Mathematics

Mathematics 3
Intermediate 1

4891

Spring 1999

HIGHER STILL

Mathematics

Mathematics 3
Intermediate 1

Support Materials

STAFF NOTES

Introduction

Students will have met much of the work of this unit, though possibly not to the depth with which it is treated here. Some of it will be new, especially for those students who have followed a strictly Foundation course at Standard Grade.

Students should be encouraged to set down all working and where appropriate, use mental calculations.

Staff should be aware that this resource has been written to cover the Mathematics content of the course at Intermediate 1 level. The depth of treatment is therefore more than is required to demonstrate competence within the unit assessment, i.e. minimum grade C. An attempt has been made to have the 'easy' questions at the start of each exercise leading to more testing questions towards the end of the exercise. The specimen assessment questions at the end of the unit are **not** intended to be only at minimum grade C level.

The notes which follow provide brief advice on the teaching of each of the topics.

Format of Student's Booklet

- Exercises on Simple Algebraic Operations
  Checkup for Simple Algebraic Operations

- Exercises on Graphical Relationships
  Checkup for Graphical Relationships

- Exercises on Trigonometry in a Right Angled Triangle
  Checkup for Trigonometry in a Right Angled Triangle

- Exercises on Standard Form (Scientific Notation)
  Checkup for Standard Form (Scientific Notation)

- Specimen Assessment Questions

- Answers for all exercises

SIMPLE ALGEBRAIC OPERATIONS

Notes for Exercise 1. Evaluating Formulae Expressed in Symbols

Students should be given examples of formulae and shown how to substitute numbers for letters. It should also be explained that / means divide.

Examples of formulae which students should already have met $y = mx + c$ and $A = \pi r^2$

Students could be encouraged to suggest some more formulae.

Then, on board:

Example 1. $A = 9pq$ Find A, when $p = 7$ and $q = 10$

Ans. $A = 9pq$

$= 9 \times 7 \times 10$

$= \underline{630}$

Example 2. $W = {}^{32}/_{(a+1)}$ Find W, when $a = 15$

Ans. $W = {}^{32}/_{(a+1)}$

$= {}^{32}/_{(15+1)}$

$= {}^{32}/_{16}$

$= \underline{2}$

Example 3. $D = rs + 2uv$ Find D, when $r = 8$, $s = 4$, $u = 6$ and $v = 1$

Ans. $D = rs + 2uv$

$= 8 \times 4 + 2 \times 6 \times 1$

$= 32 + 12$

$= \underline{44}$

Example 4. $V = 30\sqrt{h}$ Find V, when $h = 25$

Ans. $V = 30\sqrt{h}$

$= 30\sqrt{25}$

$= 30 \times 5$

$= \underline{150}$

Example 5. $T = 3x^2 + y$ Find T, when $x = 2$ and $y = 8$.

Ans. $T = 3x^2 + y$

$T = 3 \times 2 \times 2 + 8$ (NOT $(3 \times 2)^2$)

$= 12 + 8$

$= \underline{20}$

Exercise 1 may now be attempted.

Notes for Exercise 2. Removal of Brackets

Students should be given an explanation of the following:

'Remove brackets'

Example 1. $2(x + 5)$

Ans. $2(x + 5)$
$= \underline{2x + 10}$

Example 2. $6(y - 1)$

Ans. $6(y - 1)$
$= \underline{6y - 6}$

Example 3. $4(7 + m)$

Ans. $4(7 + m)$
$= \underline{28 + 4m}$

Example 4. $3(2r + 5)$

Ans. $3(2r + 5)$
$= \underline{6r + 15}$

Example 5. $7(4v - 2w)$

Ans. $7(4v - 2w)$
$= \underline{28v - 14w}$

Example 6. $a(h + 9)$

Ans. $a(h + 9)$
$= \underline{ah + 9a}$

Example 7. $2(10p - 7q + 11r)$

Ans. $2(10p - 7q + 11r)$
$= \underline{20p - 14q + 22r)}$

Example 8. $5x(2x + 1)$

Ans. $5x(2x + 1)$
$= \underline{10x^2 + 5x}$

Exercise 2 Questions 1, 2 and 3 may now be attempted.

'Multiply out the brackets and collect like terms'

Example 1. $2(a + 3) + 1$

Ans. $2(a + 3) + 1$
$= 2a + 6 + 1$
$= \underline{2a + 7}$

Example 2. $4(b + 5) - 19$

Ans. $4(b + 5) - 19$
$= 4b + 20 - 19$
$= \underline{4b + 1}$

Example 3. $6(x + 2) - 4x$

Ans. $6(x + 2) - 4x$
$= 6x + 12 - 4x$
$= \underline{2x + 12}$

Example 4. $3v + 2(6v - 2s)$

Ans. $3v + 2(6v - 2s)$
$= 3v + 12v - 4s$
$= \underline{15v - 4s}$

Example 5. $2(y + 1) + 4(5y + 2)$

Ans. $2(y + 1) + 4(5y + 2)$
$= 2y + 2 + 20y + 8$
$= \underline{22y + 10}$

Exercise 2 Questions 4 and 5 may now be attempted.

Notes for Exercise 3. Factorising Expressions - the common factor

Students should be given an explanation of the following:
Note that it should be stressed that students are expected to always factorise fully.

'Factorise fully'

Example 1. $3x + 3y$ take out **highest** common factor

Ans. $3x + 3y$

$= \underline{3(x + y)}$

Example 2. $4a - 6b$ take out **highest** common factor

Ans. $4a - 6b$

$= \underline{2(2a - 3b)}$

Example 3. $22p + 33q - 88r$ take out **highest** common factor

Ans. $22p + 33q - 88r$

$= \underline{11(2p + 3q - 8r)}$

Example 4. $5e + de$ take out **highest** common factor (letter)

Ans. $5e + de$

$= \underline{e(5 + d)}$

Example 5. $3gt + 9th - 24it$ take out highest common **factor** and **letter**

Ans. $3gt + 9ht - 24it$

$= \underline{3t(g + 3h - 8i)}$

Exercise 3 Questions 1 and 2 may now be attempted.

More factorising:

Example 1. $2x^2 + 8xw$ take out highest common **factor** and **letter**

Ans. $2x^2 + 8xw$

$= \underline{2x(x + 4w)}$

Example 2. $13pv - 26vtu$ take out highest common **factor** and **letter**

Ans. $13pv - 26vtu$

$= \underline{13v(p - 2tu)}$

Example 3. $8cd + 12c^2d$ take out highest common **factor** and **letter**

Ans. $8cd + 12c^2d$

$= \underline{4cd(2 + 3c)}$

Exercise 3 Questions 3 and 4 may now be attempted.

Notes for Exercise 4. Solving Linear Equations

The method used in the following examples is 'change side - change sign'.
(Of course, you may wish to choose a method of your own!)

Students should be encouraged to check solution by substituting back into the original question.

'Solve'

Example 1. $x + 3 = 9$

Ans. $x + 3 = 9$

$x = 9 - 3$

$\underline{x = 6}$

(check $6 + 3 = 9$)

Example 2. $x - 7 = 11$

Ans. $x - 7 = 11$

$x = 11 + 7$

$\underline{x = 18}$

(check $18 - 7 = 11$)

Example 3. $2y = 16$

Ans. $2y = 16$

$y = 16 \div 2$

$\underline{y = 8}$

(check $2 \times 8 = 16$)

Example 4. $6y = 9$

Ans. $6y = 9$

$y = 9 \div 6$

$\underline{y = 1{\cdot}5}$

(check $6 \times 1{\cdot}5 = 9$)

Example 5. $^1/_2v = 7$

Ans. $^1/_2v = 7$

$x = 7 \div {}^1/_2$

$\underline{x = 14}$

(check $^1/_2 \times 14 = 7$)

Example 6. $5m + 1 = 11$

Ans. $5m + 1 = 11$

$5m = 11 - 1$

$5m = 10$

$\underline{m = 2}$ $(10 \div 5)$

(check $5 \times 2 + 1 = 11$)

Example 7. $7m - 1 = 41$

Ans. $7m - 1 = 41$

$7m = 41 + 1$

$7m = 42$

$\underline{m = 6}$ $(42 \div 7)$

(check $7 \times 6 - 1 = 41$)

Example 8. $6w = 9 + 2w$

Ans. $6w = 9 + 2w$

$6w - 2w = 9$

$4w = 9$

$\underline{w = 2{\cdot}25}$ $(9 \div 4)$

(check $6 \times 2{\cdot}25 = 9 + 2 \times 2{\cdot}25$)

Exercise 4 Questions 1, 2 and 3 may now be attempted.

Further examples:

Example 1. $4x - 1 = 3x + 6$

Ans. $4x - 1 = 3x + 6$

$4x - 3x = 6 + 1$

$\underline{x = 7}$

(check $4 \times 7 - 1 = 3 \times 7 + 6$)

Example 2. $9g + 2 = 2g + 9$

Ans. $9g + 2 = 2g + 9$

$9g - 2g = 9 - 2$

$7g = 7$

$\underline{g = 1}$

(check $9 \times 1 + 2 = 2 \times 1 + 9$)

Example 3. $5(x - 4) = 35$

Ans. $5(x - 4) = 35$

$5x - 20 = 35$

$5x = 35 + 20$

$5x = 55$

$x = 11$ $(55 \div 5)$

(check 5 x (11 - 4) = 35)

Exercise 4 Questions 4 and 5 may now be attempted.

Notes for Exercise 5. Solving Inequalities

Students should be introduced to the term 'inequality' and the meaning of $<$, $>$, $\leq$, $\geq$, $=$

The method used in the following examples is 'change side - change sign'.
(Again, you may wish to choose a method of your own!)

Example 1. Use **<**, **>**, **=** to connect the two numbers in each pair:

(a) 5, 8 (b) -2, -3 (c) (2 + 3), (99 - 94)

Ans. (a) 5 **<** 8 (b) -2 **>** -3 (c) (2 + 3) **=** (99 - 94)

Solve these inequalities:

Example 2. $a + 7 < 9$

Ans. $a + 7 < 9$

$a < 9 - 7$

$a < 2$

Example 3. $7a - 3 \geq 5a + 14$

Ans. $7a - 3 \geq 5a + 14$

$7a - 5a \geq 14 + 3$

$2a \geq 17$

$a \geq 8{\cdot}5$ $(17 \div 2)$

If it so happened that a could be chosen only from the set {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10} then the answers to Examples 2 and 3 would be:

Example 2 {0, 1} Example 3 {9, 10}

Exercise 5 may now be attempted.

Followed by the Checkup for Simple Algebraic Operations.

GRAPHICAL RELATIONS

Calculators with a graphical facility could be used to explore properties of the straight line.

Notes for Exercise 1 Lines of the form $\boldsymbol{y = ax}$

The coordinate system, including negative coordinates should be revised first. An explanation of what is meant by the 'equation of a line' should be given.
i.e. a rule which connects the x- and y- coordinates of any point which lies on the line.

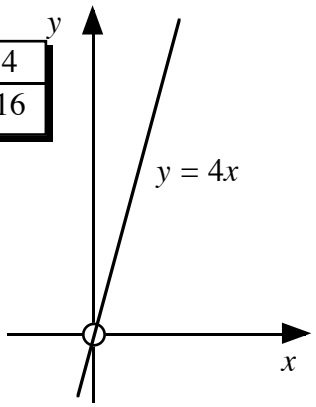
Example 1. Draw the line $y = 4x$

Table =>

x	0	1	2	3	4
$y = 4x$	0	4	8	12	16

Coordinates => (0,0), (1,4), (2,8), (3,12), (4,16)

Draw line =>



Exercise 1 questions 1 – 4 may now be attempted.

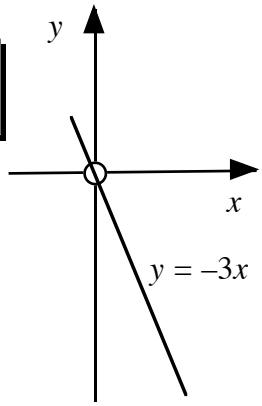
Example 2. Draw the line $y = -3x$ Note the negative coefficient

Table =>

x	0	1	2	3	4
$y = -3x$	0	–3	–6	–9	–12

Coordinates => (0,0), (1,–3), (2,–6), (3,–9), (4,–12)

Draw line =>



Exercise 1 questions 5 – 8 may now be attempted.

Notes for Exercise 2 Lines of the form $\boldsymbol{y = ax + b}$

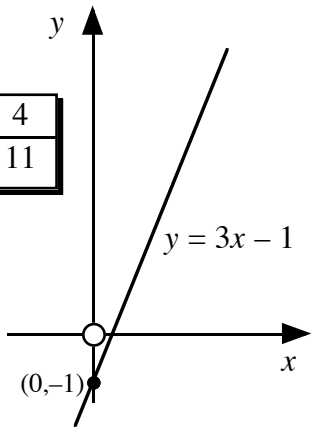
Example 1. Draw the line $y = 3x - 1$

Table =>

x	0	1	2	3	4
$y = 3x - 1$	–1	2	5	8	11

Coordinates => (0,–1), (1,2), (2,5), (3,8), (4,11)

Draw line =>



Discuss the difference between this line and all the previous lines
(i.e. it does not pass through the origin).

Exercise 2 may now be attempted.

The findings from Exercises 1 and 2 should be summarised and the students given a clear note on the effects of varying the $\boldsymbol{a}$ and $\boldsymbol{b}$ on the line $\boldsymbol{y = ax + b}$

Notes for Exercise 3 Lines of the form $\boldsymbol{y = k}$ and $\boldsymbol{x = h}$

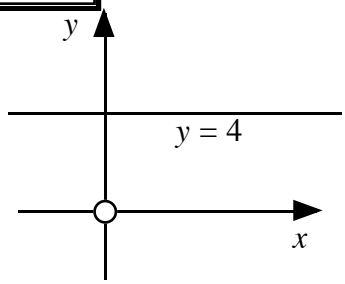
The coordinates of the points governed by $y =$ (a number) should be discussed.

Table =>

x	0	1	2	3	4
$y = 4$	4	4	4	4	4

Coordinates => (0,4), (1,4), (2,4), (3,4), (4,4)

Draw line =>



Exercise 3 may be attempted in full.

The findings from Exercise 3 can now be summarised.

i.e. the line $y = k$ is parallel to the x-axis
the line $x = h$ is parallel to the y-axis.

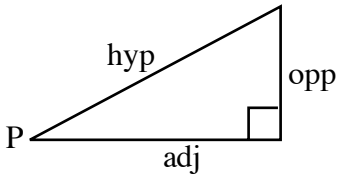
The Checkup for Graphical Relations may now be attempted.

TRIGONOMETRY IN A RIGHT ANGLED TRIANGLE

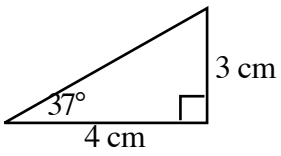
There are various ways of introducing Trigonometry, including the use of computers, videos and graphics calculators.

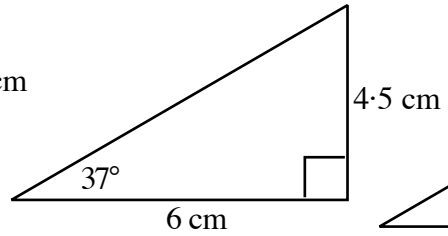
This simple one is based on looking at various sized right angled triangles with angles 37° (36·9°), 53° (53·1°) and 90°.

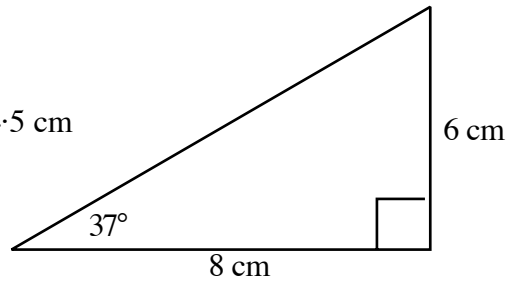
Define the terms 'opposite', 'hypotenuse' and 'adjacent'. in terms of angle P.



Draw 3 - 4 similar right angled triangles or pre-prepare a worksheet with the triangles already drawn







Show that, in each triangle, (with 37° at angle P), the ratio defined by

$$\frac{\text{opp}}{\text{adj}} = \frac{3}{4} = \frac{4{\cdot}5}{6} = \frac{6}{8} = 0{\cdot}75 \quad \text{(is fixed)}$$

Define this as the **tangent** of angle P and write it as:

tangent (37°) = 0·75 or for short $\boxed{\tan 37° = 0{\cdot}75}$

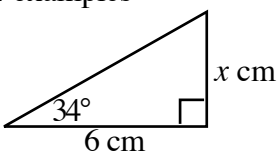
Show that irrespective of the size of the triangle, as long as angle P = 37°, the ratio of $^{\text{opp}}/_{\text{adj}}$ will always be 0·75.

Introduce the scientific calculator and have students check that tan 37° = 0·75 (0·75355..)

Have students look up several tangents and try to get them to round answers (say, 3 d.p.)

Exercise 1, question 1, may now be attempted. (5 - 10 minutes)

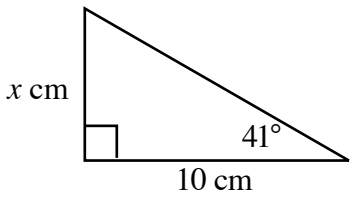
Now students should be shown how to calculate the missing side in a right angled triangle by means of
3 - 4 examples



$\tan 34° = \frac{x}{6}$

$\Rightarrow x = 6 \times \tan 34°$

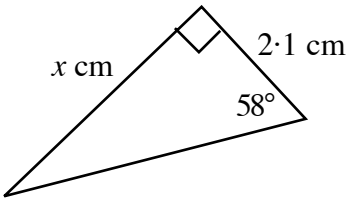
$\Rightarrow x = 4{\cdot}05$ cm



$\tan 41° = \frac{x}{10}$

$\Rightarrow x = 10 \times \tan 41°$

$\Rightarrow x = 8{\cdot}69$ cm



$\tan 58° = \frac{x}{2{\cdot}1}$

$\Rightarrow x = 2{\cdot}1 \times \tan 58°$

$\Rightarrow x = 3{\cdot}36$ cm

Exercise 1, questions 2 and 3, may now be attempted.

Notes for Exercise 2 Using tangents in reverse

Students should be shown how to use the

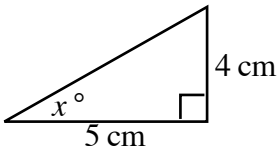
Shift tan , 2nd tan , Inv tan or $\tan^{-1}$ buttons to find the size of angle $x°$, given the value of its ratio.

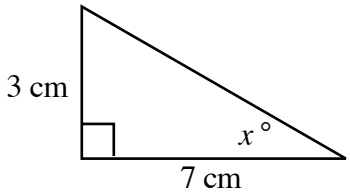
$\Rightarrow \tan x° = 0{\cdot}515$
$\Rightarrow \quad x = 27{\cdot}2$
(to 1 d.p.)

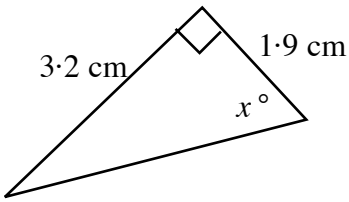
$\Rightarrow \tan x° = 2{\cdot}435$
$\Rightarrow \quad x = 67{\cdot}7°$
(to 1 d.p.)

