m (c) 63 000 m
(d) 423 000 m (e) 7400 m (f) 2650 m
(g) 14 321 m (h) 70 m (i) 6 km
(j) 17 km (k) 53 km (l) 4.75 km
(m) 0.807 km (n) 0.062 km (o) 0.003 km
(p) 0.0293 km

4. (a) 6000 g (b) 8000 g (c) 15 000 g
(d) 92 000 g (e) 1700 g (f) 5470 g
(g) 2925 g (h) 4 g (i) 3 kg
(j) 40 kg (k) 8.34 kg (l) 29.75 kg
(m) 0.237 kg (n) 0.052 kg (o) 0.009 kg
(p) 0.0036 kg

5. (a) 0.32 m (b) 6.42 m (c) 0.642 m
(d) 8.88 m (e) 2240 mm (f) 45 000 mm
(g) 32 000 cm (h) 8730 mm

6. (a) 8200 kg (b) 160 000 kg (c) 0.088 kg
(d) 3.47 kg

7. (a) 3600 g (b) 3 700 000 g (c) 0.84 g
(d) 0.062 g

8. (a) 250 ml (b) 22 000 ml (c) 750 ml
(d) 450 ml

9. (a) 4.74 litres (b) 0.064 litres (c) 0.3 litres
(d) 3.6 litres

10. (a) 0.3 kg (b) 300 gm

11. 120 times

12. (a) 750 ml (b) 0.75 litres

13. 18 sweets

14. (a) 12.5 gm (b) 16 ml (c) 6.25 gm

Section 3.3 Converting Between Metric And Imperial Measures

(Pg.43) Skill Exercises: Converting between Metric and Imperial Measures

1. (a) 15 cm (b) 20 cm (c) 19 cm (d) 240 cm
(e) 360 cm (f) 112.5 cm

2.

SEATTLE	640 km
AUBURN	614 km
TACOMA	269 km
LAKE TAPPS	259 km
OLYMPIA	237 km

3. (a) 222 g (b) 0.222 kg (c) 8 oz

4. (a) 135 litres (b) 240 pts

5. 10.1 litres

6. 1.9 kg

7.

mph	km/h
30	48
31.3	50
40	64
43.8	70
50	80

mph	km/h
60	96
62.5	100
70	112
75	120

Unit 4: ANSWERS – GEOMETRY – PART 1

Section 4.1 Investigating Triangles

(Pg.48) Skill Exercises: Measuring Angles

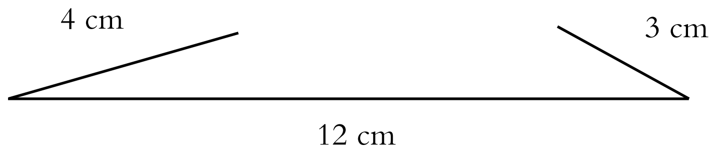
1. (a) 50° (b) 60° (c) 80° (d) 145°
   (e) 95° (f) 45° (g) 105° (h) 38°
2. (a) 235° (b) 290° (c) 231° (d) 338°
3. (a) Cola 160° Pineapple 40°
   Orange 50° Lemonade 75°
   Water 35°
   (b) Largest sector (largest angle)
   (c) Lemonade
5. (a) $A\hat{D}C = 118°$; $B\hat{A}E = B\hat{C}D = 84°$; $AED = C\hat{D}E = 127°$
   (b) $D\hat{A}F = C\hat{D}E = 127°$; $A\hat{D}C = B\hat{C}D = D\hat{E}F = A\hat{F}E = 117°$
   (c) All angles = 135°
   (d) $A\hat{B}C = 127°$; $D\hat{A}G = B\hat{C}D = 117°$;
   $A\hat{G}F = C\hat{D}E = G\hat{F}E = D\hat{E}F = 135°$

(Pg.51) Skill Exercises: Classifying Angles

1. (a) Reflex (b) Acute (c) Obtuse
   (d) Reflex (e) Acute (f) Obtuse
2. (a) A: acute; B: obtuse; C: acute; D: reflex
   (b) A: acute; B: obtuse; C: obtuse; D: acute; E: acute; F: reflex

(Pg.54) Skill Exercises: Constructing Triangles

1. (a) 30° + 61° + 89° = 180° (b) 34° + 102° + 44° = 180°
   (c) 30° + 50° + 100° = 180° (d) 120° + 30° + 30° = 180°
2. Comparison of students' work.
3. The lengths of the two shorter sides do not add up to or exceed the length of the longest side.



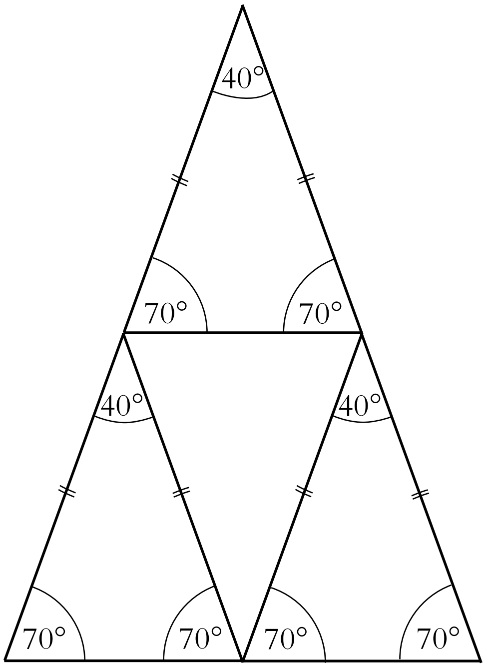
4. Triangles (a), (b) and (d) can be drawn.
   (a) 59°, 35°, 86°
   (b) 32°, 95°, 53°
   (d) 60°, 60°, 60°
5. (a) AB = 6.2 cm, BC = 5.1 cm (b) ∠ABC = 90°
6. (a) 60° (b) 130° (c) 40° (d) 40°

(Pg.57) Skill Exercises: Finding Angles in Triangles

1. (a) 50° (b) 25° (c) 63°
   (d) 37° (e) 125° (f) 48°
2. (a) $a = b = 50^\circ$ (b) $a = 85^\circ$, $b = 10^\circ$
   (c) $a = b = c = 60^\circ$ (d) $a = b = 29^\circ$
3. (a) Isosceles (b) Scalene (c) Isosceles (d) Equilateral
4. (a) $a = 55^\circ$, $b = 125^\circ$ (b) $a = 48^\circ$, $b = 132^\circ$
   (c) $a = 34^\circ$, $b = 146^\circ$ (d) $a = 42^\circ$, $b = 138^\circ$
5. Exterior angle = sum of two interior opposite angles.
   (a) 102° (b) 142° (c) 137° (d) 133°
6. a = 119°, b = 126°, c = 115°
   Yes, $a + b + c = 360^\circ$
7. (a) 115° + 115° + 130° = 360° (b) 150° + 160° + 50° = 360°
   (c) 90° + 142° + 128° = 360° (d) 122° + 118° + 120° = 360°
   Exterior angles add up to 360°.

