

CFE National 4 - Pack 2

Unit : Relationships (REL)

WORKSHEETS



- ❖ Worksheets covering all the unit topics
- ❖ + Answers

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RELATIONSHIPS

Applying Algebraic Skills to Linear Equations

- Drawing and recognising the graph of a linear equations
- Solving linear equations
- Changing the subject of a formula

Applying Geometric Skills to Sides and Angles of a Shape

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- Using a fractional scale factor to enlarge or reduce a shape
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- Calculating a side in a right-angled triangle
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- Constructing a scattergraph
- Drawing and applying the line of best fit

ANSWERS

Applying Algebraic Skills to Linear Equations

A worksheet is available
for this exercise.

Drawing the graph of a linear equation

1. A straight line has as its equation $y = 2x$.

(a) **Copy** and complete the table for this line.

x	0	1	2	3	4	5
y		2				10

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

2. A straight line has as its equation $y = 3x$.

(a) **Copy** and complete the table for this line.

x	0	1	2	3	4	5
y		3				

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

3. A straight line has as its equation $y = \frac{1}{2}x$.

(a) **Copy** and complete the table for this line.

x	0	2	4	6	8	10
y		1			4	

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

4. A straight line has as its equation $y = \frac{1}{3}x$.

(a) **Copy** and complete the table for this line.

x	0	3	6	9	12
y	0			3	

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

5. A straight line has as its equation $y = x$.

(a) **Copy** and complete the table for this line.

x	1	2	3	4	5	6
y	1				5	

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

6. A straight line has as its equation $y = x + 2$.

(a) **Copy** and complete the table for this line.

x	0	1	2	3	4	5
y	2			5		

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

7. A straight line has as its equation $y = 2x + 1$.

(a) **Copy** and complete the table for this line.

x	0	1	2	3	4	5
y		3			9	

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

8. A straight line has as its equation $y = \frac{1}{2}x + 4$.

(a) **Copy** and complete the table for this line.

x	0	2	4	6	8	10
y	4				8	

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

9. A straight line has as its equation $y = \frac{1}{4}x + 5$.

(a) **Copy** and complete the table for this line.

x	0	4	8	12
y		6		

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

10. A straight line has as its equation $y = 3x - 2$.

(a) **Copy** and complete the table for this line.

x	1	2	3	4	5
y	1			10	

(b) Plot the points from the table on a coordinate diagram and draw the line through them.

11. (a) Plot the points $(1, -1)$, $(1, 0)$, $(1, 1)$, $(1, 2)$, $(1, 3)$, $(1, 4)$, $(1, 5)$

(b) Draw a line through these points

(c) You have drawn the line $x = 1$. Label your line.

12. Use a similar method to draw the lines

(a) $x = 5$ (b) $x = 3$ (c) $x = -2$ (d) $x = -4$

13. (a) Plot the points $(-1, 2)$, $(0, 2)$, $(1, 2)$, $(2, 2)$, $(3, 2)$, $(4, 2)$, $(5, 2)$