Exercise 2, question 1, may now be attempted.

Now, students should be shown how to determine the missing side in a right angled triangle given the 2 sides.







$\tan x° = \frac{4}{5}$
$\Rightarrow \tan x° = 0{\cdot}8$
$\Rightarrow \quad x = 38{\cdot}7°$

$\tan x° = \frac{3}{7}$
$\Rightarrow \tan x° = 0{\cdot}429$
$\Rightarrow \quad x = 23{\cdot}2°$

$\tan x° = \frac{3{\cdot}2}{1{\cdot}9}$
$\Rightarrow \tan x° = 1{\cdot}684$
$\Rightarrow \quad x = 59{\cdot}3°$

Exercise 2, questions 2 and 3, may now be attempted.

Notes for Exercises 3 to 6 The sine and cosine function.

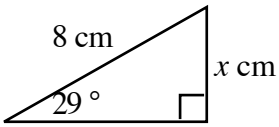
The sine and cosine functions can be introduced using similar methods to those used in the tangents function. (sine ratio is covered in Exercises 3 and 4 and cosine ratio in Exercises 5 and 6)

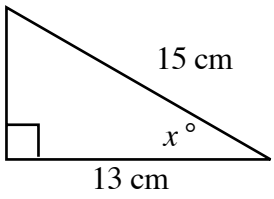
Exercises 3 to 6 may now be attempted after the appropriate introduction.

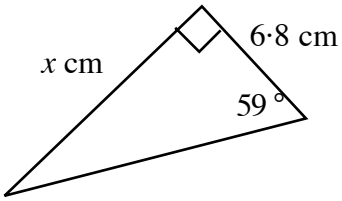
Notes for Exercise 7

In this exercise students have to decide on the appropriate ratio to be used in a question.

The mnemonic **SOH CAH TOA** could be introduced with 3 or 4 examples to indicate its use.







$\sin 29° = \frac{x}{8}$
$\Rightarrow x = 8 \times \sin 29°$
$\Rightarrow x = 3{\cdot}88$ cm

$\cos x° = \frac{13}{15}$
$\Rightarrow \cos x° = 0{\cdot}867$
$\Rightarrow x = 29{\cdot}9°$

$\tan 59° = \frac{x}{6{\cdot}8}$
$\Rightarrow x = 6{\cdot}8 \times \tan 59°$
$\Rightarrow x = 11{\cdot}3$ cm

Exercise 7 may now be attempted.
Then the Checkup Exercise for Trigonometry in a Right Angled Triangle.

STANDARD FORM (Scientific Notation)

Notes for Exercise 1 Powers (indices)

The idea of taking a power of a number should be introduced or revised.

$4^3 = 4 \times 4 \times 4 = 64$; $5^2 = 5 \times 5 = 25$; $3^4 = 3 \times 3 \times 3 \times 3 = 81$

(in particular, emphasise the powers of 10)

$10^4 = 10 \times 10 \times 10 \times 10 = 10000$ = (a 1, followed by 4 zeros)
$10^6 = 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 1000000$ = (a 1, followed by 6 zeros)

Negative powers of 10 can be defined using these examples:

$$10^{-3} = \frac{1}{10^3} = \frac{1}{10 \times 10 \times 10} = \frac{1}{1000} = 0{\cdot}001$$

$$10^{-2} = \frac{1}{10^2} = \frac{1}{10 \times 10} = \frac{1}{100} = 0{\cdot}01$$

Students should also be shown how to use the x^y button on the calculator to find, for example, 10^5.

Exercise 1 may now be attempted.

Notes for Exercise 2 Interpret numbers expressed in Standard Form (or Scientific Notation)

Examples which could be used:

$3{\cdot}27 \times 10^3 = 3{\cdot}27 \times (10 \times 10 \times 10) = 3270$ (using a calculator)

$4{\cdot}8 \times 10^6 = 4{\cdot}8 \times (10 \times 10 \times 10 \times 10 \times 10 \times 10) = 4800000$ (using a calculator)

$5{\cdot}8 \times 10^{-2} = \frac{5{\cdot}8}{10^2} = \frac{5{\cdot}8}{10 \times 10} = \frac{5{\cdot}8}{100} = 0{\cdot}058$ (using a calculator)

$3{\cdot}75 \times 10^{-4} = \frac{3{\cdot}75}{10^4} = \frac{3{\cdot}75}{10\times10\times10\times10} = \frac{3{\cdot}75}{10\,000} = 0{\cdot}000375$ (using a calculator)

Exercise 2 may now be attempted.

Notes for Exercise 3 Converting Large Numbers to Standard Form

The following two methods could be used:

Method 1 $5293 = 529{\cdot}3 \times 10$
$= 52{\cdot}93 \times 10 \times 10$
$= 5{\cdot}293 \times 10 \times 10 \times 10 = \boxed{5{\cdot}293 \times 10^3}$

Method 2 $5293 = (5 \cdot 2\ 9\ 3) = \boxed{5{\cdot}293 \times 10^3}$

Method 2 could be explained either as the 'point' or the 'digits' being moved 3 places'.

Exercise 3 may now be attempted.

Notes for Exercise 4 Converting Small Numbers to Standard Form

The following two methods could be used:

Method 1 $0{\cdot}00361 = \frac{0{\cdot}0361}{10} = \frac{0{\cdot}361}{10 \times 10}$
$= \frac{3{\cdot}61}{10 \times 10 \times 10} = \frac{3{\cdot}61}{10^3} = \boxed{3{\cdot}61 \times 10^{-3}}$

Method 2 $0{\cdot}00361 = (0\ 0\ 0\ 3 \cdot 6\ 1) = \boxed{3{\cdot}61 \times 10^{-3}}$

Again, Method 2 could be explained either as the 'point moving 3 places' or 'the digits being moved 3 places'.

Exercise 4 may now be attempted.

Notes for Exercise 5 Using Standard Form with a calculator

The EE or Exp button on the calculator should be introduced using a few basic examples such as

$(2{\cdot}6 \times 10^8) \times (4{\cdot}2 \times 10^6)$ and $(2{\cdot}484 \times 10^7) \div (4{\cdot}6 \times 10^{-4})$ and $(1{\cdot}8 \times 10^{-4})^3$

Exercise 5 may now be attempted.
Followed by the Checkup Exercise on Standard Form.

STUDENT MATERIALS

CONTENTS

SIMPLE ALGEBRAIC OPERATIONS

By the end of this set of exercises, you should be able to

(a) evaluate formulae expressed in symbols

(b) manipulate algebraic expressions involving brackets
multiply expressions
remove brackets and collect like terms

(c) factorise expressions – common factor

(d) solve simple linear equations

(e) solve simple inequalities

SIMPLE ALGEBRAIC OPERATIONS

A. Evaluating Formulae Expressed in Symbols

Exercise 1

For the following formulae, find the value of the letter asked for:

1. $A = b + c$ ..... find A, when $b = 17$ and $c = 25$
2. $R = g \div t$ ..... find R, when $g = 625$ and $t = 25$
3. $F = 5 \times m \times n$ ..... find F, when $m = 5{\cdot}5$ and $n = 10$
4. $P = 7rq$ ..... find P, when $r = 6$ and $q = 0{\cdot}5$
5. $V = 2x + 2y$ ..... find V, when $x = 6$ and $y = 10$
6. $M = 4e - 40$ ..... find M, when $e = 30$
7. $Q = 16 + 5r$ ..... find Q, when $r = 12$
8. $W = {}^{81}/_{d}$ ..... find W, when $d = 3$
9. $T = \frac{108}{h} - 12$ ..... find T, when $h = 9$
10. $U = \frac{95}{(k+1)}$ ..... find U, when $k = 4$
11. $B = {}^{c}/_{d}$ ..... find B, when $c = 6500$ and $d = 65$
12. $C = gh + i$ ..... find C, when $g = 4$, $h = 6$ and $i = 8$
13. $D = e + ft$ ..... find D, when $e = 90$, $f = 2$ and $t = 15$
14. $E = jk - n$ ..... find E, when $j = 3$, $k = 6$ and $n = 17$
15. $H = x - yz$ ..... find H, when $x = 50$, $y = 24$ and $z = 2$
16. $J = \sqrt{L}$ ..... find J, when $L = 25$
17. $M = 8\sqrt{N}$ ..... find M, when $N = 10000$
18. $S = T^2$ ..... find S, when $T = 3{\cdot}5$
19. $W = 3a^2 + 4$ ..... find W, when $a = 2$
20. $T = b^2p$ ..... find T, when $b = 5$ and $p = 4$
21. $Q = (x - y)^2$ ..... find Q, when $x = 9$ and $y = 8$
22. $V = \sqrt{(m^2 + n^2)}$ ..... find V, when $m = 3$ and $n = 4$
23. $Z = a^2 + 2ab + c$ ..... find Z, when $a = 8$, $b = 3$ and $c = 18$
24. $S = \sqrt{(p^2q^2 + 160)}$ ..... find S, when $p = 2$ and $q = 3$

B. Algebraic Expressions with Brackets

Exercise 2

1. Remove the brackets:

(a) $2(a + 4)$	(b) $3(b + 1)$	(c) $4(c + 5)$	(d) $5(d + 9)$
(e) $6(e + 7)$	(f) $2(f - 3)$	(g) $4(g - 2)$	(h) $5(h - 1)$
(i) $2(i - 3)$	(j) $7(j - 6)$	(k) $5(k - 9)$	(l) $8(1 + x)$
(m) $4(3 + m)$	(n) $9(1 + n)$	(o) $2(1 - w)$	(p) $3(3 - p)$
(q) $3(q + v)$	(r) $2(r + w)$	(s) $7(s - y)$	(t) $10(t - 100)$

2. Multiply out the brackets:

(a) $2(2a + 3)$	(b) $3(4b + 1)$	(c) $5(1 + 2c)$	(d) $2(3 - 4d)$
(e) $6(6e - 1)$	(f) $10(3 - 8f)$	(g) $4(2g + 4x)$	(h) $5(3h + y)$
(i) $2(4i - 5x)$	(j) $7(10j - 3y)$	(k) $7(11k - 9x)$	(l) $8(2ab - c)$
(m) $a(m + 4)$	(n) $a(n + 5)$	(o) $x(y - 1)$	(p) $w(w - 9)$
(q) $a(2q + x)$	(r) $a(5r + 2w)$	(s) $7d(2 - 3e)$	(t) $2t(10t - s)$

3. Rewrite the following **without** brackets:

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

4. Multiply out the brackets and collect like terms: **Show all working.**

(a) $3(x + 3) + 5$	(b) $2(x + 1) + 4$	(c) $4(x + 5) + 1$
(d) $2(y + 2) - 3$	(e) $5(y + 1) - 2$	(f) $6(y + 5) - 20$
(g) $2(z + 3) + 4z$	(h) $8(z + 1) + 7z$	(i) $3(z + 4) - 2z$
(j) $8(w + 3) - 3w$	(k) $9(w + 4) - 7w$	(l) $2w + 3(w + 1)$
(m) $4v + 5(v - 2)$	(n) $5v + 2(4v + 1)$	(o) $6v + 4(5v - 2)$
(p) $3r + (r - 1)$	(q) $2r + 3(r + 2s)$	(r) $4r + 2(5r + 7s)$
(s) $6a + 2(7a - 10b)$	(t) $90b + 10(10a + b)$	(u) $7 + 3(d - 1)$

cont'd .....

5. Remove the brackets and simplify: **Show all working.**

(a) $3(g + 3) + 2(g + 1)$ (b) $4(2h + 5) + 2(h + 2)$

(c) $5(3k + 4) + 2(6k + 1)$ (d) $10(2m + 3n) + 2(3m + 5n)$

(e) $3(2p + 4) + 4(p - 1)$ (f) $6(q - 2) + 2(q + 6)$

(g) $5(3r - 2s) + 2(r + 12s)$ (h) $2(5t - 2u + 6v) + 3(2t + 2u - 4v)$

C. Factorising Expressions – Common Factor

Exercise 3

1. Factorise fully :

(a) $6x + 6y$ (b) $3a - 3b$ (c) $5e - 5f$ (d) $9p + 9q$

(e) $3m - 15$ (f) $8n + 24$ (g) $4y + 6z$ (h) $14c + 28d$

(i) $10r - 15s$ (j) $4f - 24g$ (k) $9p + 21$ (l) $7x + 56$

(m) $24v + 32w$ (n) $30m - 120$ (o) $32r - 80z$ (p) $2a + 6b + 18c$

(q) $12p - 30q + 36$ (r) $21p - 49q - 7$ (s) $60r + 40s - 100t$ (t) $33x - 44y + 99$

2. Factorise fully:

(a) $3a + af$ (b) $5s - rs$ (c) $xy + yz$ (d) $a^2 + 7a$

(e) $s^2 + 8s$ (f) $m^2 - 4m$ (g) $5xr + 5xs$ (h) $3ab - 6ac$

(i) $5ef - 15f$ (j) $3e^2 + 7e$ (k) $9p^2 - 5pw$ (l) $3w^2 - 8wg$

(m) $d^2 + 3dg - 6d$ (n) $y^2 - 2yn - 7yk$ (o) $3va + 8vg + 4vh$ (p) $3sm - 5sn + 7s$

(q) $2f^2 + 4fed - fd$ (r) $5x^2 - 7xy + 9xyz$ (s) $7ax + 7ay - a$

D. Solving Linear Equations

Exercise 4

1. Find x, y and v by solving these equations:

(a) $x + 4 = 7$	(b) $x - 5 = 8$	(c) $x + 8 = 19$	(d) $x + 19 = 20$
(e) $x - 8 = 12$	(f) $x - 14 = 1$	(g) $x - 0{\cdot}5 = 8{\cdot}5$	(h) $x + 36 = 36$
(i) $2y = 10$	(j) $3y = 12$	(k) $6y = 42$	(l) $8y = 80$
(m) $4y = 6$	(n) $12y = 30$	(o) $16y = 20$	(p) $62y = 0$
(q) $^1/_3v = 7$	(r) $^1/_2v = 10$	(s) $^1/_4v = 7$	(t) $^1/_5v = 4$

2. Solve these equations:

(a) $2s + 4 = 6$	(b) $3r - 1 = 8$	(c) $4q + 3 = 15$	(d) $9p - 4 = 32$
(e) $7n + 2 = 37$	(f) $5m - 6 = 39$	(g) $8k - 8 = 0$	(h) $9j + 7 = 7$
(i) $5 + 3h = 11$	(j) $7 + 5g = 17$	(k) $3 + 4f = 31$	(l) $70 = e + 66$
(m) $25 = d + 9$	(n) $17 = c + 1$	(o) $81 = b - 19$	(p) $100 = a - 100$

3. Solve for x:

(a) $2x = x + 5$	(b) $5x = 4x + 8$	(c) $6x = 2x + 4$	(d) $7x = 3x + 28$
(e) $9x = 6x + 21$	(f) $4x - 3 = 3x$	(g) $9x - 8 = 5x$	(h) $4x = 24 + x$
(i) $7x = 2x + 25$	(j) $3x + 1 = 4x$	(k) $3x = 18 - 3x$	(l) $4x = 15 - x$
(m) $x + 40 = 5x$	(n) $24 + x = 4x$	(o) $14 - x = 6x$	(p) $77 - 2x = 9x$

4. Solve these equations:

(a) $4a - 1 = 3a + 8$	(b) $5c + 3 = 3c + 9$	(c) $9e + 2 = 2e + 9$
(d) $5g - 1 = 2g + 20$	(e) $4k - 2 = 16 - 2k$	(f) $7n - 1 = 23 - n$
(g) $3m - 8 = m + 1$	(h) $5 + 5p = 26 + 2p$	(i) $7q - 12 = 5q - 3$
(j) $6r - 14 = r + 1$	(k) $5s + 3 = 8s - 21$	(l) $12u + 7 = 7 - u$
(m) $9v - 4 = 2v + 45$	(n) $7 - 3w = w - 1$	(o) $3y - 8 = y - 5$

5. Solve these equations by multiplying out the brackets first:

(a) $2(x + 4) = 10$	(b) $3(x + 1) = 15$	(c) $3(x - 1) = 21$
(d) $4(x - 2) = 12$	(e) $6(x + 3) = 60$	(f) $7(x + 2) = 49$
(g) $5(x - 1) = 45$	(h) $4(x - 3) = 48$	(i) $6(x + 3) = 54$
(j) $7(x + 1) = 42$	(k) $9(x + 7) = 72$	(l) $3(2x + 1) = 27$
(m) $4(7 + 2x) = 44$	(n) $3(7x - 6) = 66$	(o) $90 = 6(2x - 3)$

E. Solving Inequalities

Exercise 5

1. Use **<**, **>**, or **=** to connect the two numbers in each pair.
   Write out the question again with the correct symbol.

   (a) 1, 2 (b) –1, 2 (c) 3, 0 (d) 5, 5 (e) 2, –3

   (f) –1, –2 (g) 1, –8 (h) –3, –2 (i) 0, –1 (j) –2, (–1+ (–1))

2. Solve these inequalities, leaving your answer in the form $x > 1$, $x \leq 4$, etc.

   (a) $x + 1 > 3$ (b) $x - 4 < 7$ (c) $x + 2 \geq 9$ (d) $4x > 8$

   (e) $2x < 15$ (f) $8x < 10$ (g) $2x - 3 < 7$ (h) $7x + 4 \geq 18$

   (i) $5x + 1 \leq 36$ (j) $2x - 6 \leq 13$ (k) $5x > -5$ (l) $3x + 1 \leq 11$

   (m) $4(x - 1) > 2x$ (n) $3(x + 1) < 12$ (o) $5(x - 16) < x$ (p) $5x - 7 > 3x + 1$

3. Solve these inequalities, choosing y from the set $\{0, 1, 2, 3, 4, 5, 6\}$ for your answer:

   (a) $y \geq 5$ (b) $y \leq 2$ (c) $y + 4 \geq 8$ (d) $4y < 6$

   (e) $5y + 2 > 12$ (f) $9y - 5 \geq 40$ (g) $4y - 10 \leq 2y$ (h) $9y - 3 \leq 5y + 5$

Checkup for Simple Algebraic Operations

1. For each of these formulae, find the value of the required letter:

   (a) $M = 2a + 8$, find M when $a = 7$.
   (b) $T = uv - w$, find T when $u = 5$, $v = 3$ and $w = 14$.
   (c) $A = d^2y$, find A when $d = 3$ and $y = 4$.