8. (a) $a = 69°$ (b) $a = 41°$
   (c) $a = b = 90°$ (d) $a = 50°, b = 65°, c = 65°, d = 115°$
   (e) $a = b = c = 120°$ (f) $a = b = 70°, c = 40°, d = 110°$

9.



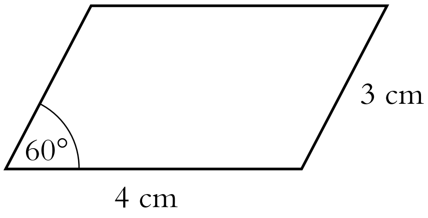
10. (a) Interior angles are each 85°
    (b) Each 80°, each 75°
    (c) Other angles decrease 5° to 70°

11. 70°, 55°, 55° or 70°, 70°, 40°

Section 4.2 Investigating 2-D And 3-D Shapes

(Pg.64) Skill Exercises: Naming Shapes

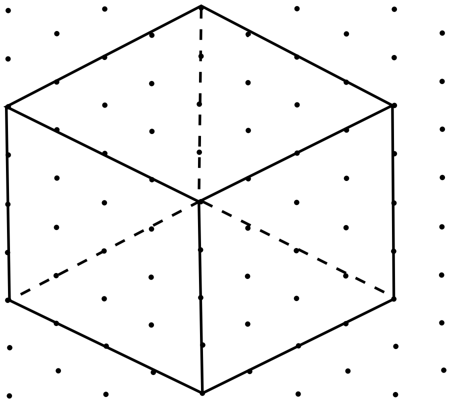
1. Rhombus or square or rectangle
2. Regular hexagon
3.



4. Yes: rhombus
5. Yes: rectangle
6. Square, rectangle, rhombus, parallelogram, kite
7. Trapezium, quadrilateral

(Pg.67) Skill Exercises: Representing Shapes

1.



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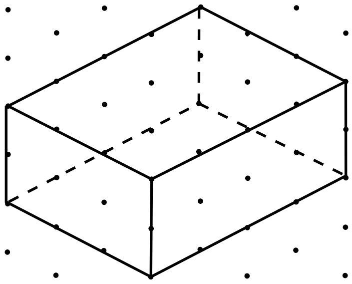

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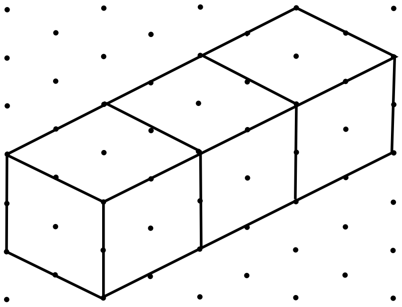

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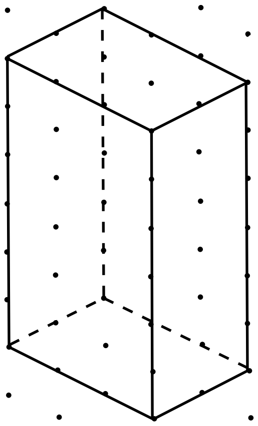

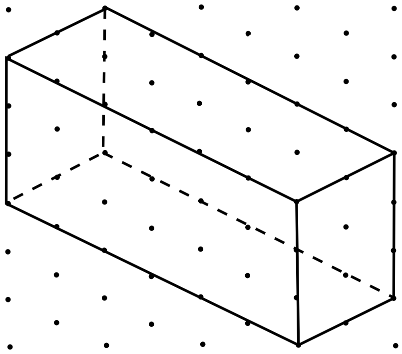

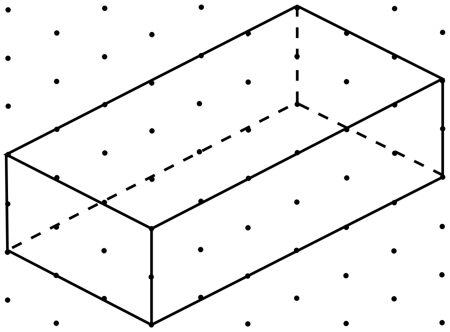

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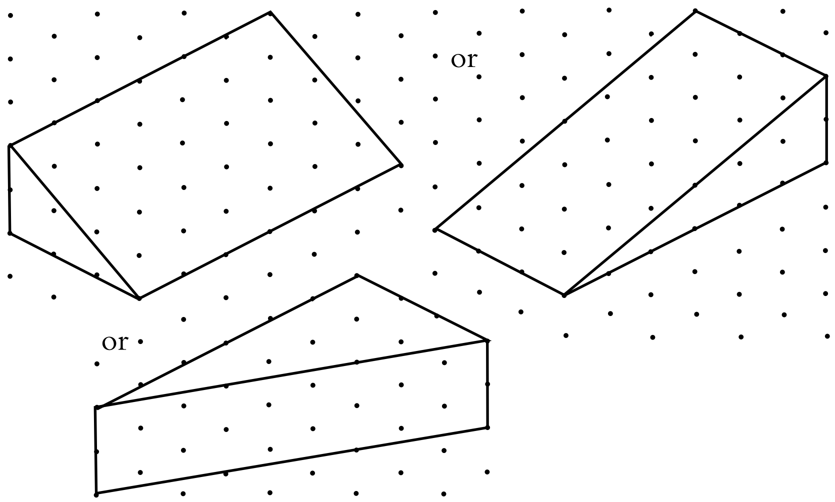

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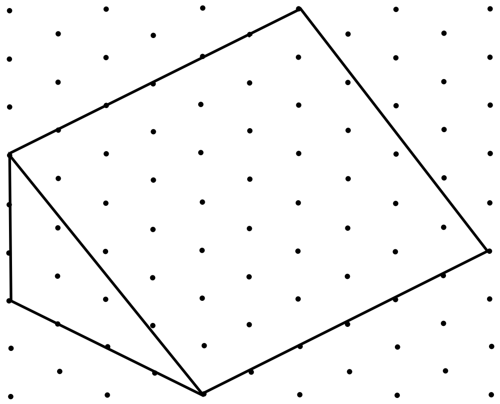

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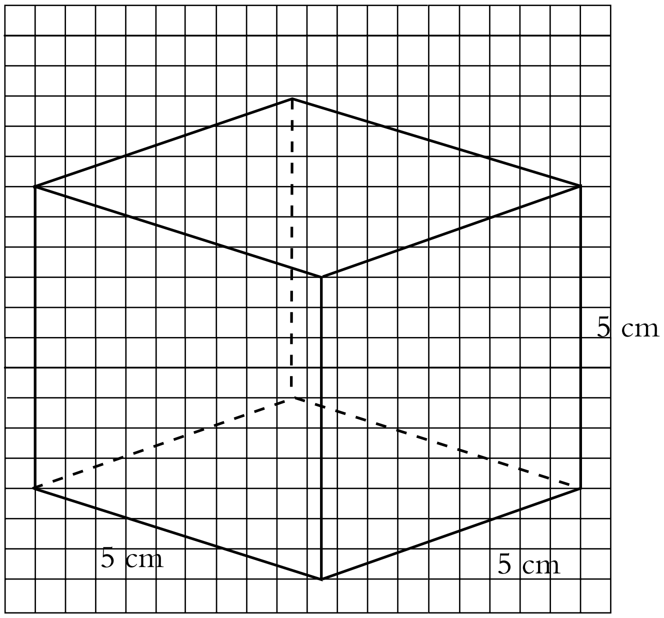