(b) Draw a line through these points

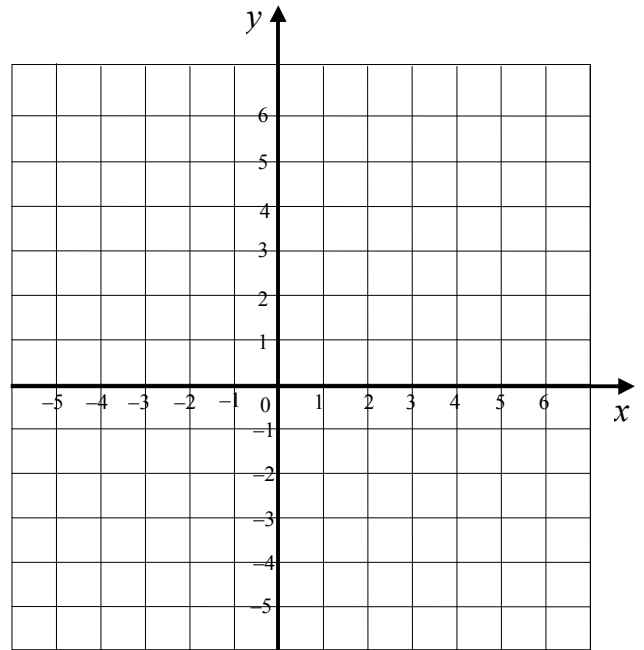
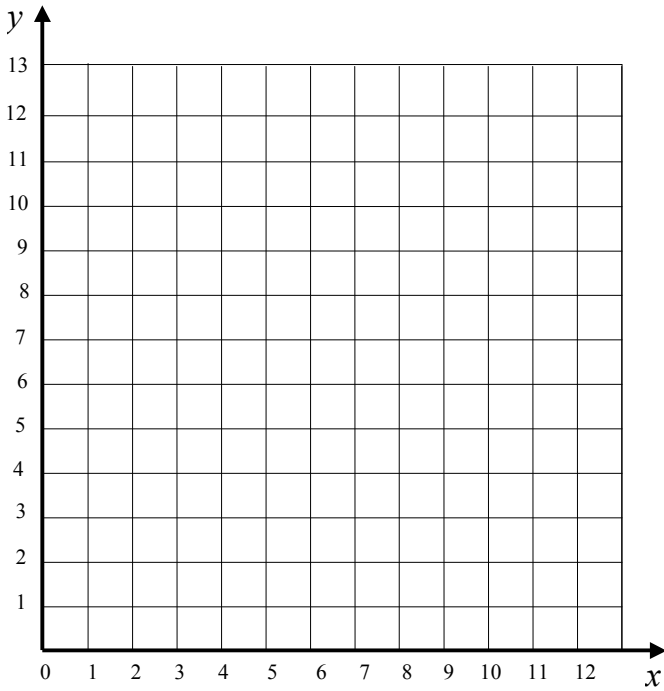
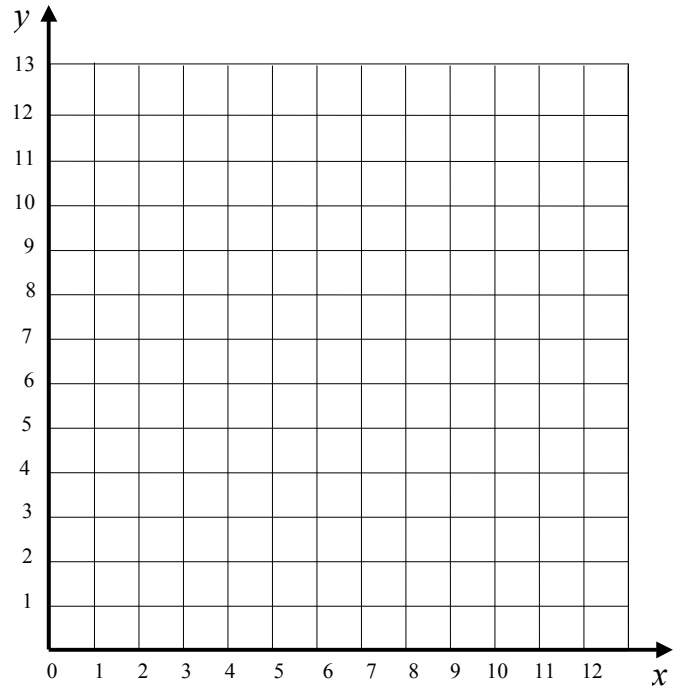
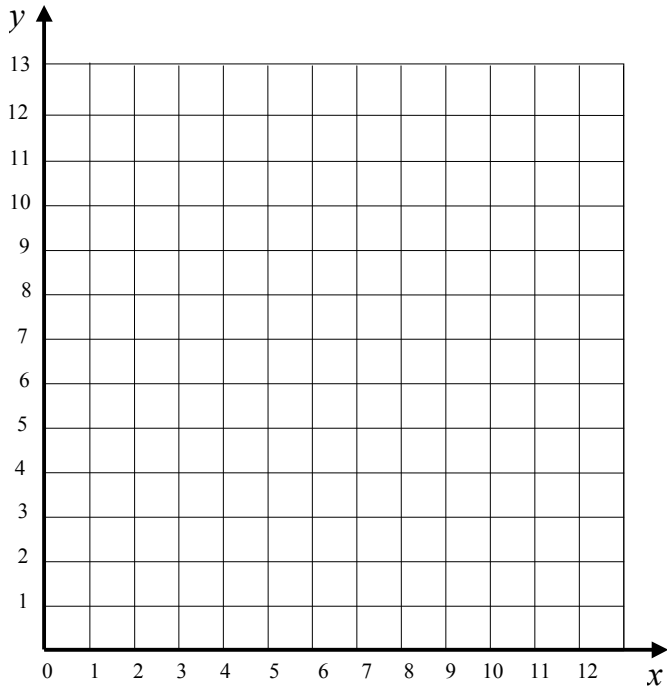
(c) You have drawn the line $y = 2$. Label your line.

14. Use a similar method to draw the lines

(a) $y = 4$ (b) $y = 5$ (c) $y = -3$ (d) $y = -1$

Worksheet

Name : _____



Drawing the graph of a linear equation (More practice)

1. (a) Copy and complete the table below for the line with equation $y = 2x - 1$.

x	-2	-1	0	1	2	3
y	-5		-1			

- (b) Copy and complete the list of points to be plotted.

$(-2, -5), (-1, \quad), (0, -1), (1, \quad), (2, \quad), (3, \quad)$

- (c) Draw a suitable grid and plot the points.