2. Multiply out the brackets and simplify **where possible**:

   (a) $5(2a + 1)$ (b) $7(b - 3c)$ (c) $x(y + 3)$
   (d) $2p(p + q - r)$ (e) $5(4v + 2) + 1$ (f) $6x + 4(x - 2)$
   (g) $2(8h + 5) - 15h$ (h) $6(2h + 1) + 2(4h - 3)$

3. Factorise these expressions fully:

   (a) $2p + 14$ (b) $5s - 25$ (c) $16 + 8r$ (d) $77 - 33f$
   (e) $6y - 9z$ (f) $4v + 6vz$ (g) $ar + 4a$ (h) $px - qx$
   (i) $4sr + 5st - 8vs$ (j) $x^2 + 3x$ (k) $14e + 7f - 35g$ (l) $2y^2 - 6y$

4. Solve these equations:

   (a) $x + 5 = 11$ (b) $x - 5 = 2$ (c) $4y = 28$ (d) $6x = 21$
   (e) $^1/_2s = 5$ (f) $^1/_4v = 3$ (g) $4n + 3 = 23$ (h) $5m - 1 = 29$
   (i) $8n + 3 = 3$ (j) $2 + 5k = 37$ (k) $5s - 1 = 4s$ (l) $8x - 9 = 5x$
   (m) $3t + 2 = 2t + 7$ (n) $5c + 4 = 3c + 10$ (o) $5 + 7e = 35 + 2e$
   (p) $5y - 4 = 3y + 5$ (q) $2(x + 3) = 14$ (r) $4(u - 1) = 28$

5. Solve these inequalities, leaving your answer in the form $x > 4$, $x \leq 5$, etc.

   (a) $x + 3 > 7$ (b) $x - 4 < 9$ (c) $x + 4 \geq 12$ (d) $7x > 21$
   (e) $2x < 11$ (f) $4x \geq 5$ (g) $2x - 4 < 8$ (h) $5x + 4 \geq 9$
   (i) $3x + 1 \leq 22$ (j) $2x - 4 \leq 16$ (k) $11x - 1 > 32$ (l) $9x + 1 \leq 28$
   (m) $5(x - 2) > 3x$ (n) $6(x + 1) < 24$ (o) $5(x - 20) < x$ (p) $8x - 8 > 2x + 1$

GRAPHICAL RELATIONSHIPS

By the end of this set of exercises, you should be able to

(a) Draw a straight line given its equation in the form $y = ax + b$ by making up a table of values.

A. DRAWING LINES

Lines of the form $y = ax$.

Exercise 1

1. (a) Copy and complete this table:

x	0	1	2	3	4
$y = 2x$	0	2	…	…	…

(b) Draw a coordinate diagram and plot the five points from the above table.
(0,0), (1,2), (2, ..), (3, ..), (4, ..)

(c) Draw the line through the five points and label it $y = 2x$.

2. Repeat the three parts of question 1 for the line $y = 3x$.
i.e. start with the table:

x	0	1	2	3	4
$y = 3x$	0	3	…	…	…

3. Complete each of the following tables and use the results to draw the lines.

(a)

x	0	1	2	3	4
$y = 4x$	…	…	…	…	…

(b)

x	0	1	2	3	4
$y = {}^1/_2x$	…	…	…	…	…

(c)

x	0	1	2	3	4
$y = x$	…	…	…	…	…

(d)

x	0	1	2	3	4
$y = 5x$	…	…	…	…	…

4. Look at the 6 lines you have drawn in questions 1 and 2.
$y = {}^1/_2x$, $y = x$ (or $y = 1x$), $y = 2x$, $y = 3x$, $y = 4x$, $y = 5x$
Copy this sentence and complete it:
;For any line $y = ax$, the bigger the value a is, the s.....r the line slopes'.

5. (a) Copy and complete this table for the line $y = -2x$:

x	0	1	2	3	4
$y = -2x$	0	–2	…	…	…

(b) Draw a coordinate diagram and plot the five points from the above table.
(0,0), (1,–2), (2, ..), (3, ..), (4, ..)

(c) Draw the line through the five points and label it $y = -2x$.

6. Repeat the three parts of question 5 for the line $y = -3x$.
i.e. start with the table:

x	0	1	2	3	4
$y = -3x$	0	–3	…	…	…

7. Complete each of the following tables and use the results to draw the lines.

(a)

x	0	1	2	3	4
$y = -4x$	…	…	…	…	…

(b)

x	0	1	2	3	4
$y = -x$	…	…	…	…	…

(c)

x	0	1	2	3	4
$y = -{}^1/_2x$	…	…	…	…	…

8. Look at the 5 lines you have drawn in questions 5 and 6.

$y = -{}^1/_2x$, $y = -x$ (or $y = -1x$) $y = -2x$, $y = -3x$, $y = -4x$

Copy and complete the following:

(i) For any line of the form $y = -ax$, the bigger the value a is, the s.....r the line slopes.

(ii) Lines like $y = x$, $y = 2x$, $y = 4x$, etc. always slope u.....s from left to right.

(iii) Lines like $y = -x$, $y = -2x$, $y = -4x$, etc. always slope d.....s from left to right.

Lines of the form $y = ax + b$

Exercise 2

1. (a) Copy and complete this table:

x	0	1	2	3	4
$y = 2x + 1$	1	3	…	…	…

(b) Draw a coordinate diagram and plot the five points from the above table.
(0,1), (1,3), (2, ..), (3, ..), (4, ..)

(c) Draw the line through the five points and label it $y = 2x + 1$

2. Repeat the three parts of question 1 for the line $y = 2x + 2$, starting with the table:

x	0	1	2	3	4
$y = 2x + 2$	…	…	…	…	…

3. Repeat the three parts of question 1 for the line $y = 2x + 4$, starting with the table:

x	0	1	2	3	4
$y = 2x + 4$	…	…	…	…	…

4 Repeat the three parts of question 1 for the line $y = 2x - 3$, starting with the table:

x	0	1	2	3	4
$y = 2x - 3$	…	…	…	…	…

5. Look at the four lines you have drawn above in questions 1 to 4 and the line $y = 2x$ from question 1 of Exercise 1.

$y = 2x$, $y = 2x + 4$, $y = 2x + 2$, $y = 2x + 1$, $y = 2x - 3$.

Copy the following statements and complete them:

(i) All the lines of the form $y = 2x \pm$ (a number), are p .....l to the line $y = 2x$.

(ii) For any line of the form $y = 2x \pm b$, the number 'b' tells you where the line cuts the ... - axis.

6. For each of the following:

(i) Copy the table and complete it.
(ii) Draw up a set of axes and plot the points from the table.
(iii) Draw the line through the set of points and label it.

(a)

x	0	1	2	3	4
$y = 3x + 1$	…	…	…	…	…

cont'd ...

(b)

x	0	1	2	3	4
$y = 4x - 2$	…	…	…	…	…

(c)

x	0	1	2	3	4
$y = x + 5$	…	…	…	…	…

(d)

x	0	1	2	3	4
$y = {}^1/_2x + 3$	…	…	…	…	…

(e)

x	0	1	2	3	4
$y = 3x - 1$	…	…	…	…	…

(f)

x	0	1	2	3	4
$y = 4x + 1$	…	…	…	…	…

7. For each of the following:

(i) Make up your own table of values (5 or 6 pairs).
(ii) Draw a new set of axes each time and plot your points.
(iii) Join up the set of points and label the lines.

(a) $y = 2x + 3$ (b) $y = 3x - 4$

(c) $y = {}^1/_2\,x + 5$ (d) $y = 5x - 3$

(e) $y = {}^1/_4\,x + 2$ (f) $y = x - 1$

8. (Harder!)

(a) Copy and complete this table for the line $y = -2x + 1$

x	0	1	2	3	4
$y = -2x + 1$	1	–1	–3	…	…

(b) Draw a set of axes and plot your five points, (0,1), (1,–1), (2,–3), (3, ..), (4, ..)

(c) Draw the line through the five points and label it $y = -2x + 1$.

9. Sketch the lines associated with the following equations by completing a table first.

(a) $y = -2x + 3$ (b) $y = -3x + 1$

(c) $y = -4x - 2$ (d) $y = -x + 2$

(e) $y = -{}^1/_2x + 3$ (f) $y = -3x - 2$

Lines of the form $y = k$ (a number) and $x = h$ (a number)

Exercise 3

1. (a) Complete this table for the line $y = 2$

x	0	1	2	3	4
$y = 2$	2	2	2	…	…

(note)

(b) Draw a set of axes and plot your five points (0,2), (1,2), (2,2), (3, ..), (4, ..)

(c) Draw the line through the five points and label it $y = 2$.

(d) Copy and complete this statement:
'The line $y = 2$ is a line which is p .....l to the ... - axis'.

2. Without making up a table, sketch the following lines:

(a) $y = 5$ (b) $y = 6$ (c) $y = –1$ (d) $y = –3$

3. Copy and complete the following statement:
'Any line of the form $y = k$ (a number), is a line which is p .....l to the ... - axis'.

4. (a) Complete this table for the line $x = 3$

(note)

(note) →

$x = 3$	3	3	3	…	…
y	0	1	2	3	4

(b) Draw a set of axes and plot your five points (3,0), (3,1), (3,2), (...,3), (...,4)

(c) Draw the line through the five points and label it $x = 3$.

(d) Copy and complete this statement:
'The line $x = 3$ is a line which is p .....l to the ... - axis'.

5. Without making up a table, sketch the following lines:

(a) $x = 1$ (b) $x = 5$ (c) $x = –2$ (d) $x = –4$

6. Copy and complete the following statement:
'Any line of the form $x = h$ (a number), is a line which is p .....l to the ... - axis'.

Checkup for Graphical Relationships

1. For each of the following equations:
   (i) Make up your own table of values (5 or 6 pairs).
   (ii) Draw a new set of axes each time and plot your points.
   (iii) Join up the set of points and label the lines.

(a) $y = 5x$
(b) $y = -2x$
(c) $y = 4x + 1$
(d) $y = 3x - 2$
(e) $y = {}^1/_2\,x + 3$
(f) $y = {}^1/_3\,x + 1$
(g) $y = -2x + 4$
(h) $y = -3x - 1$
(i) $y = 8$
(j) $y = -4$
(k) $x = 7$
(l) $x = -3$

TRIGONOMETRY IN RIGHT-ANGLED TRIANGLES

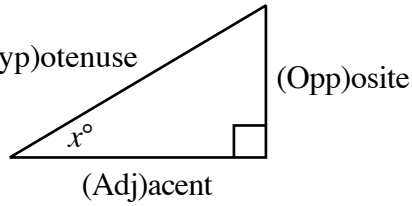
By the end of this set of exercises, you should be able to

(a) Solve Right-Angled Triangles using sine, cosine and tangent.

TRIGONOMETRY IN RIGHT ANGLED TRIANGLES

The Tangent Ratio

$$\tan x^\circ = \frac{\text{Opp}}{\text{Adj}}$$

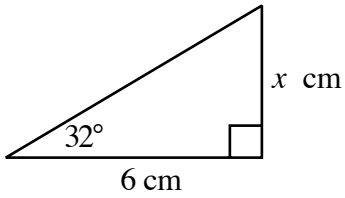


Exercise 1

1. Use your calculator to look up the following (to 2 decimal places):

(a) tan 37°	(b) tan 51°	(c) tan 70°
(d) tan 61°	(e) tan 78°	(f) tan 17°
(g) tan 43°	(h) tan 39°	(i) tan 89°
(j) tan 27°	(k) tan 69°	(l) tan 58°
(m) tan 25·6°	(n) tan 48·7°	(o) tan 6·5°

2. Set down each part of this question in the same way as shown in the example opposite.



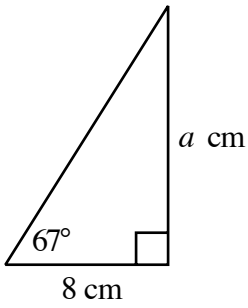
$\tan 32^\circ = \frac{x}{6}$

$\Rightarrow x = 6 \times \tan 32^\circ$

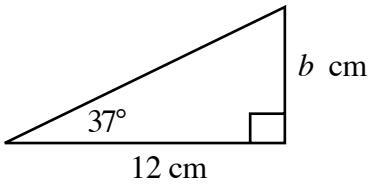
$\Rightarrow x = 3{\cdot}75$ cm

Find the values of a, b, c, ...

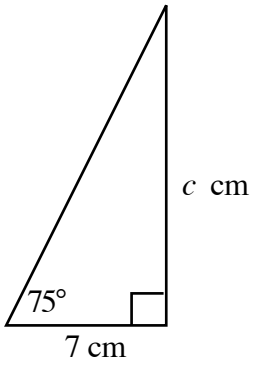
(a)



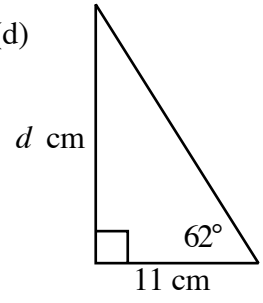
(b)



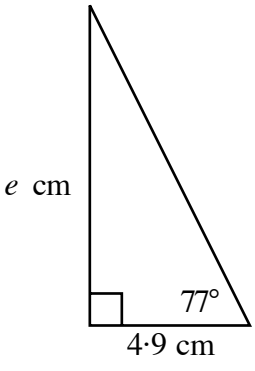
(c)



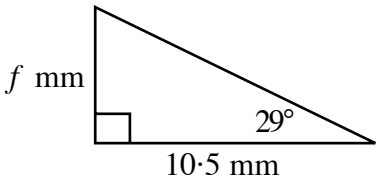
(d)



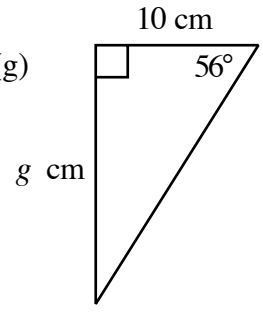
(e)



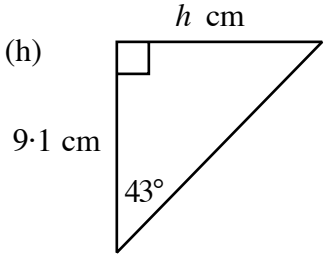
(f)



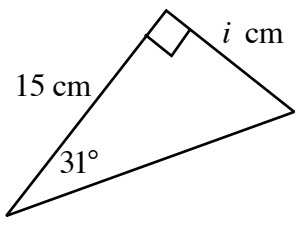
(g)



(h)

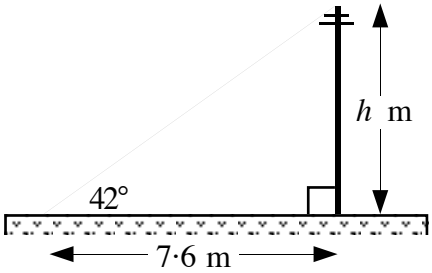


(i)

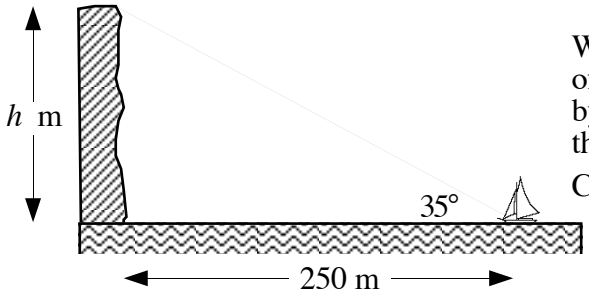


3. (a) A telegraph pole is strengthened by a steel wire as shown in the diagram opposite.

Calculate the height (h) of the pole.



(b)

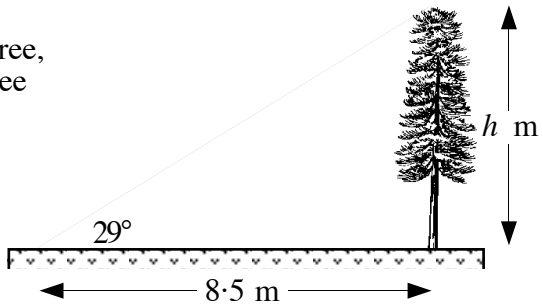


When a boat is 250 metres from the base of a cliff, the sailor has to raise his eyes by 35° from the horizontal in order to see the top of the cliff.

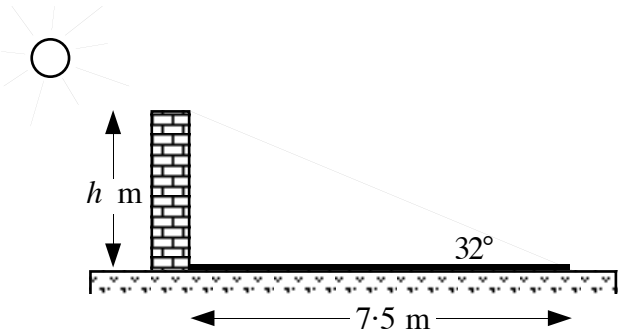
Calculate the height (h) of the cliff.

(c) At a point, 8·5 metres from the base of a tree, the "angle of elevation" of the top of the tree is 29°.

Calculate the height (h) of the tree.



(d)



When the sun shines on a wall, it casts a shadow 7·5 metres long.
The angle of elevation of the top of the wall from the end of the shadow is 32°.

Calculate the height (h) of the wall.

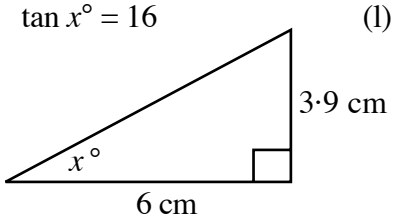
Using Tangents in Reverse

Exercise 2

1. Use [Shift] [tan] , [2nd] [tan] , [Inv] [tan] or [tan $^{-1}$] buttons to find the size of angle $x°$, given:

(a) $\tan x° = 0{\cdot}123$	(b) $\tan x° = 0{\cdot}342$	(c) $\tan x° = 0{\cdot}9$
(d) $\tan x° = 1$	(e) $\tan x° = 1{\cdot}732$	(f) $\tan x° = 2$
(g) $\tan x° = 3{\cdot}157$	(h) $\tan x° = 5{\cdot}095$	(i) $\tan x° = 4{\cdot}5$
(j) $\tan x° = 10{\cdot}987$	(k) $\tan x° = 16$	(l) $\tan x° = 19{\cdot}081$

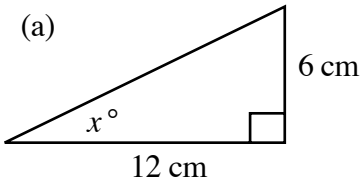
2. Set down each part of this question in the same way as shown in the example opposite.



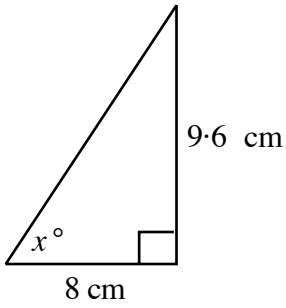
$$\tan x° = \frac{3{\cdot}9}{6}$$
$$\Rightarrow \tan x° = 0{\cdot}515$$
$$\Rightarrow \quad x = 27{\cdot}2°$$

Find the size of angle $x°$ each time.