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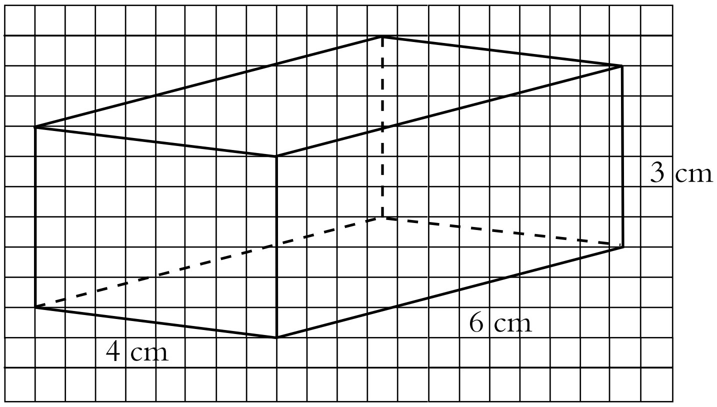

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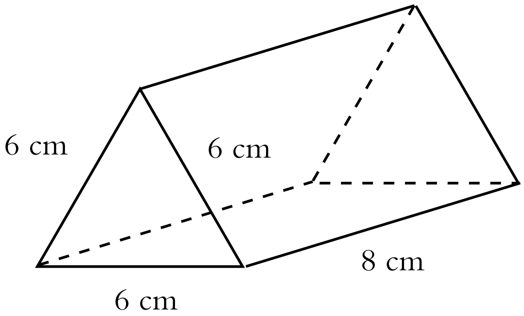
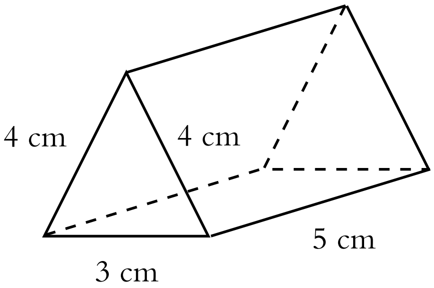


10.



Unit 5: ANSWERS – MEASUREMENT – PART 2

Section 5.1 Finding Perimeters, Areas And Volumes

(Pg.73) Skill Exercises: Area and Perimeter of a Square

1. (a) Area: 4 cm^2, Perimeter: 8 cm
   (b) Area: 25 cm^2, Perimeter: 20 cm
   (c) Area: 49 cm^2, Perimeter: 28 cm
2. (a) 100 cm^2 (b) 144 cm^2 (c) 64 cm^2
   (d) 81 cm^2 (e) 225 cm^2 (f) 400 cm^2
3. (a) 52 cm (b) 32 cm (c) 64 cm
   (d) 76 cm (e) 36 cm (f) 72 cm
4. (a) 32 mm (b) 103 mm (c) 2.8 cm
   (d) 21.6 cm (e) 1.52 m (f) 0.84 m
   (g) 162 cm (h) 170 cm (i) 82 cm
   (j) 7 cm
5. (a) 400 mm^2 (b) 4 cm^2
6. 10 cm
7. 6 cm
8. 121 cm^2
9. 48 cm
10. (a) 4 cm (b) 8 cm

(Pg.75) Skill Exercises: Area and Perimeter of a Rectangle

1. (a) 8 cm^2 (b) 18 cm^2 (c) 30 cm^2 (d) 6 cm^2
2. (a) 12 cm (b) 18 cm (c) 22 cm (d) 14 cm
3. (a) 24 cm^2 (b) 8 cm^2 (c) 36 cm^2 (d) 11 mm^2
   (e) 42 cm^2 (f) 27 mm^2
4. (a) 22 cm (b) 12 cm (c) 26 cm (d) 24 mm
   (e) 26 cm (f) 24 mm
5.

	Area	Perimeter
(a)	24.8 cm^2	20.4 cm
(b)	13.5 cm^2	15 cm
(c)	22.68 mm^2	19.2 mm
(d)	2.1 m^2	5.8 m
(e)	21.96 cm^2	19.4 cm
(f)	59.2 mm^2	30.8 mm

6. (a) Area: 0.3 m^2 or 3000 cm^2
   (b) Perimeter: 2.6 m or 260 cm
7. Area = 15 cm^2 or 1500 mm^2
8. Perimeter = 4.6 mm or 0.46 cm
   Area = 120 mm^2 or 1.2 cm^2
9. 28 cm
10. 4 cm and 8 cm

(Pg.78) Skill Exercises: Area and Perimeter of a Triangle

1. (a) Area: 24 cm^2, Perimeter: 24 cm
   (b) Area: 17.5 m^2, Perimeter: 19.5 m
   (c) Area: 48 cm^2, Perimeter: 33.5 cm
   (d) Area: 600 mm^2, Perimeter: 150 mm
   (e) Area: 12 cm^2, Perimeter: 17.2 cm
   (f) Area: 24 cm^2, Perimeter: 28 cm
   (g) Area: 17.55 cm^2, Perimeter: 21.3 cm
   (h) Area: 21.84 mm^2, Perimeter: 21.7 mm
2. Area $\approx$ 15.3 cm^2, Perimeter $\approx$ 19.5 cm
3. Area $\approx$ 20 cm^2

(Pg.81) Skill Exercises: Area and Circumference of a Circle

1. (a) $d = 22$ cm (b) $C = 69.1$ cm (3 s.f.)
   (c) $A = 380\text{cm}^2$ (2 s.f.)
2. $C = 50.3$ cm (3 s.f.) $A = 201\text{ cm}^2$ (3 s.f.)
3. $C = 59.7$ cm (3 s.f.) $A = 284\text{ cm}^2$ (3 s.f.)
4.

Radius	Diameter	Circumference	Area
12 cm	24 cm	75.4 cm	452.4 cm^2
1 cm	2 cm	6.3 cm	3.1 cm^2
3 mm	6 mm	18.8 mm	28.3 mm^2
4.5 m	9 m	28.3 m	63.6 m^2
11.5 km	23 km	72.3 km	415.5 km^2

(Note: answers to Circumference and Area all correct to 1 d.p.)

5. $C = 37.7$ cm (3 s.f.) $A = 113\text{ cm}^2$ (3 s.f.)