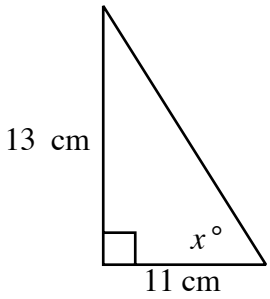
(a)



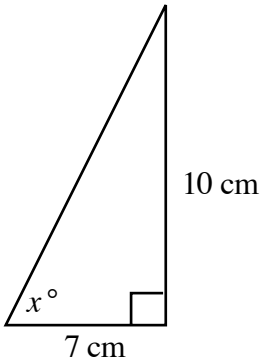
(b)



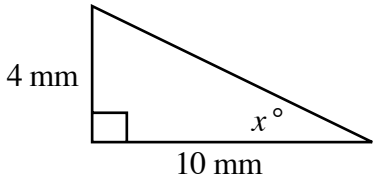
(c)



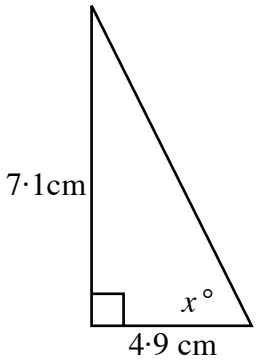
(d)



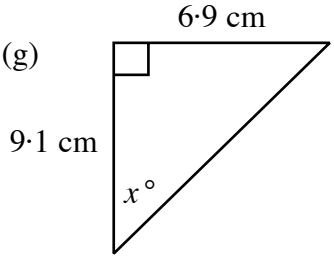
(e)



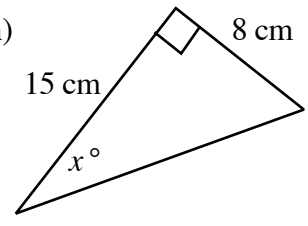
(f)



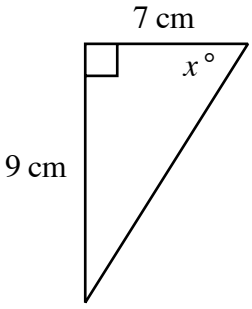
(g)



(h)

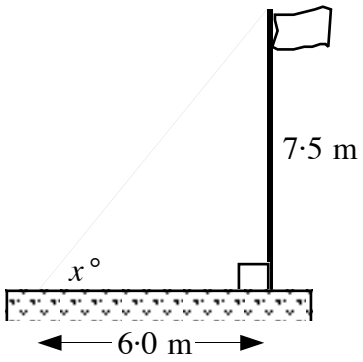


(i)

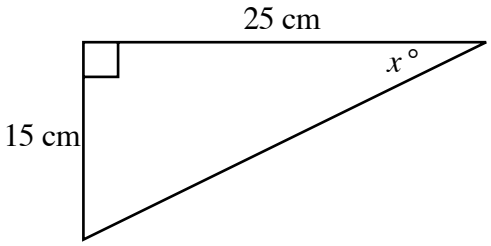


3 (a) A flagpole is 7·5 metres high.
A strengthening wire is attached from the top of the pole to a point 6 metres from the base of the pole.

Calculate the size of the angle between the wire and the ground.



(b)

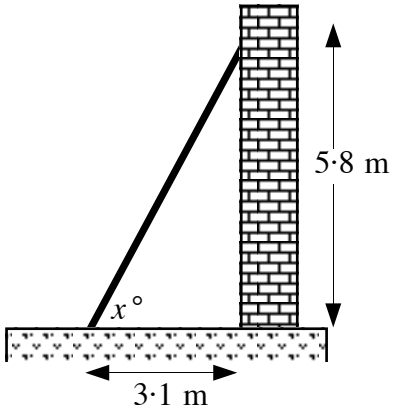


The picture shows a shelf support bracket in the shape of a right angled triangle.

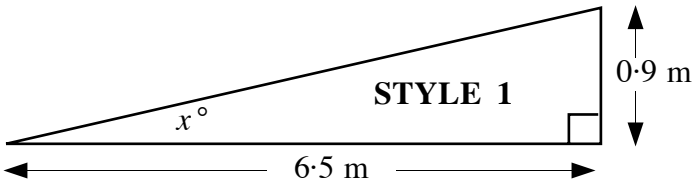
Calculate the size of the angle marked x °.

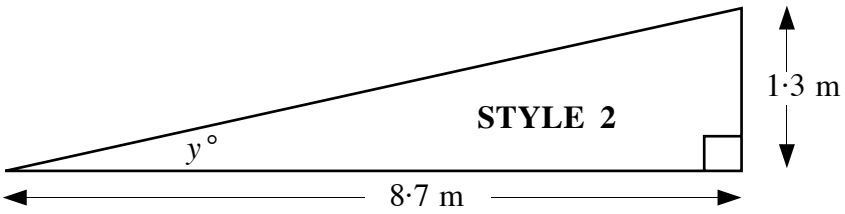
(c) A ladder is resting against a wall.
The base of the ladder is 3·1 metres from the foot of the wall.
The ladder reaches a point 5·8 metres up the wall.

Calculate the size of the angle the ladder makes with the ground.



(d) Shown below are two newly designed wheelchair ramps.



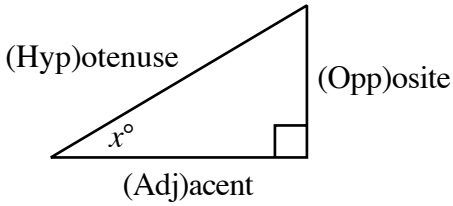


(i) Calculate the sizes of the angles marked x ° and y °.

(ii) Which of ramp is steeper?

The Sine Ratio

$$\sin x^\circ = \frac{\text{Opp}}{\text{Hyp}}$$

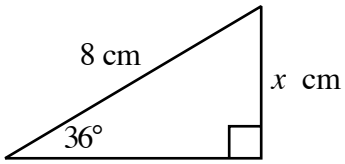


Exercise 3

1. Use your calculator to look up the following:

(a) sin 37°	(b) sin 51°	(c) sin 70°
(d) sin 61°	(e) sin 78°	(f) sin 17°
(g) sin 43°	(h) sin 39°	(i) sin 86°
(j) sin 47°	(k) sin 69°	(l) sin 58°
(m) sin 25·6°	(n) sin 48·7°	(o) sin 6·5°

2. Set down each part of this question in the same way as shown in the example opposite.



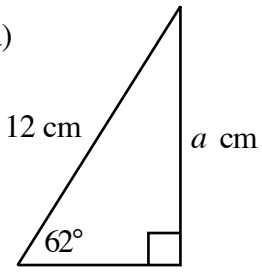
$\sin 36^\circ = \frac{x}{8}$

$\Rightarrow x = 8 \times \sin 36^\circ$

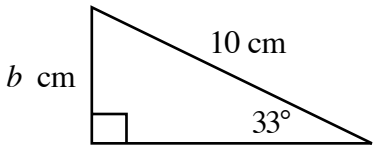
$\Rightarrow x = 4{\cdot}70$ cm

Find the values of a, b, c, ...

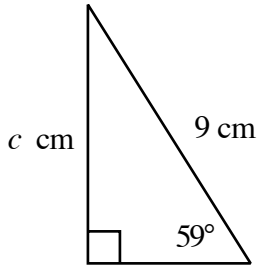
(a)



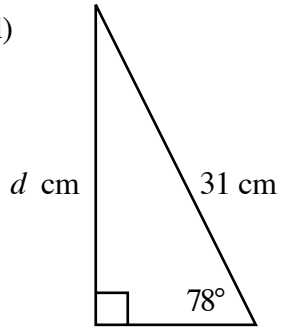
(b)



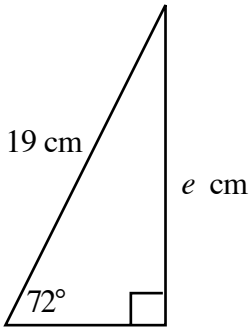
(c)



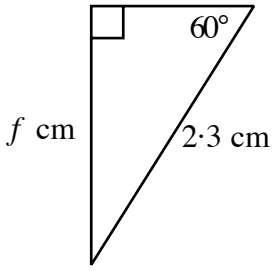
(d)



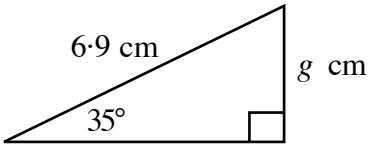
(e)



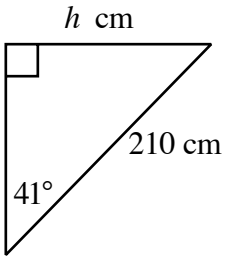
(f)



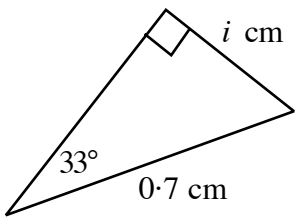
(g)



(h)



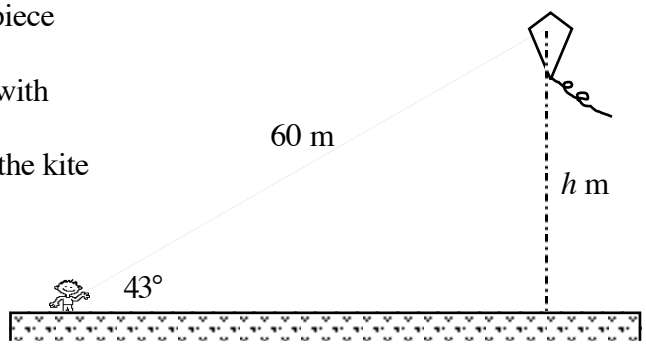
(i)



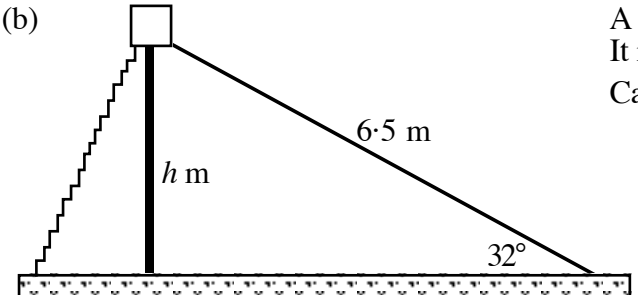
3. (a) A boy flies a kite on the end of a piece of string 60 metres long.

The string makes an angle of 43° with the ground.

Calculate the height (h) metres of the kite above ground.



(b)

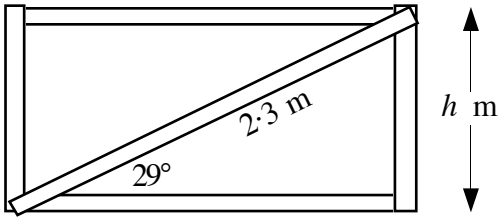


A slide in the park is 6·5 metres long. It makes an angle of 32° with the ground.

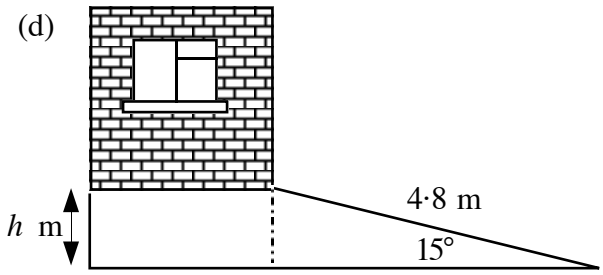
Calculate the height (h) of the slide.

(c) A gate has a strengthening bar across its diagonal.
The bar is 2·3 metres long, as shown in the diagram.

Calculate the height (h) of the gate.



(d)



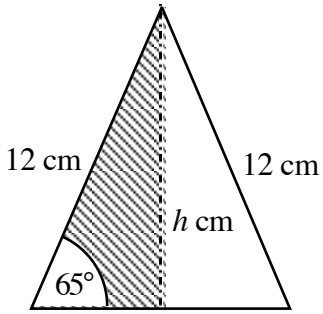
A car ramp is 4·8 metres long. It makes an angle of 15° with the ground.

Calculate the height (h) of the top of the ramp above the ground.

(e) An isosceles triangle has each of its two sloping sides 12 centimetres long.

The sides make an angle of 65° with the base.

Calculate the height (h) of the triangle.



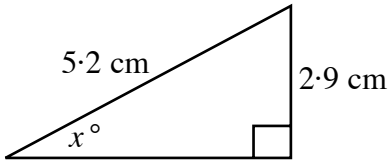
Using Sines in Reverse

Exercise 4

1. Use [Shift] [sin] , [2nd] [sin] , [Inv] [sin] or [sin -1] buttons to find the size of angle $x°$, given:

(a) $\sin x° = 0{\cdot}223$	(b) $\sin x° = 0{\cdot}376$	(c) $\sin x° = 0{\cdot}9$
(d) $\sin x° = 0{\cdot}853$	(e) $\sin x° = 0{\cdot}732$	(f) $\sin x° = 0{\cdot}5$
(g) $\sin x° = 0{\cdot}866$	(h) $\sin x° = 0{\cdot}195$	(i) $\sin x° = 0{\cdot}445$
(j) $\sin x° = 0{\cdot}987$	(k) $\sin x° = 0{\cdot}333$	(l) $\sin x° = 1{\cdot}1$ (?)

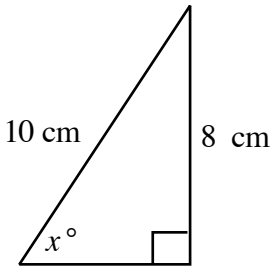
2. Set down each part of this question in the same way as shown in the example opposite.



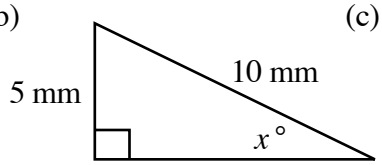
$$\sin x° = \frac{2{\cdot}9}{5{\cdot}2}$$
$$\Rightarrow \sin x° = 0{\cdot}558$$
$$\Rightarrow \quad x = 33{\cdot}9°$$

Find the size of angle x each time.

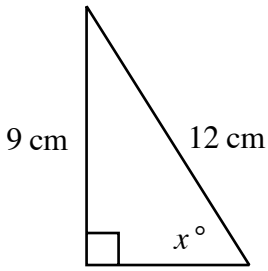
(a)



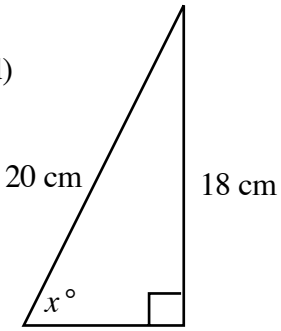
(b)



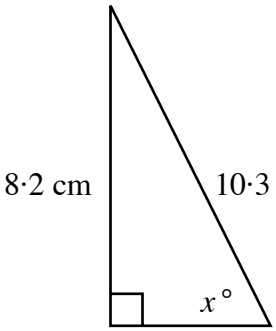
(c)



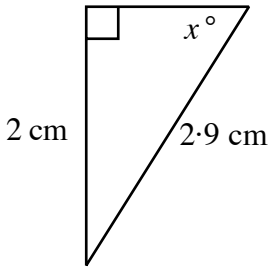
(d)



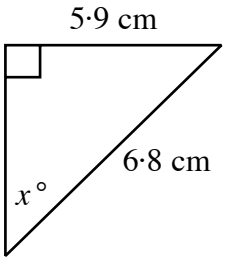
(e)



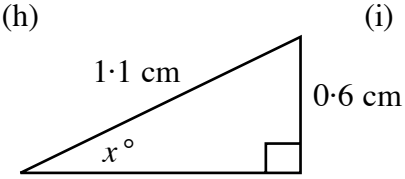
(f)



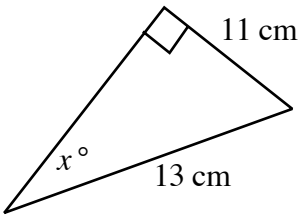
(g)



(h)

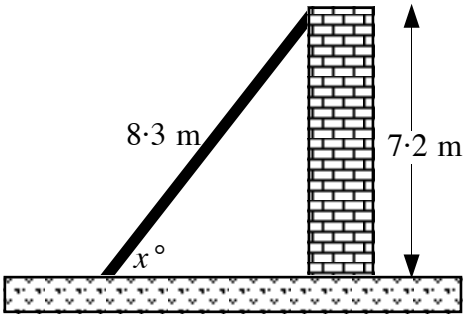


(i)

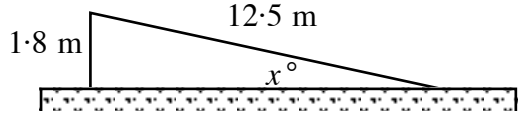


3 (a) A large wooden beam, 8·3 m long, is used to shore up a crumbling wall as shown.

Calculate the size of the angle between the support and the ground.



(b)

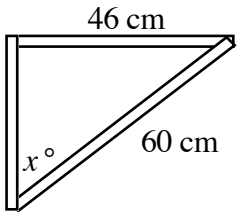


The picture shows a roller skate ramp built in the local park.

Calculate the size of the angle marked x °.

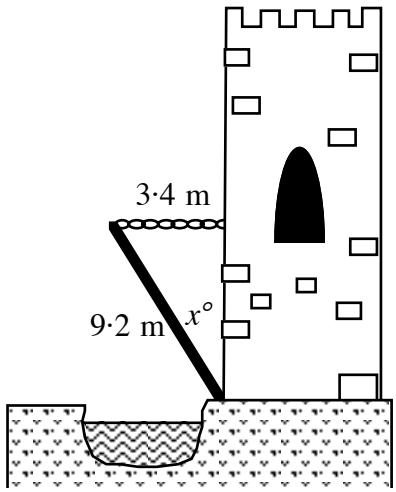
(c) Part of a bicycle frame is in the shape of a right angled triangle.

Calculate the size of the angle marked x ° in the diagram.

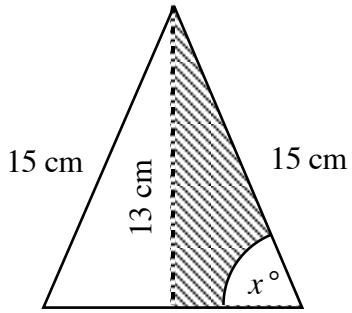


(d) The drawbridge of a castle is 9·2 metres long. In the figure, the chain is attached to the tip of the drawbridge and is horizontal.

If the chain is 3·4 metres long, calculate the size of the angle between the drawbridge and the wall.



(e)

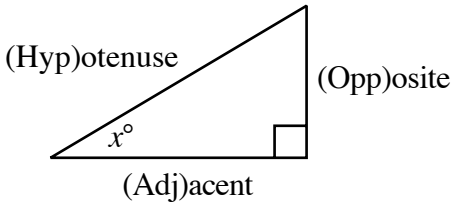


An isosceles triangle has its two sloping sides each 15 centimetres long.
The height of the triangle is 13 centimetres.

Calculate the size of the angle x° between one of the long sides and the base.

The Cosine Ratio

$$\cos x^\circ = \frac{\text{Adj}}{\text{Hyp}}$$

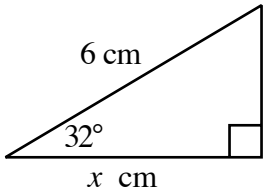


Exercise 5

1. Use your calculator to look up the following:

(a) cos 57°	(b) cos 61°	(c) cos 50°
(d) cos 81°	(e) cos 18°	(f) cos 27°
(g) cos 33°	(h) cos 75°	(i) cos 88°
(j) cos 26°	(k) cos 9°	(l) cos 60°
(m) cos 35·6°	(n) cos 58·3°	(o) cos 7·5°

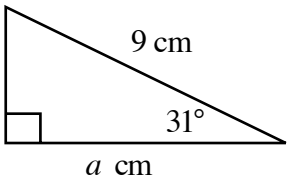
2. Set each part of this question down in the same way as shown in the example opposite.