Section 5.2 Volume Of A Cuboid

(Pg.82) Skill Exercises: Cubic Measure

1. (a) 10 cm^3 (b) 12 cm^3 (c) 12 cm^3 (d) 36 cm^3
2. (a) 3 cm^3 (b) 5 cm^3 (c) 5 cm^3
3. (a) 8 (b) 48 cm^3
4. (a) 20 (b) 80 cm^3
5. (a) 16 (b) 64 cm^3

(Pg.85) Skill Exercises: Volume Of A Cube

1. (a) 27 cm^3 (b) 64 cm^3 (c) 15.625 cm^3 (d) 3.375 cm^3
2. (a) 27 000 cm^3 (b) 0.027 m^3
3. (a) 512 000 cm^3 (b) 8000 cm^3 (c) 64
4. (a) $\frac{1}{8}\text{ m}^3$ (b) 0.125 m^3 (c) 125 000 cm^3
5. (a) 1000 cm^3 (b) 0.001 m^3

(Pg.86) Skill Exercises: Volume of a Cuboid

1. (a) 40 cm^3 (b) 63 cm^3 (c) 20 m^3 (d) 96 m^3
2. (a) 15 m^3 (b) 15 000 000 cm^3
3. (a) 30 000 cm^3 (b) 250 cm^3 (c) 120

Unit 6: ANSWERS – TRIGONOMETRY

Section 6.1 Using Pythagoras' Theorem Triples To Solve Problems

(Pg.92) Skill Exercises: Pythagoras' Theorem

1. (a) PQ (b) YZ (c) JK (d) ST

2.

	(a)	(b)	(c)
(i)	25	64	121
(ii)	144	225	3600
(iii)	169	289	3721
(iv)	169	289	3721
(v)	25 + 144 = 169	64 + 225 = 289	121 + 3600 = 3721

3. (a) $10^2 + 24^2 = 100 + 576 = 676$

and $26^2 = 676$

i.e. equal

(b) $9^2 + 12^2 = 81 + 144 = 225$

and $15^2 = 225$

i.e. equal

(c) $13^2 + 84^2 = 169 + 7056 = 7225$

$85^2 = 7225$

i.e. equal

4. (a) Yes (b) Yes (c) No (d) No

(Pg.95) Skill Exercises: Calculating the Length of the Hyptonuse

1. (a) 10 cm (b) 39 mm (c) 41 mm (d) 34 mm

(Pg.96) Skill Exercises: Calculating the Length of the Other Side

1. (a) 16 cm (b) 40cm (c) 60 cm (d) 24 cm

(Pg.97) Skill Exercises: Using Pythagoras' Theorem

1. 5 m
2. Height = 12 m
3. 130 m
4. 26 m
5. 12 m

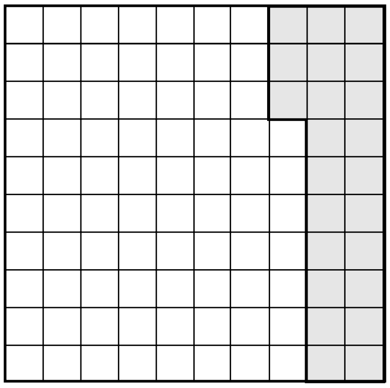
Unit 7: ANSWERS – NUMBER – PART 2

Section 7.1 Calculating Percentages

(Pg.102) Skill Exercises: Calculating Percentages

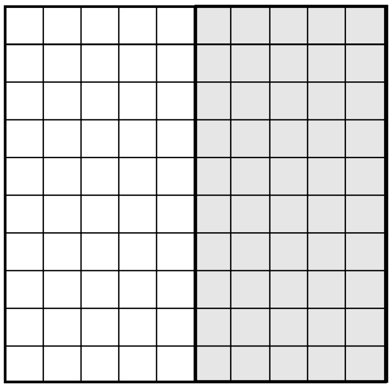
1. (a) 47% (b) 36% (c) 28%
   (d) 30% (e) 80% (f) 75%
2. (a) 53% (b) 64% (c) 72%
   (d) 70% (e) 20% (f) 25%
3. 24%
4.

(a)



23% shaded

(b)



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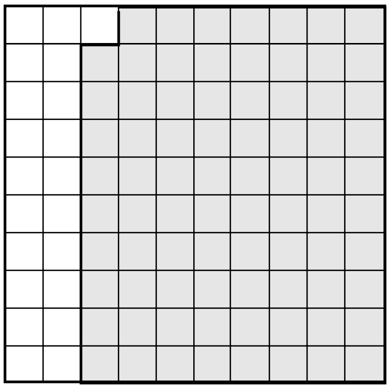
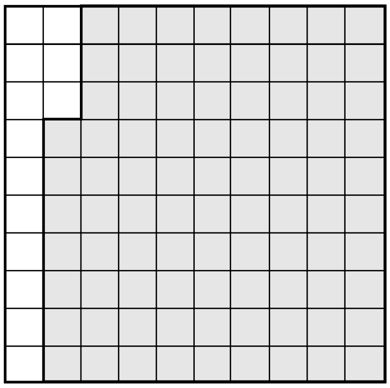
(b)



79% shaded

(d)



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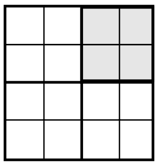
5.

(a)



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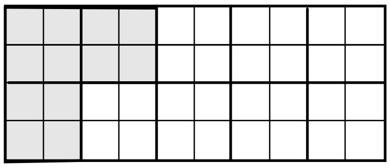
(b)



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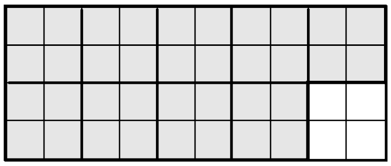
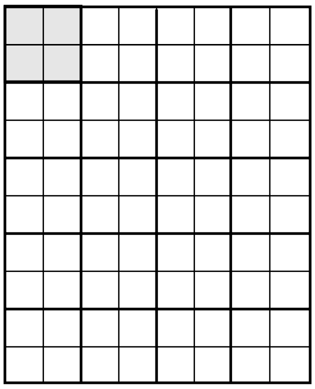
(c)



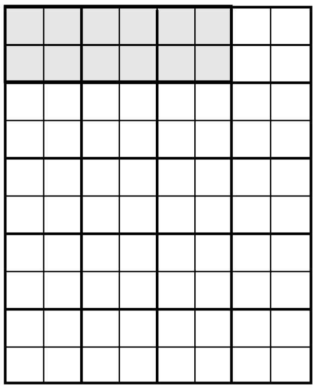
90% shaded

(d)



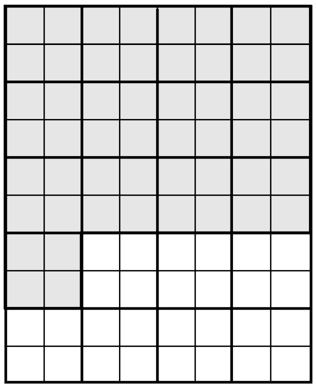
5% shaded

(e)



15% shaded

(f)



65% shaded

6. (a) 90% (b) 70% (c) 55% (d) 95%
(e) 80% (f) 60% (g) 75%

7. 65%

8. 12%

9. (a) $100 (b) 150 kg (c) 30 sene (d) 10 sene
(e) 1.5 kg (f) 30 m (g) $8 (h) 52 sene
(i) $60 (j) 150 kg

10. (a) 40%
(b) Adam $15; Ben $10
(c) Adam $18; Ben $12

Section 7.2 Converting Numbers Between The Forms

(Pg.106) Skill Exercises: Decimals into Fractions

1. (a) $\frac{7}{10}$ or 7 tenths (b) $\frac{7}{100}$ or 7 hundredths

(c) 7 units (d) $\frac{7}{1000}$ or 7 thousandths

(e) $\frac{7}{100}$ or 7 hundredths (f) $\frac{7}{1000}$ or 7 thousandths

2. (a) 0.106, 0.16, 0.601, 0.61, 0.616, 0.661

(b) 0.28, 0.4, 0.47, 0.78, 0.82

(c) 0.2, 0.23, 0.3, 0.301, 0.32

(d) 0.17, 0.19, 0.79, 0.9, 0.91

3. (a) $\frac{1}{10}$ (b) $\frac{9}{10}$ (c) $\frac{3}{10}$ (d) $\frac{7}{100}$

(e) $\frac{1}{4}$ (f) $\frac{1}{1000}$ (g) $\frac{1}{20}$ (h) $\frac{3}{1000}$

(i) $\frac{17}{1000}$ (j) $\frac{71}{100}$ (k) $\frac{87}{100}$ (l) $\frac{210}{1000}$

4. (a) $\frac{2}{5}$ (b) $\frac{2}{25}$ (c) $\frac{27}{50}$ (d) $\frac{3}{500}$

(e) $\frac{3}{250}$ (f) $\frac{81}{500}$ (g) $\frac{6}{125}$ (h) $\frac{21}{25}$

(i) $\frac{41}{125}$ (j) $\frac{7}{500}$ (k) $\frac{3}{500}$ (l) $\frac{27}{250}$

5. (a) 3 (b) 7 (c) 9 (d) 1

(e) 3 (f) 2

6. (a) $\frac{6}{5}$ or $1\frac{1}{5}$ (b) $\frac{151}{50}$ (c) $\frac{103}{25}$

(d) $\frac{181}{50}$ (e) $\frac{501}{125}$ (f) $\frac{1003}{200}$

7. (a) 1.3 or $1\frac{3}{10}$ (b) 0.5 or $\frac{1}{2}$ (c) 1.33 or $1\frac{33}{100}$

(d) 7.9 or $7\frac{9}{10}$ (e) 0.36 or $\frac{9}{25}$ (f) 1.91 or $1\frac{91}{100}$

(g) 7.86 or $7\frac{43}{50}$ (h) 0.418 or $\frac{209}{500}$

8\. (a) 0.61 or $\frac{61}{100}$ (b) 0.11 or $\frac{11}{100}$ (c) 0.44 or $\frac{11}{25}$

(e) 0.34 or $\frac{17}{50}$

9\. (a) $\frac{1}{10\,000}$ (b) $\frac{9}{10\,000}$ (c) $\frac{21}{100\,000}$

(d) $\frac{123\,491}{1\,000\,000}$

10\. (a) $\frac{8}{100\,000} = \frac{1}{12\,500}$ (b) $\frac{2222}{100\,000} = \frac{1111}{50\,000}$

(c) $\frac{102}{100\,000} = \frac{51}{50\,000}$ (d) $\frac{4}{1\,000\,000} = \frac{1}{250\,000}$

(e) $\frac{224}{1\,000\,000} = \frac{7}{31\,250}$ (f) $\frac{2}{10\,000\,000} = \frac{1}{5\,000\,000}$

(Pg.109) Skill Exercises: Fractions into Decimals

1\. (a) 0.3 (b) 0.07 (c) 0.009 (d) 0.13

(e) 0.131 (f) 0.047 (g) 0.21 (h) 0.183

(i) 0.19 (j) 0.019 (k) 0.11 (l) 0.081

2\. (a) 1 (b) 7 (c) 2 (d) 1

(e) 50 (f) 500 (g) 25 (h) 25

3\. (a) 0.5 (b) 0.8 (c) 0.18 (d) 0.12

(e) 0.15 (f) 0.006 (g) 0.004 (h) 0.35

(i) 0.305 (j) 0.72 (k) 0.072 (l) 0.25

4\. (a) 1.2 (b) 2.12 (c) 5.218

(d) 20.08 (e) 2.008 (f) 41.8

5\. (a) 3.5 (b) 1.05 (c) 1.65

(d) 1.24 (e) 3.2 (f) 2.002

6\. (a) $\frac{3}{5}$ or 0.6 (b) $\frac{3}{8}$ or 0.375 (c) $\frac{25}{4}$ or 6.25

(d) $\frac{16}{5}$ or 3.2 (e) $\frac{13}{2}$ or 6.5 (f) $\frac{15}{4}$ or 3.75

7\. (a) 0.875 (b) 0.875

8\. (a) 8.2 (b) 8.2

9. 0.125

10. 0.8125

(Pg.111) Skill Exercises: Decimals, Fractions and Percentages

1.	(a) 0.42	(b) 0.37	(c) 0.2	(d) 0.05
	(e) 0.08	(f) 0.1	(g) 0.22	(h) 0.03
	(i) 0.15			
2.	(a) 14%	(b) 72%	(c) 55%	(d) 40%
	(e) 3%	(f) 90%	(g) 18%	(h) 4%
	(i) 70%			
3	(a) $\frac{1}{2}$	(b) $\frac{3}{10}$	(c) $\frac{4}{5}$	(d) $\frac{7}{10}$
	(e) $\frac{3}{20}$	(f) $\frac{1}{4}$	(g) $\frac{16}{25}$	(h) $\frac{49}{50}$
	(i) $\frac{14}{25}$			
4.	(a) 7%	(b) 18%	(c) 6%	(d) 34%
	(e) 15%	(f) 28%	(g) 60%	(h) 70%
	(i) 75%	(j) 5%	(k) 50%	(l) 12%

5.

Fraction	Decimal	Percentage
$\frac{1}{25}$	0.04	4%
$\frac{1}{10}$	0.1	10%
$\frac{1}{2}$	0.5	50%
$\frac{9}{20}$	0.45	45%
$\frac{7}{50}$	0.14	14%
$\frac{21}{25}$	0.84	84%