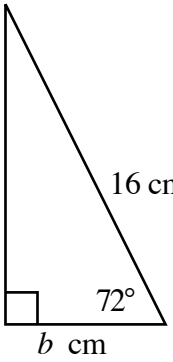
$$\cos 32^\circ = \frac{x}{6}$$
$$\Rightarrow x = 6 \times \cos 32^\circ$$
$$\Rightarrow x = 5{\cdot}09 \text{ cm}$$

Find the values of a, b, c, ...

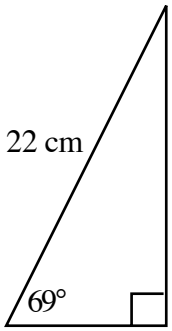
(a)



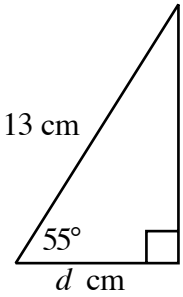
(b)



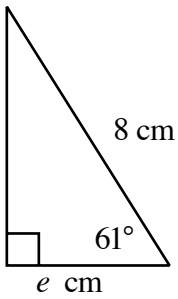
(c)



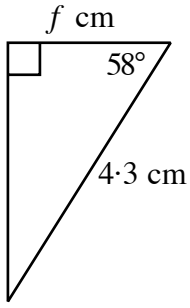
(d)



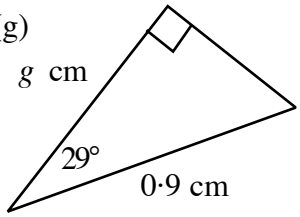
(e)



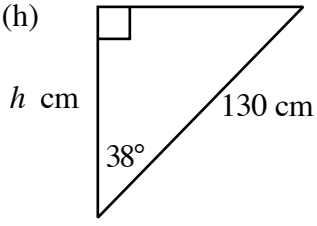
(f)



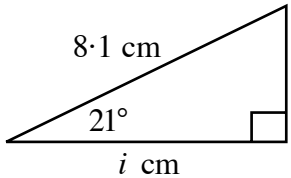
(g)



(h)

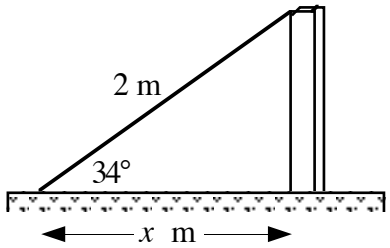


(i)

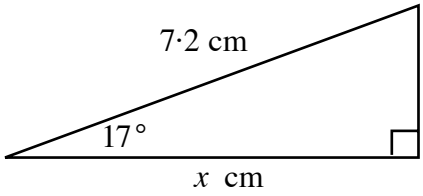


3. (a) A farmer's fencepost needs a support.
He attaches a 2 metre wire to it and the wire makes an angle of 34° to the ground.

Calculate how far the foot of the wire is from the base of the fencepost.



(b)

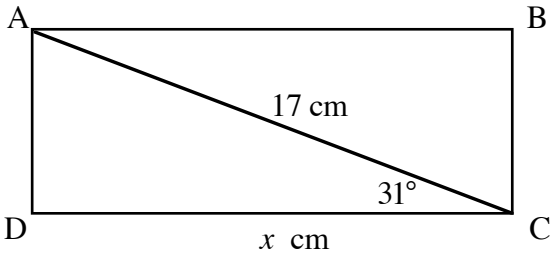


A door wedge has its sloping side 7·2 centimetres long.
The sloping side makes an angle of 17° with the base.

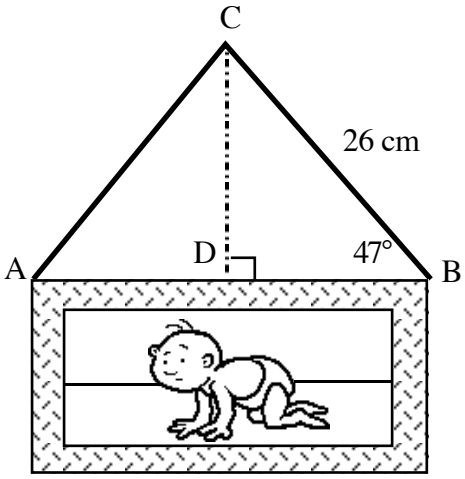
Calculate the length (x) of the base.

(c) The diagonal of rectangle ABCD is 17 centimetres long.
The diagonal AC makes an angle of 31° to the base line DC.

Calculate the length (x) of the rectangle.



(d)

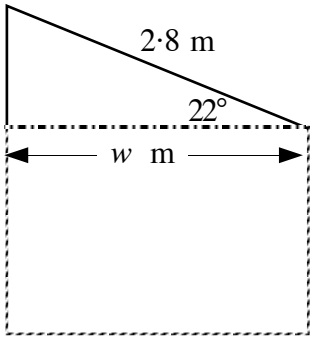


A piece of wire ACB is used to hang a picture.
Triangle ABC is isosceles.
Triangle BCD is right angled.

Calculate the length of the line BD and then write the width AB of the picture.

(e) A diagram shows the side view of a garden shed.

Calculate the width (w) of the shed.



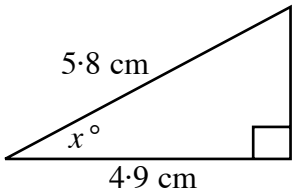
Using Cosines in Reverse

Exercise 6

1. Use Shift cos , 2nd cos , Inv cos or cos $^{-1}$ buttons to find the size of angle $x°$, given:

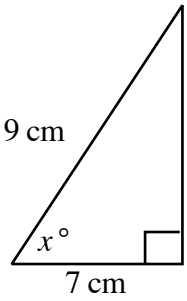
   (a) $\cos x° = 0{\cdot}423$ (b) $\cos x° = 0{\cdot}396$ (c) $\cos x° = 0{\cdot}6$
   (d) $\cos x° = 0{\cdot}573$ (e) $\cos x° = 0{\cdot}718$ (f) $\cos x° = 0{\cdot}9$
   (g) $\cos x° = 0{\cdot}866$ (h) $\cos x° = 0{\cdot}225$ (i) $\cos x° = 0{\cdot}071$
   (j) $\cos x° = 0{\cdot}999$ (k) $\cos x° = 0{\cdot}301$ (l) $\cos x° = 1{\cdot}2$ (?)

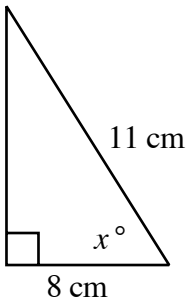
2. Set down each part of this question in the same way as shown in the example opposite.

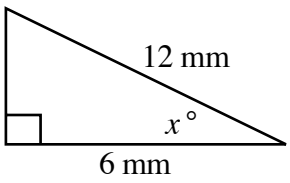
   

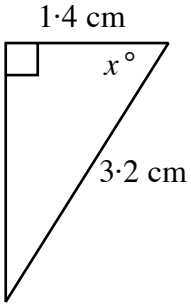
   $$\cos x° = \frac{4{\cdot}9}{5{\cdot}8}$$
   $$\Rightarrow \cos x° = 0{\cdot}845$$
   $$\Rightarrow \quad x = 32{\cdot}3°$$

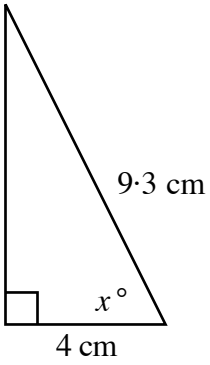
   Find the size of angle x each time.

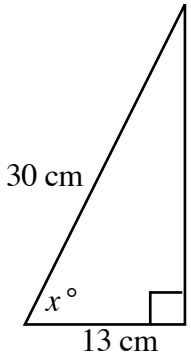
   (a)
   

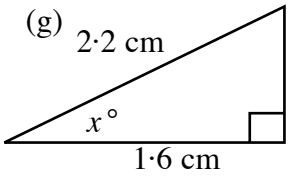
   (b)
   

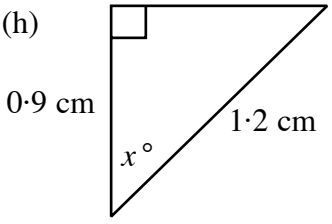
   (c)
   

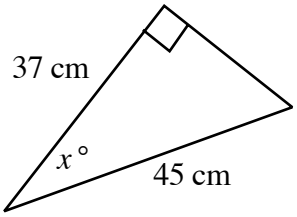
   (d)
   

   (e)
   

   (f)
   

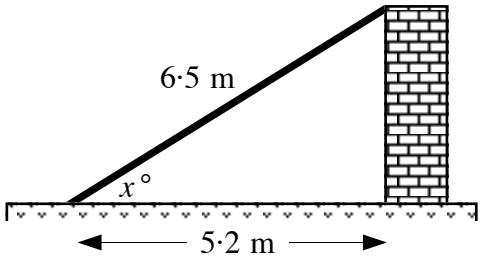
   (g)
   

   (h)
   

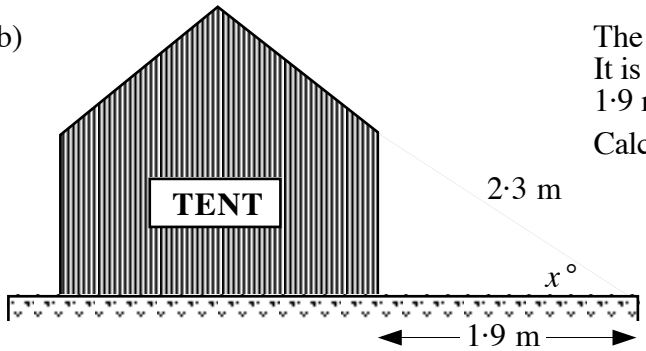
   (i)
   

3 (a) A plank of wood is 6·5 metres long. It rests against the top of a wall and its foot is 5·2 metres from the base of the wall.

Calculate the size of the angle between the plank and the ground.



(b)

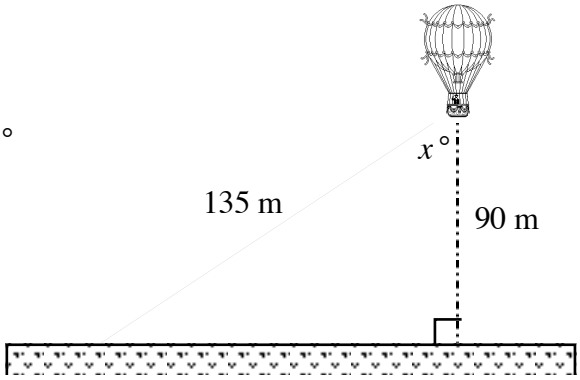


The guy rope of a tent is 2·3 metres long. It is attached to the ground at a point 1·9 metres from the foot of the tent wall.

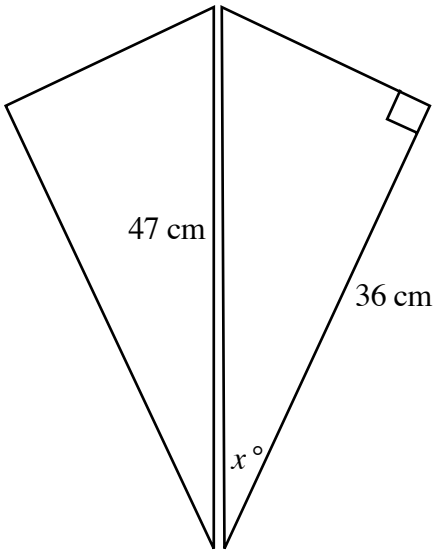
Calculate the size of the angle marked x °.

(c) A balloon is 90 metres above ground. The wire which tethers it to the ground is 135 metres long.

Calculate the size of the angle marked x ° in the diagram.



(d)



A kite is made up of two identical right angled triangles.

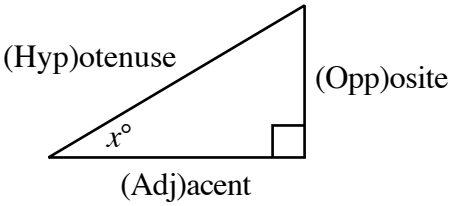
Calculate the size of the angle marked x ° in the figure.

A Mixture of Tangents, Sines and Cosines

$$\tan x^\circ = \frac{\text{Opp}}{\text{Adj}}$$

$$\sin x^\circ = \frac{\text{Opp}}{\text{Hyp}}$$

$$\cos x^\circ = \frac{\text{Adj}}{\text{Hyp}}$$

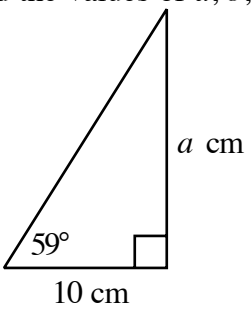


SOH CAH TOA

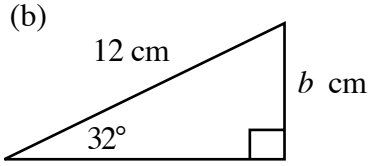
Exercise 7

1. Find the values of a, b, c, ...

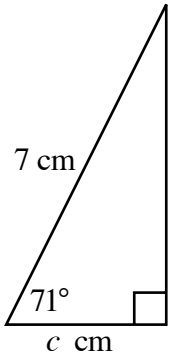
(a)



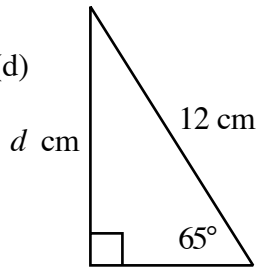
(b)



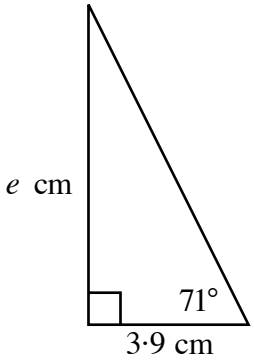
(c)



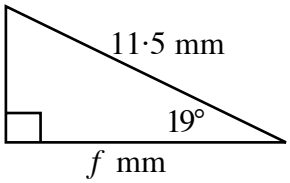
(d)



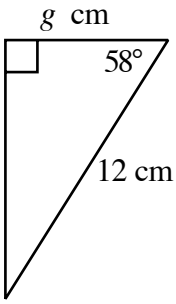
(e)



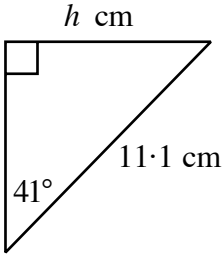
(f)



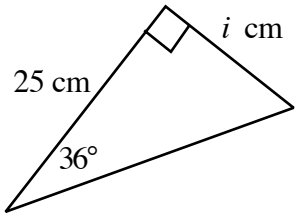
(g)



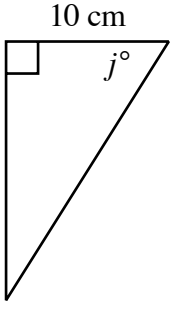
(h)



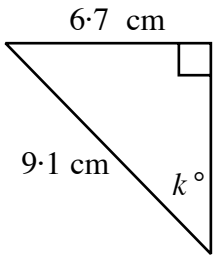
(i)



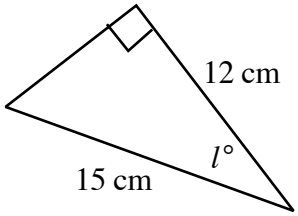
(j)



(k)



(l)



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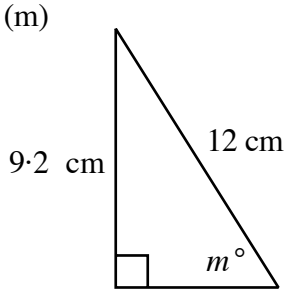
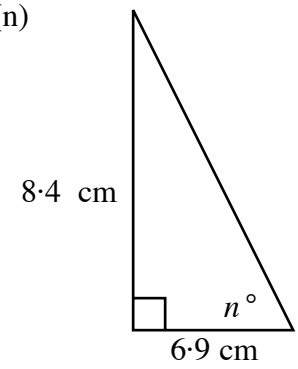
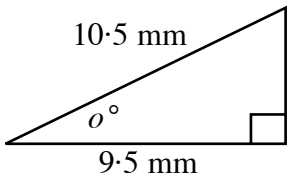
(m)



(n)

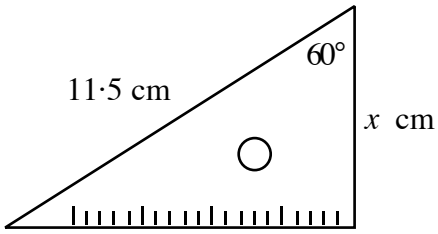


(o)

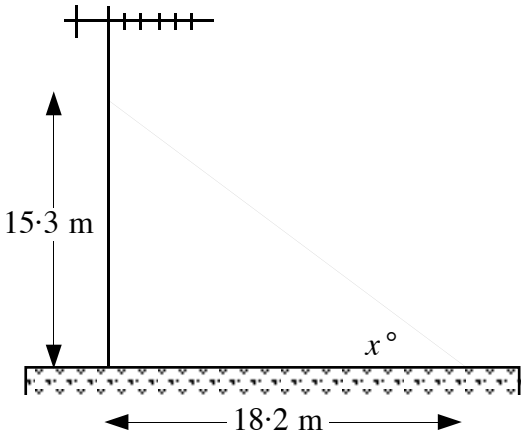


2. (a) A plastic set-square has one of its angles 60°. The longest side is 11·5 centimetres long.

Calculate the size of the shortest side marked x cm.



(b)



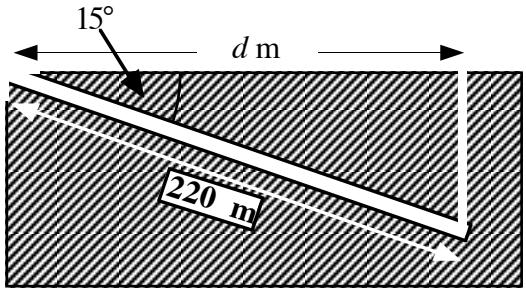
A radio mast has a support wire attached from the ground to a point 15·3 metres up the mast.

Calculate the size of the angle between the wire and the ground.

(c) A mine shaft slopes at an angle of 15° with the ground.

The shaft is 220 metres long.

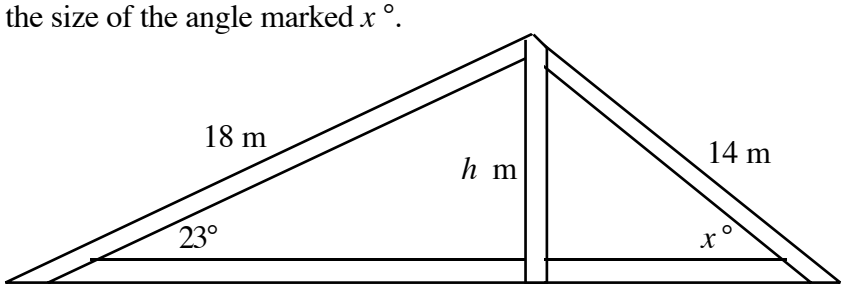
Calculate the distance d metres from the mine entrance to the top of a vertical air-shaft which comes up from the foot of the mine.