6. (a) $\frac{124}{200}$ or $\frac{31}{50}$ (b) 62% (c) 38%

7. 10%

8. (a) 75% (b) 10% (c) 15%

9. (a) 24% (b) $\frac{24}{100}$ or $\frac{6}{25}$

10. (a) 35% (b) 25% (c) 75%

(d) $\frac{4}{10}$ or $\frac{2}{5}$ (e) $\frac{1}{4}$ (f) $\frac{3}{4}$

Section 7.3 Applying The Order Of Operations

(Pg.114) Skill Exercises: Order of Operations

(a) 37 (b) 14 (c) 8 (d) 6

(e) 10 (f) 23 (g) 8 (h) 36

(i) 21 (j) 10

Unit 8: ANSWERS — PROBABILITY

Section 8.1 Exploring Chance Events

(Pg.117) Skill Exercises: The Language of Probability

1. (a) $\frac{3}{7}$ (b) $\frac{4}{7}$ (c) 0

2. (a) $\frac{3}{5}$ (b) $\frac{2}{5}$ (c) 0

3. (a) $\frac{1}{2}$ (b) $\frac{1}{2}$ (c) $\frac{3}{13}$ (d) $\frac{3}{26}$

   (e) $\frac{3}{36}$ (f) $\frac{5}{13}$ (g) $\frac{5}{13}$ (h) $\frac{1}{13}$

   (i) $\frac{1}{4}$ (j) $\frac{1}{52}$ (k) $\frac{3}{52}$ (l) $\frac{5}{26}$

4. (a) $\frac{5}{26}$ (b) $\frac{21}{26}$ (c) 1

5. (a) $\frac{2}{7}$ (b) $\frac{2}{7}$ (c) $\frac{1}{7}$ (d) 0

(Pg.119) Skill Exercises: Probability

1. (a) $\frac{1}{20}$ (b) $\frac{1}{2}$ (c) $\frac{3}{20}$ (d) $\frac{3}{10}$

   (e) $\frac{2}{5}$

2. (a) 52

(b) (i) $\frac{1}{52}$ (ii) $\frac{13}{52} = \frac{1}{4}$ (iii) $\frac{4}{52} = \frac{1}{13}$

(iv) $\frac{2}{52} = \frac{1}{26}$ (v) $\frac{3}{52}$

3. (e)

(1,2)	(2,3)	(3,4)	(4,5)	(5,6)
(1,3)	(2,4)	(3,5)	(4,6)	
(1,4)	(2,5)	(3,6)		
(1,5)	(2,6)			
(1,6)				

(f) $\frac{1}{15}$

(g) $\frac{8}{15}$

Unit 9: ANSWERS – ALGEBRA – PART 2

Section 9.1 Writing Simple Mathematical Expressions

(Pg.122) Skill Exercises: Writing Simple Mathematical Expressions

1. 1f 2e 3i
   4j 5a 6g
   7c 8h 9d
   10b

2. (a) $10 + c$ (b) $c - 12$ (c) $\frac{c}{4}$
   (d) $c - 8$ (e) $11 \times c = 11c$ (f) $12 \times c = 12c$
   (g) $c + 10$ (h) $c - 15$ (i) $\frac{3}{c}$
   (j) $\frac{c + 4}{2}$ or $\frac{(c + 4)}{2}$

Section 9.2 Solving Simple Equations

(Pg.124) Skill Exercises: Solving Simple Equations

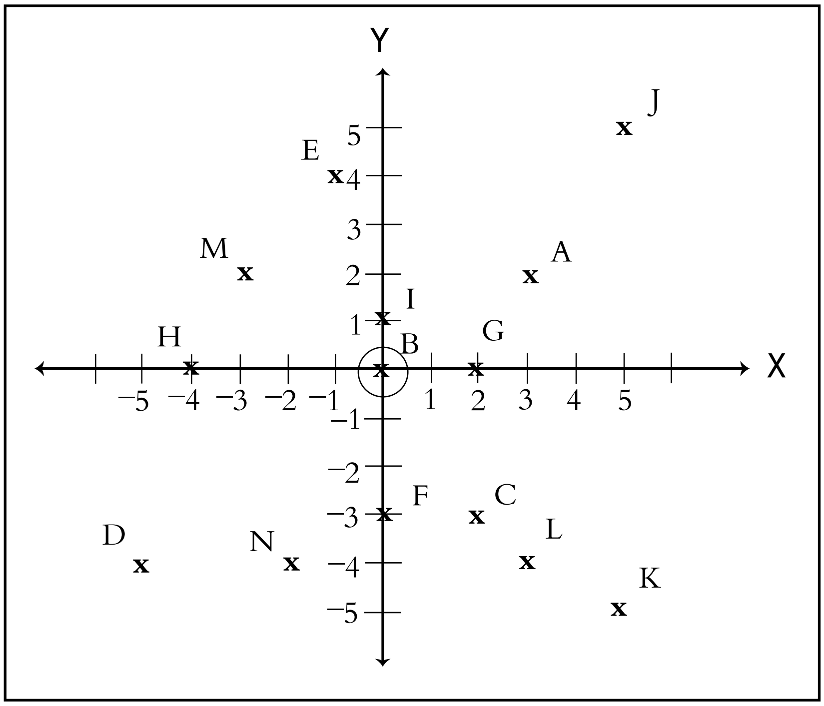
(a) $b = 16$ (b) $m = 5$ (c) $y = 14$
(d) $k = 28$ (e) $x = 11$ (f) $w = 34$
(g) $b = 18$ (h) $x = 9$ (i) $x = 5$
(j) $m = 16$ (k) $x = 4$ (l) $y = 3$
(m) $y = {}^{-}3$ (n) $m = 15$ (o) $b = 20$
(p) $y = 8$ (q) $m = 15$ (r) $w = 3$
(s) $x = 3$ (t) $n = 1$

Section 9.3 Plotting Points On The Cartesian Plane

(Pg.126) Skill Exercise: Plotting Points

1. A = (2, 1)
   B = (1, 3)
   C = $(^{-}1, 1)$
   D = $(^{-}4, ^{-}3)$
   E = $(2, ^{-}4)$
   F = $(4, ^{-}1)$
   G = (3, 4)
   H = $(^{-}3, 3)$
   I = $(^{-}4, 0)$
   J = $(0, ^{-}1)$
   K = (3, 0)
   L = (0, 5)

2.



Unit 10: ANSWERS – GEOMETRY – PART 2

Section 10.1 Exploring Shapes

(Pg.128) Skill Exercise: Angles on a Line and Angles at a Point

1. (a) 110° (b) 95° (c) 40°
   (d) 13° (e) 32° (f) 46°
2. (a) 82° (b) 144° (c) 75°
   (d) 150° (e) 241° (f) 80°
3. 125°
4. (a) $a = 110^\circ$, $b = 100^\circ$
   (b) Increases to 105°
5. (a) 72° (b) 40°
6. 109°
7. $a = 152^\circ$, $b = 28^\circ$, $c = 152^\circ$
   Opposite angles are equal.
8. 36° and 144°
9. $a = 27^\circ$, $b = 152^\circ$
10. (a) 60° (b) 36° (c) 12 sides

(Pg.133) Skill Exercises: Parallel and Intersecting Lines

1. (a) c, e, g (b) d, f, h
2. (a) $a = 70^\circ$, corresponding angles;
   $b = 110^\circ$, supplementary angles
   (b) $a = 40^\circ$, alternate angles;
   $b = 140^\circ$, supplementary angles;
   $c = 140^\circ$, vertically opposite

(c) $a = 80^\circ$, supplementary angles;

$b = 80^\circ$, vertically opposite
$c = 110^\circ$, corresponding angles;

$d = 80^\circ$, corresponding or supplementary angles

(d) $a = 81^\circ$, supplementary angles;

$b = 99^\circ$, vertically opposite;

$c = 81^\circ$, supplementary angles;

$d = 99^\circ$, alternative angles

3. $b = 65^\circ$, $a = c = 115^\circ$

4. 36°, 144°, 144°

5. 133°, 47°, 47°

6. $a = 100^\circ$, $b = 130^\circ$, $c = 50^\circ$, $d = 30^\circ$, $e = 150^\circ$

7. (a) $b = 37^\circ$, supplementary angels;

$c = 37^\circ$, alternate angles;

$a + b + c = 180^\circ$, (angles in a triangle)

$a = 106^\circ$

(b) Isosceles triangle

8. $c = 180 - (20 + 62) = 98^\circ$ (angles in a triangle);

$a = c = 98^\circ$, alternate angles;

$b = 180 - (46 + 98) = 36^\circ$ (angles in a triangle)

9. (a) $\angle$ BED = 54°, supplementary angles;

$\angle$ CDE = 180 – (72 + 54) = 54°, angles in a triangle;

Since BC parallel to ED (BCDE trapezium),

$\angle$ ABC = $\angle$ BED = 54°, corresponding angles;

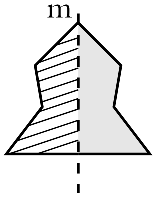
$\angle$ ACB = $\angle$ CDE = 54°, corresponding angles;

$\angle$ CBE = $\angle$ BCD = 126°, supplementary angles

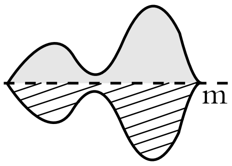
(b) Since BE = CD, we have isosceles trapezium.

(Pg.137) Skill Exercises: Reflection and Translation

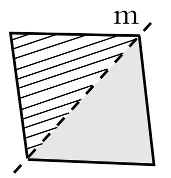
1. (a)



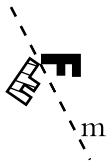
(b)



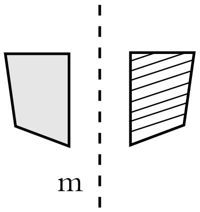
(c)



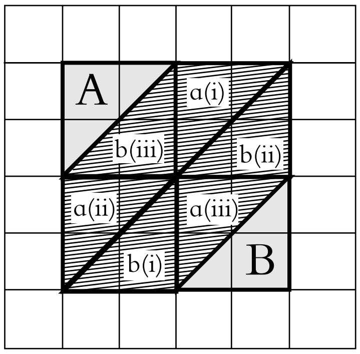
(d)



(e)



2. (a) (i) 5 (ii) 1
   (b) (i) 5 (ii) 1
3. (a) One square right, two squares down.
   (b) Four squares right, three squares up
   (c) Two squares left, one square down
   (d) Three squares right, two squares down
   (e) Five squares right
   (f) Three squares left
4. (c) A square, 4 units × 4 units



Unit 11: ANSWERS – STATISTICS

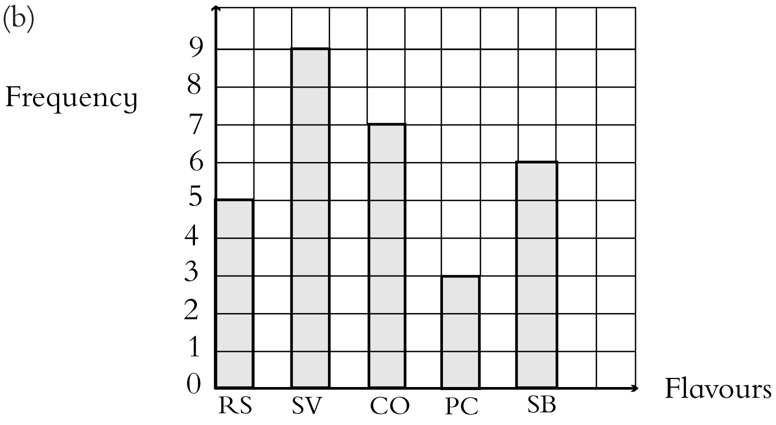
Section 11.1 Exploring Data

(Pg.142) Skill Exercises: Collecting and Displaying Data

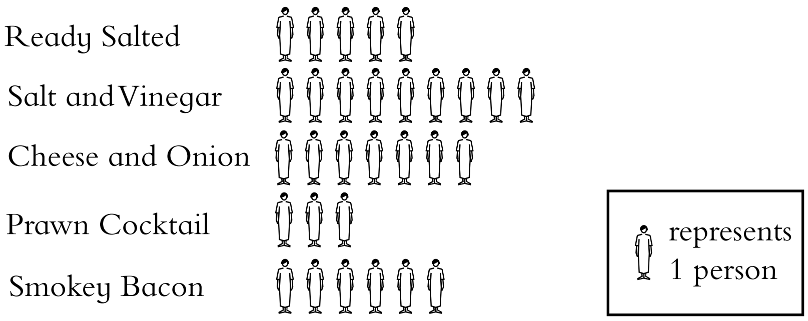
1. (a)

	Frequency
	5
	9
	7
	3
	6
TOTAL	30

(b)

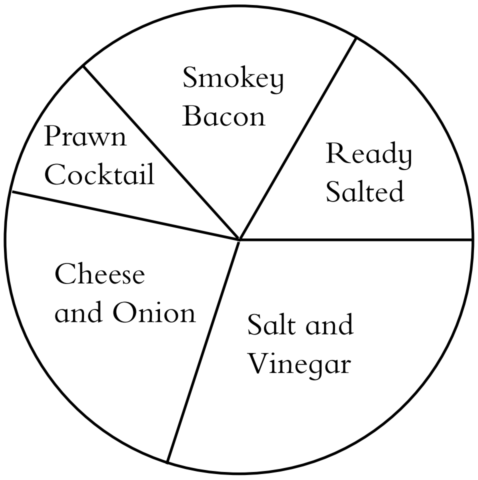


(c)



(d)

Flavour	Frequency	Calculation	Angle
Ready Salted	5	$\frac{3}{50} \times 360° =$	60°
Salt and Vinegar	9	$\frac{9}{30} \times 360° =$	108°
Cheese and Onion	7	$\frac{7}{30} \times 360° =$	84°
Prawn Cocktail	3	$\frac{3}{30} \times 360° =$	36°
Smokey Bacon	6	$\frac{6}{30} \times 360° =$	72°
		TOTAL	360°



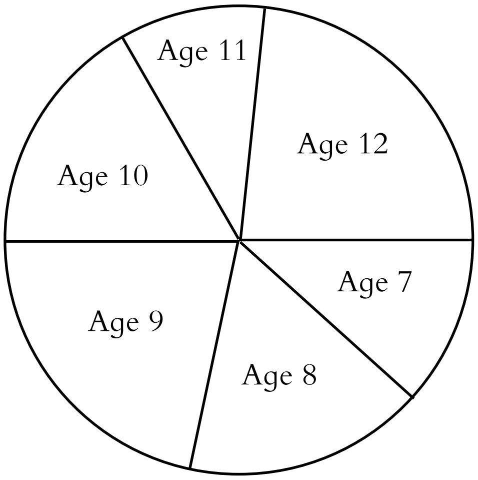
(e) Salt and Vinegar

6. (a) 12 years

(b)