(d) Shown is a wooden roof support. The vertical strip of wood cuts the shape into 2 right angled triangles.

(i) Calculate the height (h)metres of the vertical strip.

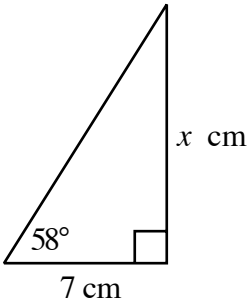
(ii) Calculate the size of the angle marked x °.



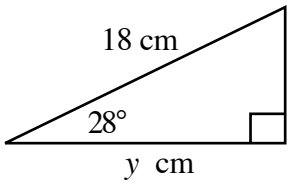
Checkup for Trigonometry in a Right Angled Triangle

1. Calculate the length of the sides marked x, y and z.

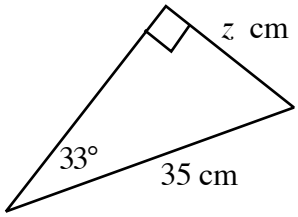
(a)



(b)

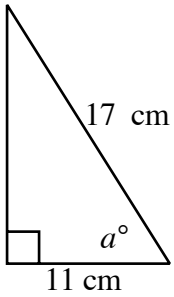


(c)

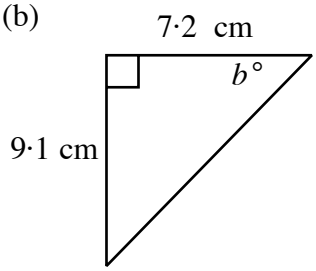


2. Calculate the length of the angles marked a, b and c.

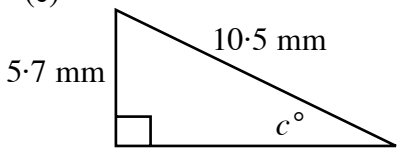
(a)



(b)

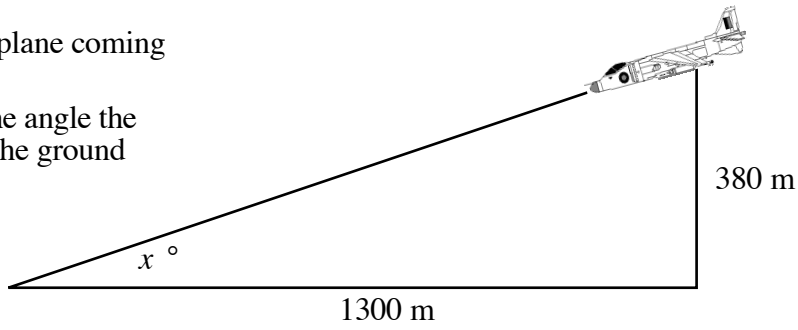


(c)

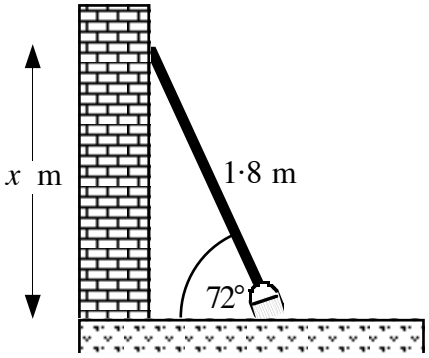


3. (a) The diagram shows a plane coming in to land.

Calculate the size of the angle the plane will make with the ground as it lands.

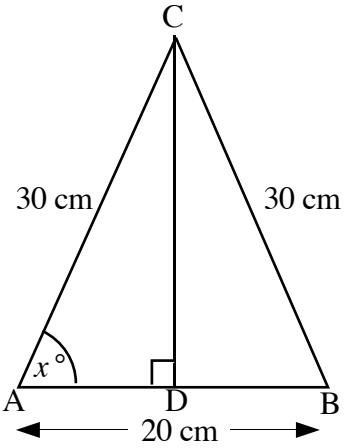


(b)



A long handled brush is leaning against a wall.
The brush is 1·8 metres long.
It makes an angle of 72° with the ground.
Calculate how far up the wall the top of the brush handle reaches.

(c) Triangle ABC is isosceles.
Triangle ADC is right angled.
AC and BC are both 30 centimetres long.
AB is 20 centimetres long.
Calculate the size of the angle marked x °.



USE STANDARD FORM (SCIENTIFIC NOTATION)

By the end of this set of exercises, you should be able to

(a) interpret numbers expressed in Standard Form

(b) convert large and small numbers to Standard Form

(c) use Standard Form in simple calculations.

STANDARD FORM

A. Interpret numbers expressed in Standard Form

Exercise 1

1. Remember $10^4 = 10 \times 10 \times 10 \times 10 = 10\,000$ (1, followed by 4 zeros)

   What is the value of:

   (a) 10^2 (b) 10^3 (c) 10^6 (d) 10^1 (e) 10^5 (f) 10^{12} ?

2. It can be shown that $10^{-3} = \frac{1}{10^3} = \frac{1}{10 \times 10 \times 10} = \frac{1}{1000} = 0{\cdot}001$

   Copy and complete:

   (a) $10^{-2} = \frac{1}{10^2} = \frac{1}{10 \times \ldots} = \frac{1}{\ldots\ldots} = 0{\cdot}\ \ldots\ldots$

   (b) $10^{-4} = \frac{1}{10^{\cdots}} = \frac{1}{10 \times .. \times .. \times ..} = \frac{1}{\ldots\ldots} = 0{\cdot}\ \ldots\ldots$

   (c) $10^{-6} = \ldots$ (d) $10^{-1} = \ldots$ (e) $10^{-5} = \ldots$ (f) $10^{-7} = \ldots$

3. Find the value of:

   (a) 10^7 (b) 10^6 (c) 10^8

   (d) 10^{-5} (e) 10^{-1} (f) 10^0 (???)

Exercise 2

1. Remember: $4{\cdot}87 \times 10^4$ means $4{\cdot}87 \times (10 \times 10 \times 10 \times 10) = 48\,700$

   Find the value of:

   (a) $2{\cdot}67 \times 10^7 = 2{\cdot}67 \times (10 \times 10 \times 10 \times \ldots\ldots\ldots) = \ldots\ldots\ldots\ldots$

   (b) $8{\cdot}4 \times 10^6 = 8{\cdot}4 \times (10 \times 10 \times \ldots\ldots\ldots) = \ldots\ldots\ldots$

   (c) $3{\cdot}15 \times 10^2$ (d) $4{\cdot}97 \times 10^5$ (e) 2×10^4

   (f) $6{\cdot}931 \times 10^8$ (g) $7{\cdot}26 \times 10^1$ (h) $5{\cdot}901 \times 10^9$

2. Remember: $3{\cdot}62 \times 10^{-3} = \frac{3{\cdot}62}{10^3} = \frac{3{\cdot}62}{10 \times 10 \times 10} = \frac{3{\cdot}62}{1000} = 0{\cdot}00362$

   Copy and complete :-

   (a) $6{\cdot}4 \times 10^{-2} = \frac{6{\cdot}4}{10^2} = \frac{6{\cdot}4}{10 \times 10} = \frac{6{\cdot}4}{\ldots\ldots} = 0{\cdot}\ \ldots\ldots$ cont'd ....

(b) $1{\cdot}9 \times 10^{-4} = \frac{1{\cdot}9}{10^{\cdots}} = \frac{1{\cdot}9}{(10 \times 10 \times ..)} = \frac{1{\cdot}9}{\ldots\ldots} = 0{\cdot}$ .....

(c) $2{\cdot}3 \times 10^{-5} =$ ... (d) $1{\cdot}61 \times 10^{-3} =$ ... (e) $4{\cdot}93 \times 10^{-2} =$ ...

(f) $8{\cdot}26 \times 10^{-4} =$ ... (g) $7{\cdot}05 \times 10^{-1} =$ ... (h) $9{\cdot}171 \times 10^{-6} =$ ...

3. Find the value of:

(a) $4{\cdot}31 \times 10^{2}$ (b) $8{\cdot}55 \times 10^{4}$ (c) $9{\cdot}81 \times 10^{1}$

(d) $2{\cdot}76 \times 10^{3}$ (e) $3{\cdot}9 \times 10^{5}$ (f) $6{\cdot}13 \times 10^{6}$

(g) $5{\cdot}81 \times 10^{8}$ (h) $9{\cdot}2 \times 10^{-2}$ (i) $1{\cdot}655 \times 10^{-4}$

(j) $7{\cdot}98 \times 10^{-3}$ (k) $6{\cdot}8 \times 10^{-6}$ (l) $8{\cdot}01 \times 10^{-1}$

B. Convert large numbers into Standard Form

Exercise 3

1. Remember:

$$\begin{aligned} 8621 &= 862{\cdot}1 \times 10 \\ &= 86{\cdot}21 \times 10 \times 10 \\ &= 8{\cdot}621 \times 10 \times 10 \times 10 \\ &= 8{\cdot}621 \times 10^{3} \end{aligned}$$

in standard form

Put the following numbers into standard form using the same method:

(a) $369 = 36{\cdot}9 \times 10 = 3{\cdot}69 \times .. \times .. = 3{\cdot}69 \times 10^{\cdots}$

(b) $23\,700 = 2370 \times 10 = 237 \times 10 \times 10 = 23{\cdot}7 \times .. \times .. \times .. = 2{\cdot}37 \times .. \times .. \times .. \times .. = 2{\cdot}37 \times 10^{\cdots}$

(c) 5 236 (d) 965 (e) 87 (f) 17 962 (g) 35 284

2. Write the following numbers in standard form:

(a) 965 (b) 872 (c) 2 324 (d) 5 640 (e) 8 700

(f) 38 260 (g) 59 481 (h) 136 800 (i) 385 000 (j) 1 265 000

(k) 14 860 000 (l) 375 000 000 (m) 123 600 (n) 98 270 (o) 4 502

(p) 375 000 (q) 1 345 000

Convert small numbers into Standard Form

Exercise 4

1. Remember: $0{\cdot}00276 = \frac{0{\cdot}0276}{10} = \frac{0{\cdot}276}{10 \times 10} = \frac{2{\cdot}76}{10 \times 10 \times 10} = \frac{2{\cdot}76}{10^3} = 2{\cdot}76 \times 10^{-3}$ standard form

Use the same method to change the following numbers to standard form:

(a) $0{\cdot}0813 = \frac{0{\cdot}813}{10} = \frac{8{\cdot}13}{10 \times 10} = \frac{8{\cdot}13}{10^{\cdots}} = 8{\cdot}13 \times 10^{\cdots}$

(b) $0{\cdot}0061 = \frac{0{\cdot}061}{10} = \frac{0{\cdot}61}{10 \times 10} = \frac{\ldots}{10 \times \ldots \times \ldots} = \frac{\cdots\cdots}{10^{\cdots}} = 6{\cdot}1 \times 10^{\cdots}$

(c) $0{\cdot}0761$ (d) $0{\cdot}00931$ (e) $0{\cdot}812$ (f) $0{\cdot}000687$ (g) $0{\cdot}00052$

2. Write the following numbers in standard form:

(a) $0{\cdot}0123$	(b) $0{\cdot}00815$	(c) $0{\cdot}000612$	(d) $0{\cdot}943$
(e) $0{\cdot}00402$	(f) $0{\cdot}0062$	(g) $0{\cdot}8$	(h) $0{\cdot}0000051$
(i) $0{\cdot}0000806$	(j) $0{\cdot}0203$	(k) $0{\cdot}00024$	(l) $0{\cdot}00002$
(m) $0{\cdot}00304$	(n) $0{\cdot}000073$	(o) $0{\cdot}094$	(p) $0{\cdot}57$

C. Use standard form in simple calculations

Exercise 5

1. Use the EE or Exp button on your calculator to find the following:
(Give your answer in standard form).

(a) $(2{\cdot}1 \times 10^7) \times (3{\cdot}2 \times 10^5)$	(b) $(6{\cdot}9 \times 10^4) \times (8{\cdot}3 \times 10^9)$
(c) $253 \times (3{\cdot}9 \times 10^6)$	(d) $(2{\cdot}1 \times 10^4)^2$
(e) $(5{\cdot}85 \times 10^9) \div (1{\cdot}3 \times 10^2)$	(f) $(2{\cdot}952 \times 10^{12}) \div (2{\cdot}4 \times 10^3)$
(g) $(3{\cdot}5 \times 10^{-2}) \times (6{\cdot}4 \times 10^8)$	(h) $(5{\cdot}2 \times 10^{10}) \times (7{\cdot}5 \times 10^{-4})$
(i) $(1{\cdot}6 \times 10^{-5}) \times (3{\cdot}85 \times 10^{-4})$	(j) $(6{\cdot}2 \times 10^{-7}) \times (8{\cdot}5 \times 10^{-4})$
(k) $287\,500 \times (4{\cdot}0 \times 10^{-2})$	(l) $(1{\cdot}7 \times 10^{-3})^2$
(m) $(1{\cdot}242 \times 10^5) \div (2{\cdot}3 \times 10^{-3})$	(n) $(6{\cdot}21 \times 10^{-3}) \div (1{\cdot}8 \times 10^{-9})$

2. The <u>distance</u> travelled by a beam of light in 1 year is called a **light year.**

Light travels at 300 000 kilometres per second !!

Here's how to calculate what a **light year** is:

(a) How far will a beam of light travel in 1 minute ? => (300 000 x 60) = ... km
(b) How far will it travel in 1 hour ? => (..... x 60) = ... km
(c) How far will it travel in a day ? => (..... x 24) = ... km
(d) How far will it travel in a year ? => (..... x 365·25) = ... km
(e) Copy and complete => 1 light year = ... x $10^{\cdots}$ km

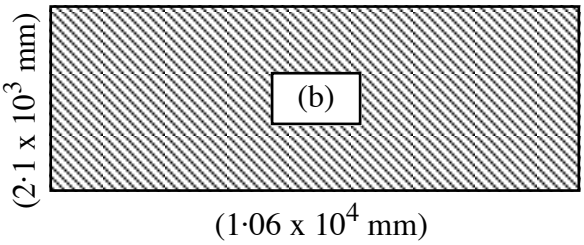
3. Use the result on the previous page to calculate how far away the following stars are:

(a) Alpha Centauri – 4·4 light years
(b) Ceti – 11·8 light years
(c) Ross Star – 9·45 light years
(d) Barnard's Star – 5·91 light years
(e) Sirius – 8·6 light years
(f) Alpha Bootis – 37 light years
(g) Capella – 46·1 light years
(h) Beta Orionis – 815 light years

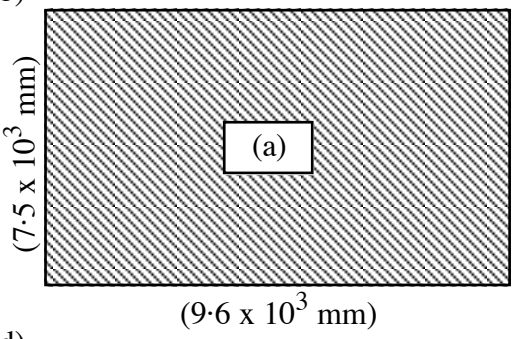
4. The diagrams below show the measurements, in millimetres, of the floors of newly designed office buildings.

Calculate their areas and give your answers in standard form.

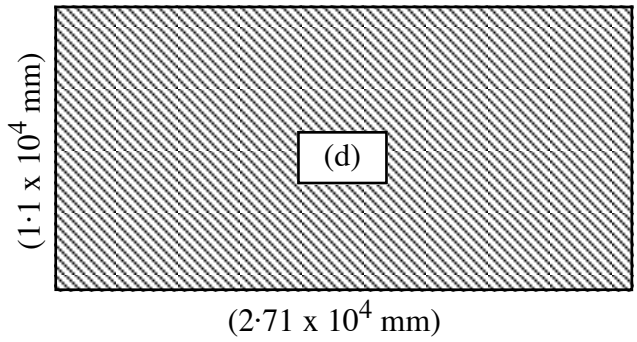
(a)



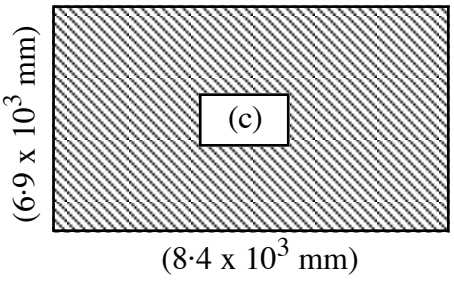
(b)



(c)



(d)



5. Shown opposite were the populations of some of the countries of the world, recorded in 1979.

(a) Calculate the total combined population of
  (i) China and India.
  (ii) The U.K. and the United States.

(b) How much greater was the population of
  (i) India than that of the U.S.S.R.?
  (ii) The U.K. than that of Portugal?

Country	*Population*
China	$8{\cdot}52 \times 10^8$
India	$6{\cdot}10 \times 10^8$
U.S.S.R.	$2{\cdot}57 \times 10^8$
Portugal	$9{\cdot}45 \times 10^6$
U.K.	$5{\cdot}59 \times 10^7$
United States	$2{\cdot}16 \times 10^8$

Checkup for Standard Form

1. Find the values of:

   (a) 10^3 (b) 10^{-4} (c) $2{\cdot}3 \times 10^4$ (d) $5{\cdot}91 \times 10^6$

   (e) $6{\cdot}72 \times 10^1$ (f) 4×10^{-3} (g) $3{\cdot}01 \times 10^{-2}$ (h) $8{\cdot}721 \times 10^{-5}$

2. Put the following numbers into standard form:

   (a) 5 672 (b) 18 300 (c) 234 000 (d) 6 340 000

   (e) 0·0034 (f) 0·0000675 (g) 0·86 (g) 0·000000081

3. Use your [EE] or [Exp] button on the calculator to find the values of the following:
   (Give all your answers in standard form)

   (a) $(3{\cdot}75 \times 10^6) \times (4{\cdot}2 \times 10^7)$ (b) $(1{\cdot}533 \times 10^8) \div (4{\cdot}2 \times 10^{-3})$

   (c) $(3{\cdot}6 \times 10^{-5})^2$ (d) $(8{\cdot}7 \times 10^9) - (1{\cdot}4 \times 10^7)$

SPECIMEN ASSESSMENT QUESTIONS

1. For each of these formulae, find the value of the letter which is asked for:

   (a) $Y = 2x - 1$, if $x = 5$ find Y.

   (b) $A = r^2 + s$, find A when $r = 3$ and $s = 6$.

   (c) $D = a(b - c)$, find D when $a = 5$, $b = 8$ and $c = 2$.