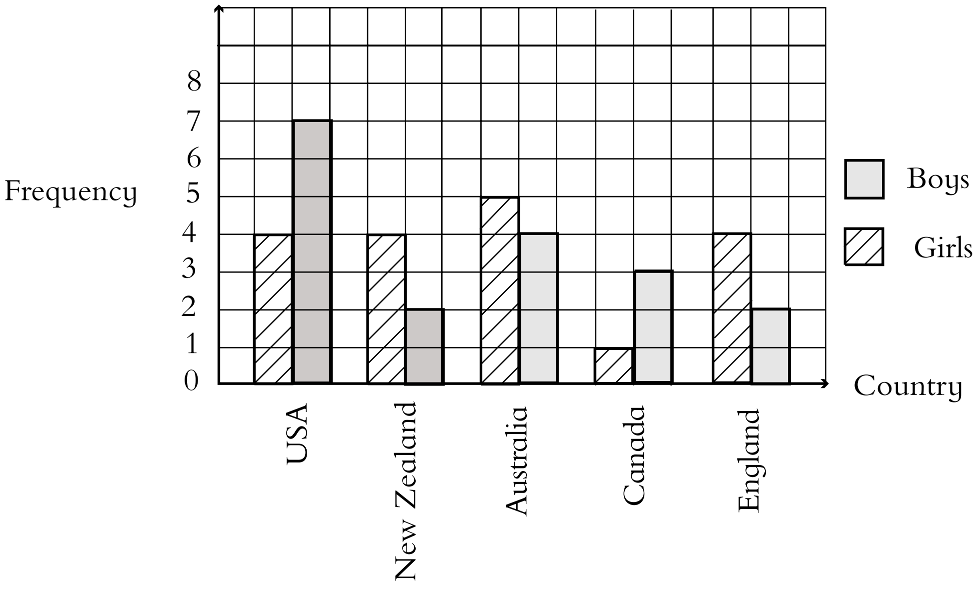
Age	Calculation	Angle
7	$\frac{7}{60} \times 360° =$	42°
8	$\frac{10}{60} \times 360° =$	60°
9	$\frac{13}{60} \times 360° =$	78°
10	$\frac{10}{60} \times 360° =$	60°
11	$\frac{6}{60} \times 360° =$	36°
12	$\frac{14}{60} \times 360° =$	84°
	TOTAL	360°

(c)

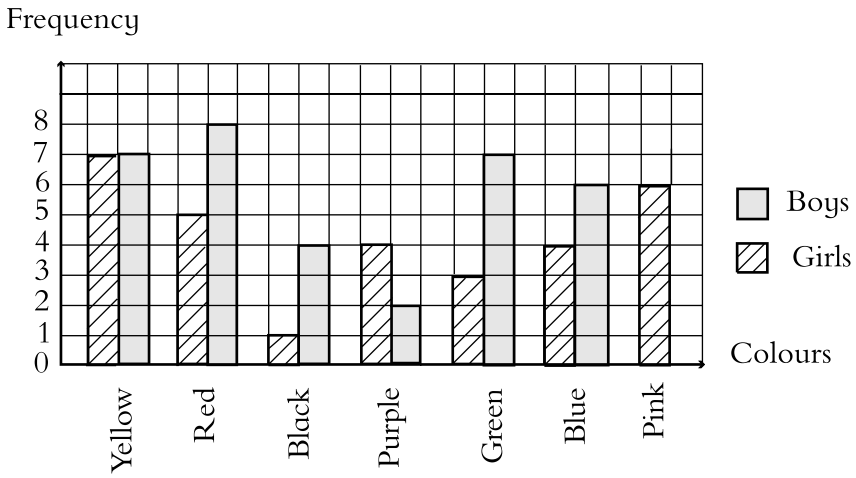


7. (a) 4 (b) 6 (c) More popular with girls

(d) 5 (e) U.S.A (f) Australia

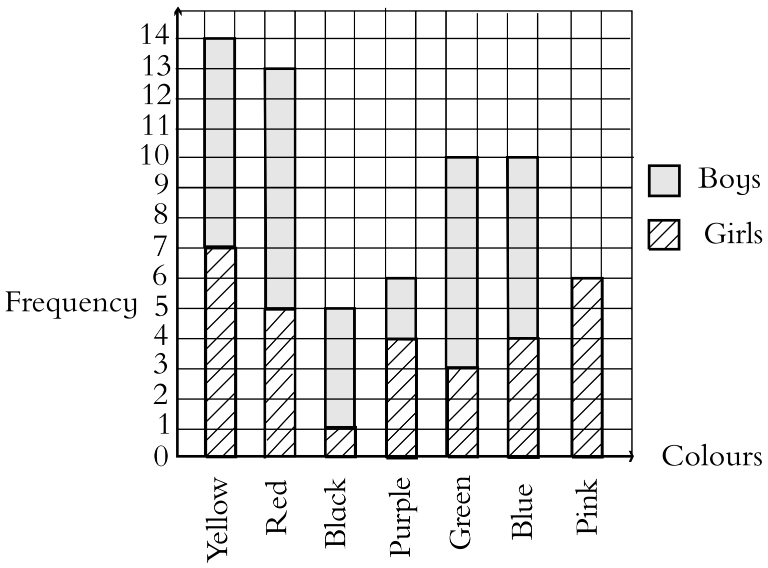


8.



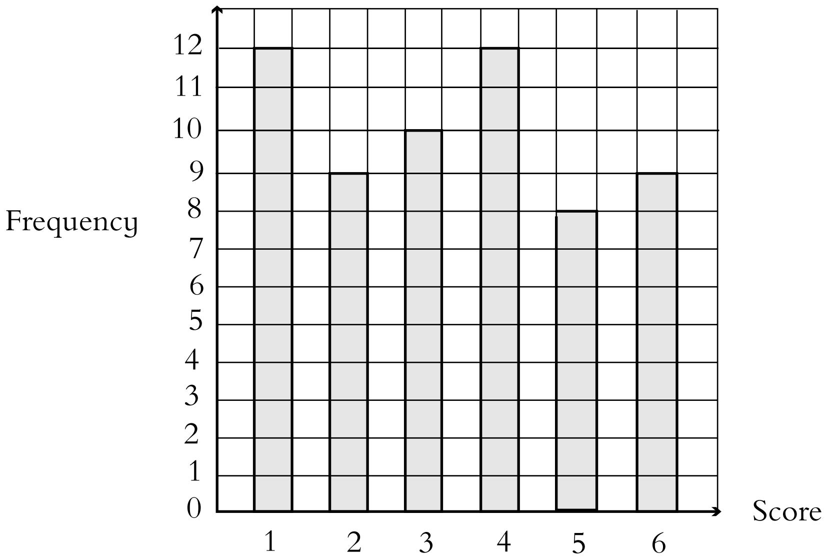
OR

8.



9. (a)

Score	Tally	Frequency
1	𝍸 𝍸 ||	12
2	𝍸 ||||	9
3	𝍸 𝍸	10
4	𝍸 𝍸 ||	12
5	𝍸 |||	8
6	𝍸 ||||	9



We would expect 10 of each score. All frequencies are reasonably close to 10, so we conclude that the dice probably is fair; rolling the dice many more times and recording the results would give a more accurate indication.