2. Multiply out the brackets:

   (a) $2(2x + 5)$ (b) $9(3 - 2y)$ (c) $2x(y + 4)$

3. Remove the brackets and simplify:

   (a) $2(3x - 5) + 7x$ (b) $3(a + 2b) + 4b$ (c) $9x + 5(3 - x)$

4. Factorise these expressions fully:

   (a) $2x + 12$ (b) $6s - 8$ (c) $pq + mp$ (d) $9y - 15xy$

5. Solve the equations:

   (a) $x - 18 = 20$ (b) $3n + 2 = 17$ (c) $7s - 12 = 16$

   (d) $5p + 4 = 3p + 17$ (e) $2(v - 3) = 8$

6. Solve the inequalities, leaving your answer in the form $x > 1$, $x \leq 2$, etc.

   (a) $x + 6 > 8$ (b) $3x - 4 < 11$ (c) $4x - 1 \geq 25$

7. For each of the following equation:

   (i) make up your own table of values (5 or 6 pairs)
   (ii) draw a new set of axes each time and plot your points
   (iii) join up the set of points and label the lines

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

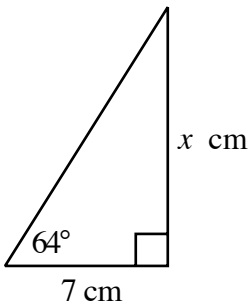
   (c) $y = 2x - 3$ (d) $y = {}^1/_2x - 2$

   (e) $y = -3x - 2$ (f) $y = -x + 4$

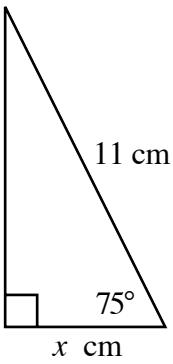
   (g) $y = 6$ (h) $x = -3$

8. In each of the following triangles, calculate the length of the line marked x.

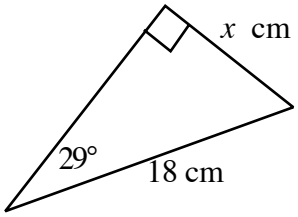
   (a)



   (b)

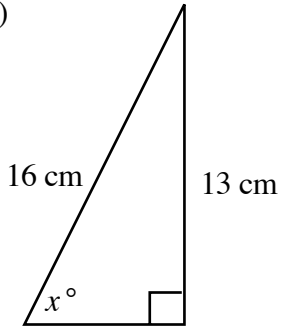


   (c)

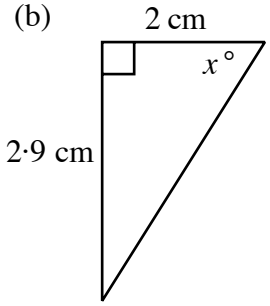


9. In each of the following triangles, calculate the size of the angle marked x °.

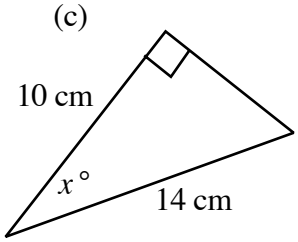
(a)



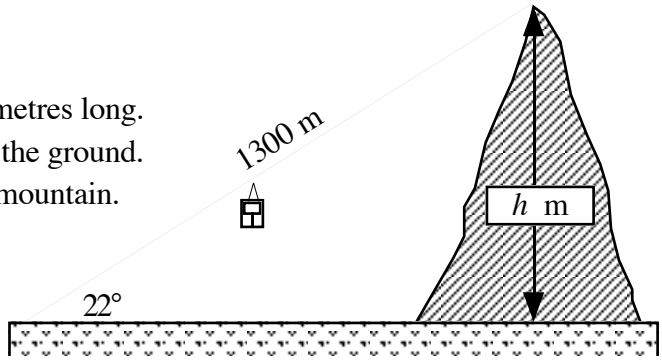
(b)



(c)



10. The wire cable of a chair-lift is 1300 metres long. The cable makes an angle of 22° with the ground. Calculate the height (h metres) of the mountain.



11. Find the value of:

(a) 10^6 (b) 10^{-3} (c) $2{\cdot}8 \times 10^4$ (d) $3{\cdot}13 \times 10^8$

(e) $5{\cdot}62 \times 10^{-1}$ (f) $8{\cdot}96 \times 10^{-5}$ (g) 7×10^{-4}

12. Convert the following numbers to standard form:

(a) 3 260 (b) 89 320 (c) 1 276 000 (d) 940

(e) 0·0614 (f) 0·00021 (g) 0·0000006 (h) 0·57

13. Use the EE or Exp button on your calculator to find the values of the following:

(give each answer in standard form)

(a) $(2{\cdot}8 \times 10^{10}) \times (3{\cdot}5 \times 10^7)$ (b) $(2{\cdot}25 \times 10^9) \div (1{\cdot}5 \times 10^{-2})$

(c) $2420 \times (8{\cdot}6 \times 10^{15})$ (d) $(5{\cdot}4 \times 10^{-6})^2$

ANSWERS

Simple Algebraic Operations

Exercise 1

1. 42	2. 25	3. 275	4. 21	5. 32	6. 80	7. 76	8. 27
9. 0	10. 19	11. 100	12. 32	13. 120	14. 1	15. 2	16. 5
17. 800	18. 12·25	19. 16	20. 100	21. 1	22. 5	23. 130	24. 14

Exercise 2

1. (a) $2a + 8$ (b) $3b + 3$ (c) $4c + 20$ (d) $5d + 45$ (e) $6e + 42$
   (f) $2f - 6$ (g) $4g - 8$ (h) $5h - 5$ (i) $2i - 6$ (j) $7j - 42$
   (k) $5k - 45$ (l) $8 + 8x$ (m) $12 + 4m$ (n) $9 + 9n$ (o) $2 - 2w$
   (p) $9 - 3p$ (q) $3q + 3v$ (r) $2r + 2w$ (s) $7s - 7y$ (t) $10t - 1000$

2. (a) $4a + 6$ (b) $12b + 3$ (c) $5 + 10c$ (d) $6 - 8d$ (e) $36e - 6$
   (f) $30 - 80f$ (g) $8g + 16x$ (h) $15h + 5y$ (i) $8i - 10x$ (j) $70j - 21y$
   k) $77k - 63x$ (l) $16ab - 8c$ (m) $am + 4a$ (n) $an + 5a$ (o) $xy - x$
   (p) $w^2 - 9w$ (q) $2aq + ax$ (r) $5ar + 2aw$ (s) $14d - 21de$ (t) $20t^2 - 2st$

3. (a) $6a + 8b + 4$ (b) $12c + 6d + 15$ (c) $35e + 10f + 5$
   (d) $8g + 12h + 16i$ (e) $14j + 28k + 42l$ (f) $9m + 9n + 18p$
   (g) $10q - 4r - 8$ (h) $12s + 20t - 32$ (i) $12u - 30v - 42$
   (j) $14x - 21y - 35z$ (k) $20a - 4b + 8c$ (l) $20d + 10e - 40f$

4. (a) $3x + 14$ (b) $2x + 6$ (c) $4x + 21$ (d) $2y + 1$ (e) $5y + 3$
   (f) $6y + 10$ (g) $6z + 6$ (h) $15z + 8$ (i) $z + 12$ (j) $5w + 24$
   (k) $2w + 36$ (l) $5w + 3$ (m) $9v - 10$ (n) $13v + 2$ (o) $26v - 8$
   (p) $4r - 1$ (q) $5r + 6s$ (r) $14r + 14s$ (s) $20a - 20b$ (t) $100b + 100a$
   (u) $4 + 3d$

5. (a) $5g + 11$ (b) $10h + 24$ (c) $27k + 22$ (d) $26m + 40n$
   (e) $10p + 8$ (f) $8q$ (g) $17r + 14s$ (h) $16t + 2u$

Exercise 3

1. (a) $6(x + y)$ (b) $3(a - b)$ (c) $5(e - f)$ (d) $9(p + q)$
   (e) $3(m - 5)$ (f) $8(n + 3)$ (g) $2(2y + 3z)$ (h) $14(c + 2d)$
   (i) $5(2r - 3s)$ (j) $4(f - 6g)$ (k) $3(3p + 7)$ (l) $7(x + 8)$
   (m) $8(3v + 4w)$ (n) $30(m - 4)$ (o) $16(2r - 5z)$ (p) $2(a + 3b + 9c)$
   (q) $6(2p - 5q + 6)$ (r) $7(3p - 7q - 1)$ (s) $20(3r + 2s - 5t)$ (t) $11(3x - 4y + 9)$

2. (a) a(3 + f) (b) s(5 – r) (c) y(x + z) (d) a(a + 7) (e) s(s + 8)
(f) m(m – 4) (g) 5x(r + s) (h) 3a(b – 2c) (i) 5f(e – 3) (j) e(3e + 7)
(k) p(9p – 5w) (l) w(3w – 8g) (m) d(d + 3g – 6) (n) y(y – 2n – 7k)
(o) v(3a + 8g + 4h) (p) s(3m – 5n + 7) (q) f(2f + 4ed – d)
(r) x(5x – 7y + 9yz) (s) a(7x + 7y – 1)

Exercise 4

1. (a) $x = 3$ (b) $x = 13$ (c) $x = 11$ (d) $x = 1$ (e) $x = 20$
(f) $x = 15$ (g) $x = 9$ (h) $x = 0$ (i) $y = 5$ (j) $y = 4$
(k) $y = 7$ (l) $y = 10$ (m) $y = 1{\cdot}5$ (n) $y = 2{\cdot}5$ (o) $y = 1{\cdot}25$
(p) $y = 0$ (q) $v = 21$ (r) $v = 20$ (s) $v = 28$ (t) $v = 20$

2. (a) $s = 1$ (b) $r = 3$ (c) $q = 3$ (d) $p = 4$ (e) $n = 5$
(f) $m = 9$ (g) $k = 1$ (h) $j = 0$ (i) $h = 2$ (j) $g = 2$
(k) $f = 7$ (l) $e = 4$ (m) $d = 16$ (n) $c = 16$ (o) $b = 100$
(p) $a = 200$

3. (a) $x = 5$ (b) $x = 8$ (c) $x = 1$ (d) $x = 7$ (e) $x = 7$
(f) $x = 3$ (g) $x = 2$ (h) $x = 8$ (i) $x = 5$ (j) $x = 1$
(k) $x = 3$ (l) $x = 3$ (m) $x = 10$ (n) $x = 8$ (o) $x = 2$
(p) $x = 7$

4. (a) $a = 9$ (b) $c = 3$ (c) $e = 1$ (d) $g = 7$ (e) $k = 3$
(f) $n = 3$ (g) $m = 4{\cdot}5$ (h) $p = 7$ (i) $q = 4{\cdot}5$ (j) $r = 3$
(k) $s = 8$ (l) $u = 0$ (m) $v = 7$ (n) $w = 2$ (o) $y = 1{\cdot}5$

5. (a) $x = 1$ (b) $x = 4$ (c) $x = 8$ (d) $x = 5$ (e) $x = 7$
(f) $x = 5$ (g) $x = 10$ (h) $x = 15$ (i) $x = 6$ (j) $x = 5$
(k) $x = 1$ (l) $x = 4$ (m) $x = 2$ (n) $x = 4$ (o) $x = 9$

Exercise 5

1. (a) $1 < 2$ (b) $-1 < 2$ (c) $3 > 0$ (d) $5 = 5$ (e) $2 > -3$
(f) $-1 > -2$ (g) $1 > -8$ (h) $-3 < -2$ (i) $0 > -1$ (j) $-2 = (-1 + (-1))$

2. (a) $x > 2$ (b) $x < 11$ (c) $x \geq 7$ (d) $x > 2$ (e) $x < 7{\cdot}5$
(f) $x < 1{\cdot}25$ (g) $x < 5$ (h) $x \geq 2$ (i) $x \leq 7$ (j) $x \leq 9{\cdot}5$
(k) $x > -1$ (l) $x \leq 3^1/_3$ (m) $x > 2$ (n) $x < 3$ (o) $x < 20$
(p) $x > 4$

3. (a) 5, 6 (b) 0, 1, 2 (c) 4, 5, 6 (d) 0, 1 (e) 3, 4, 5, 6
(f) 5, 6 (g) 0, 1, 2, 3, 4, 5 (h) 0, 1, 2

Check Up

1. (a) $M = 22$ (b) $T = 1$ (c) $A = 36$

2. (a) $10a + 5$ (b) $7b - 21c$ (c) $xy + 3x$ (d) $2p^2 + 2pq - 2pr$
   (e) $20v + 11$ (f) $10x - 8$ (g) $h + 10$ (h) $20h$

3. (a) $2(p + 7)$ (b) $5(s - 5)$ (c) $8(2 + r)$ (d) $11(7 - 3f)$
   (e) $3(2y - 3z)$ (f) $2v\,(2 + 3z)$ (g) $a(r + 4)$ (h) $x(p - q)$
   (i) $s(4r + 5t - 8v)$ (j) $x(x + 3)$ (k) $7(2e + f - 5g)$ (l) $2y(y - 3)$

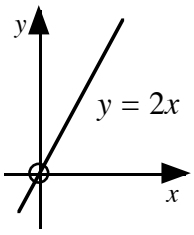
4. (a) $x = 6$ (b) $x = 7$ (c) $y = 7$ (d) $x = 3{\cdot}5$ (e) $s = 10$
   (f) $v = 12$ (g) $n = 5$ (h) $m = 6$ (i) $n = 0$ (j) $k = 7$
   (k) $s = 1$ (l) $x = 3$ (m) $t = 5$ (n) $c = 3$ (o) $e = 6$
   (p) $y = 4{\cdot}5$ (q) $x = 4$ (r) $u = 8$

5. (a) $x > 4$ (b) $x < 13$ (c) $x \geq 8$ (d) $x > 3$ (e) $x < 5{\cdot}5$
   (f) $x > 1{\cdot}25$ (g) $x < 6$ (h) $x \geq 1$ (i) $x \leq 7$ (j) $x \leq 10$
   (k) $x > 3$ (l) $x \leq 3$ (m) $x > 5$ (n) $x < 3$ (o) $x < 25$
   (p) $x > 1{\cdot}5$

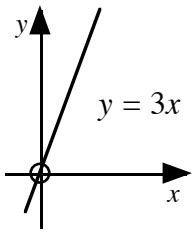
Graphical Relations

Exercise 1

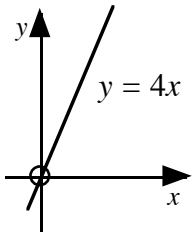
1. (a) 0, 2, 4, 6, 8
   (b) (c)



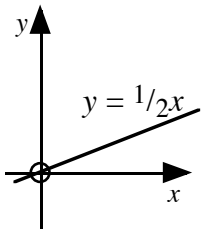
2. (a) 0, 3, 6, 9, 12
   (b) (c)



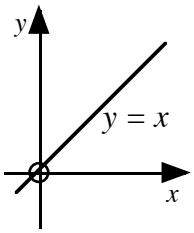
3. (a)



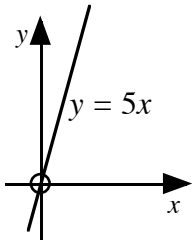
(b)



(c)

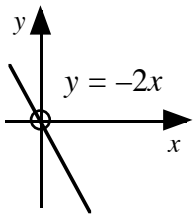


(d)

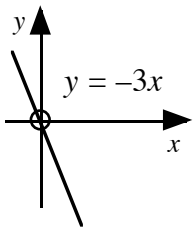


4. For any line $y = ax$, the bigger the value a is, the **steeper** the line slopes.

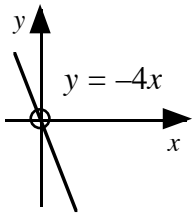
5. (a) 0, –2, –4, –6, –8
   (b) (c)



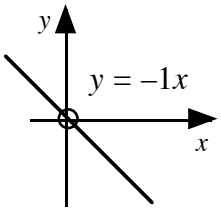
6. (a) 0, –3, –6, –9, –12
   (b) (c)



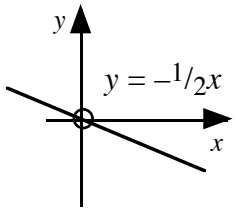
7. (a)



(b)



(c)



8. (i) steeper (ii) upwards (iii) downwards.

Exercise 2

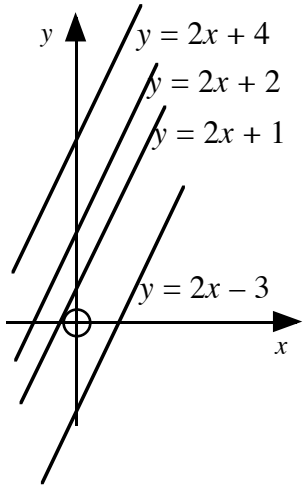
1. (a) 1, 3, 5, 7, 9
   (b) (c) see sketch

2. (a) 2, 4, 6, 8, 10
   (b) (c) see sketch

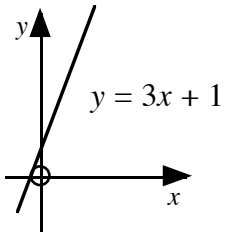
3. (a) 4, 6, 8, 10, 12
   (b) (c) see sketch

4. (a) –3, –1, 1, 3, 5,
   (b) (c) see sketch

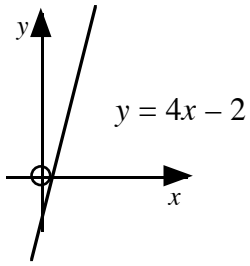
5. (i) parallel (ii) y – axis



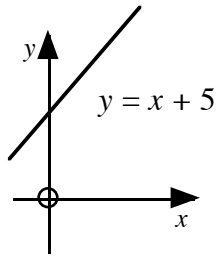
6. (a)



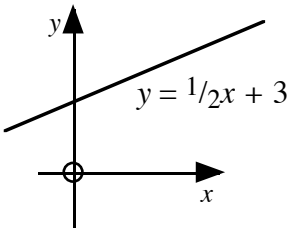
(b)



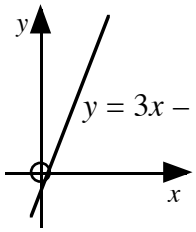
(c)



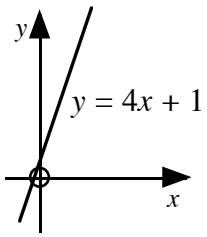
(d)



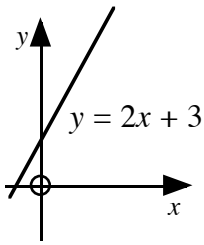
(e)



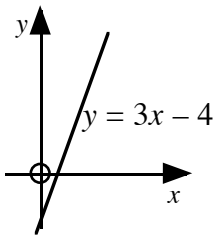
(f)



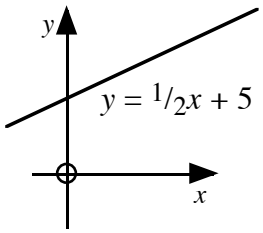
7. (a)



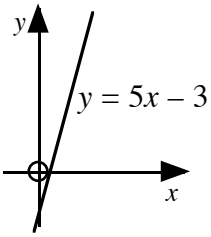
(b)



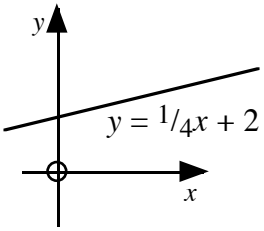
(c)



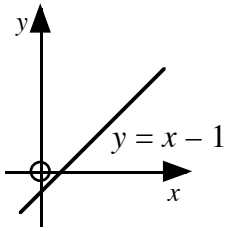
(d)



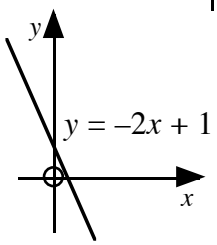
(e)



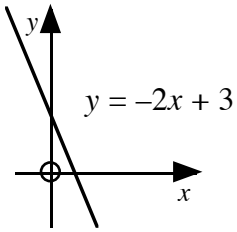
(f)



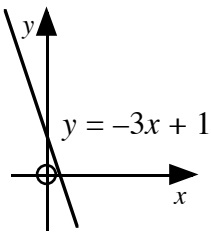
8. (a) 1, –1, –3, –5, –7
(b) (c)



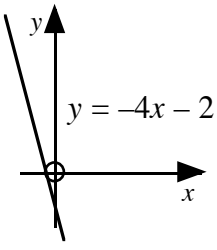
9. (a)



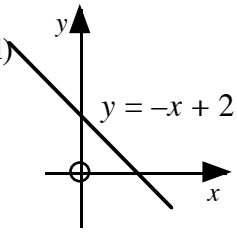
(b)



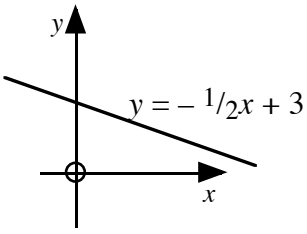
(c)



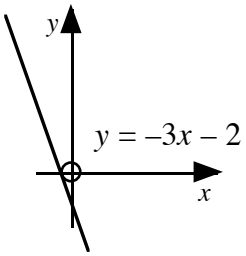
(d)



(e)

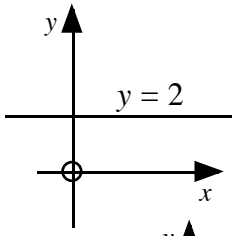


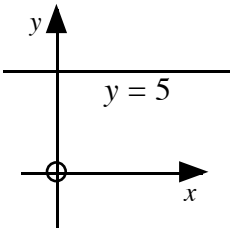
(f)

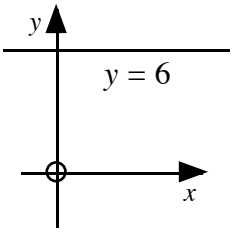


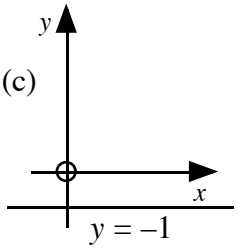
Exercise 3

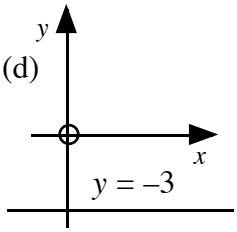
1. (a) 2, 2, 2, 2, 2
   (b) (c)
   (d) ....parallel ..... x – axis



2. (a)


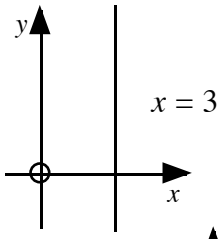
(b)


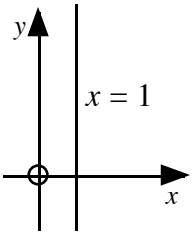
(c)


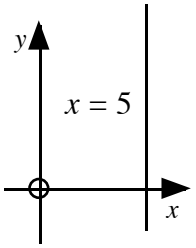
(d)


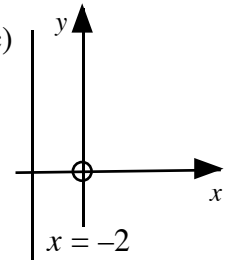
3. Any line of the form $y = k$ (a number), is a line which is **parallel** to the x – axis.

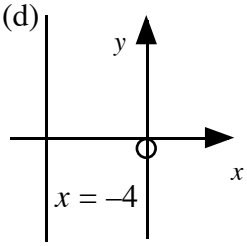
4. (a) 3. 3. 3. 3. 3
   (b) (c)
   (d) ...parallel ..... y axis



5. (a)


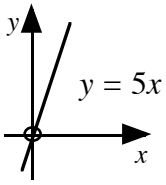
(b)


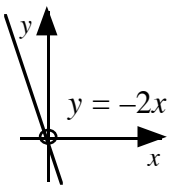
(c)


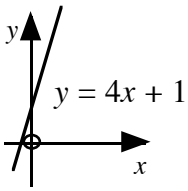
(d)


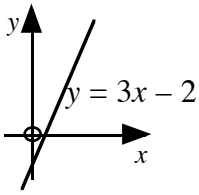
6. Any line of the form $x = h$ (a number), is a line which is **parallel** to the y – axis.

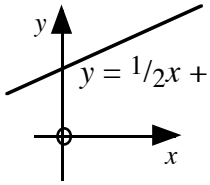
Checkup

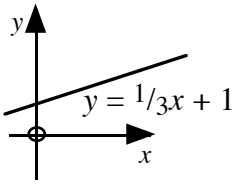
1. (a)


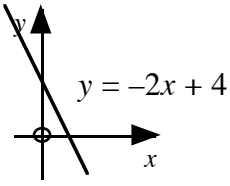
(b)


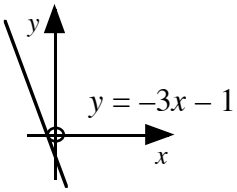
(c)


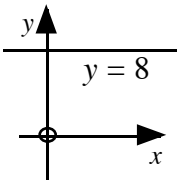
(d)


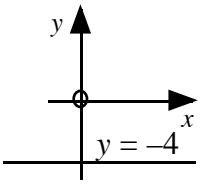
(e)


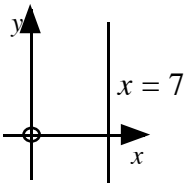
(f)


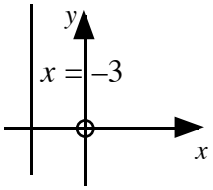
(g)


(h)


(i)


(j)


(k)


(l)


Trigonometry in a Right Angled Triangle

Exercise 1

1. (a) 0·75 (b) 1·24 (c) 2·75 (d) 1·80 (e) 4·71
   (f) 0·31 (g) 0·93 (h) 0·81 (i) 57·29 (j) 0·51
   (k) 2·61 (l) 1·60 (m) 0·48 (n) 1·14 (o) 0·11

2. (a) 18·85 (b) 9·04 (c) 26·12 (d) 20·69 (e) 21·22
   (f) 5·82 (g) 14·83 (h) 8·49 (i) 9·01

3 (a) 6·84 m (b) 175·05 m (c) 4·71 m (d) 4·69 m

Exercise 2

1. (a) 7·01° (b) 18·88° (c) 41·99° (d) 45° (e) 60°
   (f) 63·43° (g) 72·42° (h) 78·90° (i) 77·47° (j) 84·80°
   (k) 86·42° (l) 87°

2. (a) 26·57° (b) 50·19° (c) 49·76° (d) 55·01° (e) 21·80°
   (f) 55·39° (g) 37·17° (h) 28·07° (i) 52·13°

3. (a) 51·34° (b) 30·96° (c) 61·88° (d) (i) $x = 7{\cdot}88°$, $y = 8{\cdot}50°$ (ii) 2

Exercise 3

1. (a) 0·60 (b) 0·78 (c) 0·94 (d) 0·88 (e) 0·98
   (f) 0·29 (g) 0·68 (h) 0·63 (i) 1·00 (j) 0·73
   (k) 0·93 (l) 0·85 (m) 0·43 (n) 0·75 (o) 0·11

2. (a) 10·60 (b) 5·45 (c) 7·72 (d) 30·32 (e) 18·07
   (f) 1·99 (g) 3·96 (h) 137·77 (i) 0·38

3. (a) 40·92 m (b) 3·44 m (c) 1·12 m (d) 1·24 m (e) 10·88 cm

Exercise 4

1. (a) 12·89° (b) 22·09° (c) 64·16° (d) 58·54° (e) 47·05°
   (f) 30° (g) 60° (h) 11·24° (i) 26·42° (j) 80·75°
   (k) 19·45° (l) error

2. (a) 53·13° (b) 30° (c) 48·59° (d) 64·16° (e) 52·76°
   (f) 43·60° (g) 60·19° (h) 33·06° (i) 57·80°

3. (a) 60·17° (b) 8·28° (c) 50·06° (d) 21·69° (e) 60·07°

Exercise 5

1. (a) 0·54 (b) 0·48 (c) 0·64 (d) 0·16 (e) 0·95
   (f) 0·89 (g) 0·84 (h) 0·26 (i) 0·03 (j) 0·90
   (k) 0·99 (l) 0·50 (m) 0·81 (n) 0·53 (o) 0·99

2. (a) 7·71 (b) 4·94 (c) 7·88 (d) 7·46 (e) 3·88
(f) 2·279 (g) 0·79 (h) 102·44 (i) 7·56

3. (a) 1·66 m (b) 6·89 cm (c) 14·57 cm (d) 35·46 cm (e) 2·60 m

Exercise 6

1. (a) 64·98° (b) 66·67° (c) 53·13° (d) 55·04° (e) 44·11°
(f) 25·84° (g) 30° (h) 77·0° (i) 85·93° (j) 2·56°
(k) 72·48° (l) error

2. (a) 38·94° (b) 43·34° (c) 60° (d) 64·06° (e) 64·53°
(f) 64·32° (g) 43·34° (h) 41·41° (i) 34·69°

3. (a) 36·9° (b) 34·3° (c) 48·2° (d) 40°

Exercise 7

1. (a) 16·64 (b) 6·36 (c) 2·28 (d) 10·88 (e) 11·33
(f) 10·87 (g) 6·36 (h) 7·28 (i) 18·16 (j) 47·7°
(k) 47·4° (l) 36·9° (m) 50·1° (n) 50·6° (o) 25·2°

2. (a) 5·75 cm (b) 40·1° (c) 212·5 m (d) (i) 7·03 m (ii) 30·2°

Checkup Exercise

1. (a) 11·2 (b) 15·89 (c) 19·06
2. (a) 49·7° (b) 51·6° (c) 32·9°
3. (a) 16·3° (b) 1·71 m (c) 70·5°

Standard Form

Exercise 1

1. (a) 100 (b) 1 000 (c) 1 000 000 (d) 10
(e) 100 000 (f) 1 000 000 000 000
2. (a) 0·01 (b) 0·0001 (c) 0·000001 (d) 0·1
(e) 0·00001 (f) 0·0000001
3. (a) 10 000 000 (b) 1 000 000 (c) 100 000 000 (d) 0·00001
(e) 0·1 (f) 1

Exercise 2

1. (a) 26 700 000 (b) 8 400 000 (c) 315 (d) 497 000
(e) 20 000 (f) 693 100 000 (g) 72·6 (h) 5 901 000 000
2. (a) 0·064 (b) 0·00019 (c) 0·000023 (d) 0·00161
(e) 0·0493 (f) 0·000826 (g) 0·705 (h) 0·000009171
3. (a) 431 (b) 85 500 (c) 98·1 (d) 2 760
(e) 390 000 (f) 6 130 000 (g) 581 000 000 (h) 0·092
(i) 0·0001655 (j) 0·00798 (k) 0·0000068 (l) 0·801

Exercise 3

1. (a) $3{\cdot}69 \times 10^2$ (b) $2{\cdot}37 \times 10^4$ (c) $5{\cdot}236 \times 10^3$ (d) $9{\cdot}65 \times 10^2$
   (e) $8{\cdot}7 \times 10^1$ (f) $1{\cdot}7962 \times 10^4$ (g) $3{\cdot}5284 \times 10^4$
2. (a) $9{\cdot}65 \times 10^2$ (b) $8{\cdot}72 \times 10^2$ (c) $2{\cdot}324 \times 10^3$ (d) $5{\cdot}64 \times 10^3$
   (e) $8{\cdot}7 \times 10^3$ (f) $3{\cdot}826 \times 10^4$ (g) $5{\cdot}9481 \times 10^4$ (h) $1{\cdot}368 \times 10^5$
   (i) $3{\cdot}85 \times 10^5$ (j) $1{\cdot}265 \times 10^6$ (k) $1{\cdot}486 \times 10^7$ (l) $3{\cdot}75 \times 10^8$
   (m) $1{\cdot}236 \times 10^5$ (n) $9{\cdot}827 \times 10^4$ (o) $4{\cdot}502 \times 10^3$ (p) $3{\cdot}75 \times 10^5$
   (q) $1{\cdot}345 \times 10^6$

Exercise 4

1. (a) $8{\cdot}13 \times 10^{-2}$ (b) $6{\cdot}1 \times 10^{-3}$ (c) $7{\cdot}61 \times 10^{-2}$ (d) $9{\cdot}31 \times 10^{-3}$
   (e) $8{\cdot}12 \times 10^{-1}$ (f) $6{\cdot}87 \times 10^{-4}$ (g) $5{\cdot}2 \times 10^{-4}$
2. (a) $1{\cdot}23 \times 10^{-2}$ (b) $8{\cdot}15 \times 10^{-3}$ (c) $6{\cdot}12 \times 10^{-4}$ (d) $9{\cdot}43 \times 10^{-1}$
   (e) $4{\cdot}02 \times 10^{-3}$ (f) $6{\cdot}2 \times 10^{-3}$ (g) 8×10^{-1} (h) $5{\cdot}1 \times 10^{-6}$
   (i) $8{\cdot}06 \times 10^{-5}$ (j) $2{\cdot}03 \times 10^{-2}$ (k) $2{\cdot}4 \times 10^{-4}$ (l) 2×10^{-5}
   (m) $3{\cdot}04 \times 10^{-3}$ (n) $7{\cdot}3 \times 10^{-5}$ (o) $9{\cdot}4 \times 10^{-2}$ (p) $5{\cdot}7 \times 10^{-1}$

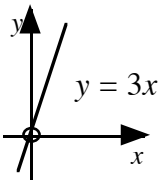
Exercise 5

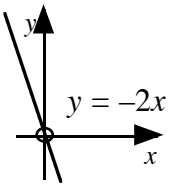
1. (a) $6{\cdot}72 \times 10^{12}$ (b) $5{\cdot}727 \times 10^{14}$ (c) $9{\cdot}867 \times 10^8$ (d) $4{\cdot}41 \times 10^8$
   (e) $4{\cdot}5 \times 10^7$ (f) $1{\cdot}23 \times 10^9$ (g) $2{\cdot}24 \times 10^7$ (h) $3{\cdot}9 \times 10^7$
   (i) $6{\cdot}16 \times 10^{-9}$ (j) $5{\cdot}27 \times 10^{-10}$ (k) $1{\cdot}15 \times 10^4$ (l) $2{\cdot}89 \times 10^{-6}$
   (m) $5{\cdot}4 \times 10^7$ (n) $3{\cdot}45 \times 10^6$
2. (a) $1{\cdot}8 \times 10^7$ (b) $1{\cdot}08 \times 10^9$ (c) $2{\cdot}592 \times 10^{10}$ (d) $9{\cdot}47.. \times 10^{12}$
3. (a) $4{\cdot}17 \times 10^{13}$ (b) $1{\cdot}12 \times 10^{14}$ (c) $8{\cdot}95 \times 10^{13}$ (d) $5{\cdot}60 \times 10^{13}$
   (e) $8{\cdot}15 \times 10^{13}$ (f) $3{\cdot}51 \times 10^{14}$ (g) $4{\cdot}37 \times 10^{14}$ (h) $7{\cdot}72 \times 10^{15}$
4. (a) $2{\cdot}226 \times 10^7$ (b) $7{\cdot}2 \times 10^7$ (c) $2{\cdot}981 \times 10^8$ (d) $5{\cdot}796 \times 10^7$
5. (a) (i) $1{\cdot}462 \times 10^9$ (ii) $2{\cdot}719 \times 10^8$ (b) (i) $3{\cdot}53 \times 10^8$ (ii) $4{\cdot}645 \times 10^7$

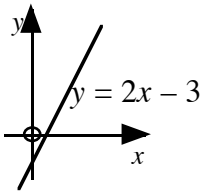
Checkup

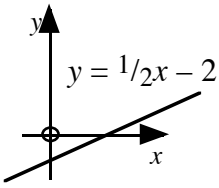
1. (a) 1 000 (b) 0·0001 (c) 23 000 (d) 5910 000
   (e) 67·2 (f) 0·004 (g) 0·0301 (h) 0·00008721
2. (a) $5{\cdot}672 \times 10^3$ (b) $1{\cdot}83 \times 10^4$ (c) $2{\cdot}34 \times 10^5$ (d) $6{\cdot}34 \times 10^6$
   (e) $3{\cdot}4 \times 10^{-3}$ (f) $6{\cdot}75 \times 10^{-5}$ (g) $8{\cdot}6 \times 10^{-1}$ (h) $8{\cdot}1 \times 10^{-8}$
3. (a) $1{\cdot}575 \times 10^{14}$ (b) $3{\cdot}65 \times 10^{10}$ (c) $1{\cdot}296 \times 10^{-9}$ (d) $8{\cdot}686 \times 10^9$

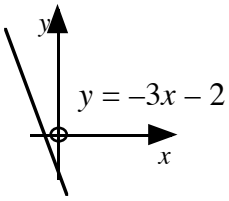
Specimen Assessment Questions

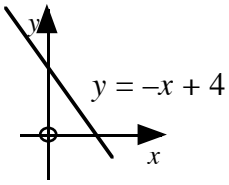
1. (a) $Y = 9$ (b) $A = 15$ (c) $D = 30$
2. (a) $4x + 10$ (b) $27 - 18y$ (c) $2xy + 8x$
3. (a) $13x - 10$ (b) $3a + 10b$ (c) $4x + 15$
4. (a) $2(x + 6)$ (b) $2(3s - 4)$ (c) $p(q + m)$ (d) $3y(3 - 5x)$
5. (a) $x = 38$ (b) $n = 5$ (c) $s = 4$ (d) $p = 6{\cdot}5$ (e) $v = 7$
6. (a) $x > 2$ (b) $x < 5$ (c) $x \geq 6{\cdot}5$
7. (a) 

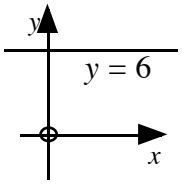
(b) 

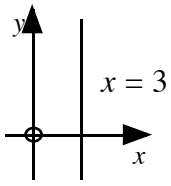
(c) 

(d) 

(e) 

(f) 

(g) 

(h) 

8. (a) 14·35 cm (b) 2·85 cm (c) 8·73 cm
9. (a) 54·34° (b) 55·41° (c) 44·42°
10. 487 m
11. (a) 1000000 (b) 0·001 (c) 28000 (d) 313000000
    (e) 0·562 (f) 0·0000896 (g) 0·0007
12. (a) $3{\cdot}26 \times 10^{3}$ (b) $8{\cdot}932 \times 10^{4}$ (c) $1{\cdot}276 \times 10^{6}$ (d) $9{\cdot}4 \times 10^{2}$
    (e) $6{\cdot}14 \times 10^{-2}$ (f) $2{\cdot}1 \times 10^{-4}$ (g) 6×10^{-7} (h) $5{\cdot}7 \times 10^{-1}$
13. (a) $9{\cdot}8 \times 10^{17}$ (b) $1{\cdot}5 \times 10^{11}$ (c) $2{\cdot}0812 \times 10^{19}$ (d) $2{\cdot}916 \times 10^{-11}$