- (d) Draw the straight line.

2. (a) Copy and complete the table below for the line with equation $y = 3x + 4$.

x	-2	-1	0	1	2	3
y		1	4			

- (b) Copy and complete the list of points to be plotted.

$(-2, \quad), (-1, 1), (0, 4), (1, \quad), (2, \quad), (3, \quad)$

- (c) Draw a suitable grid and plot the points.

- (d) Draw the straight line.

3. Repeat the method shown in above to draw the straight lines with equations:

(a) $y = x - 3$

(b) $y = 2x + 2$

(c) $y = 3x + 1$

(d) $y = 4x - 2$

(e) $y = 2x + 3$

(f) $y = \frac{1}{2}x - 4$

Recognising the graph of a linear equation

1. Write down the gradient and y -intercept for each of these lines

(a) $y = x + 3$

(b) $y = 2x + 2$

(c) $y = 3x + 1$

(d) $y = 4x + 2$

(e) $y = 2x + 3$

(f) $y = \frac{1}{2}x + 4$

2. For each line, write down the gradient and the coordinates of the point where it crosses the y -axis.

(a) $y = 3x + 1$

(b) $y = \frac{1}{2}x - 5$

(c) $y = -2x + 3$

(d) $y = -\frac{1}{4}x - 2$

(e) $y = 8x - \frac{1}{2}$

(f) $y = -x + 4$

3. Match these equations with the graphs shown below.

(1) $y = x + 1$

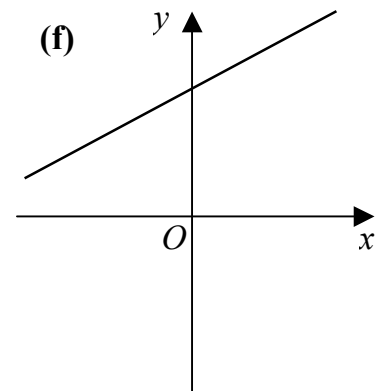
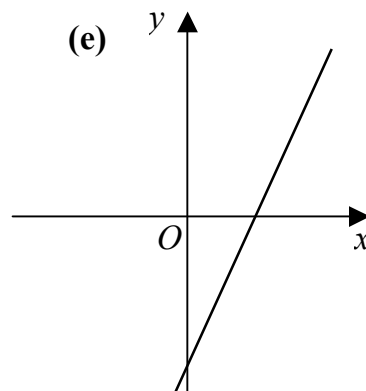
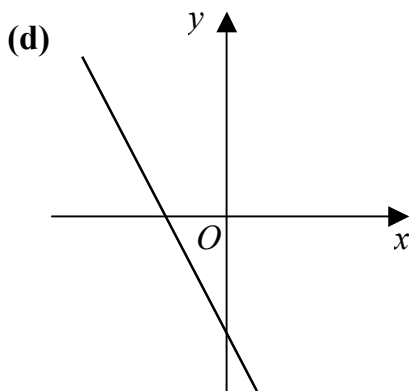
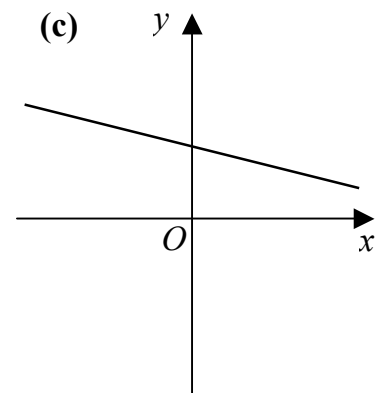
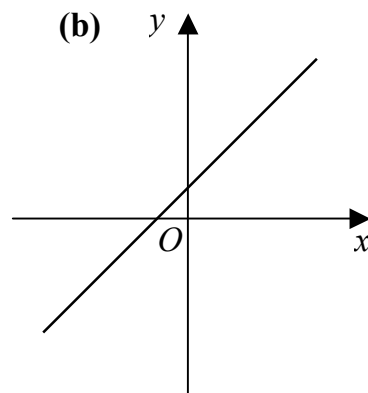
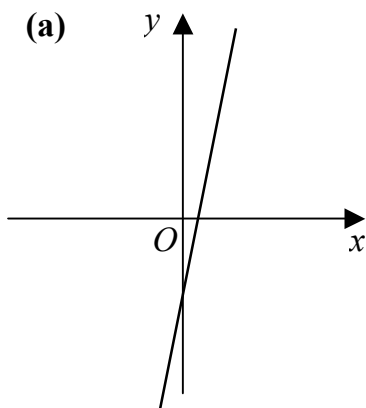
(2) $y = -2x - 3$

(3) $y = \frac{1}{2}x + 4$

(4) $y = -\frac{1}{4}x + 2$

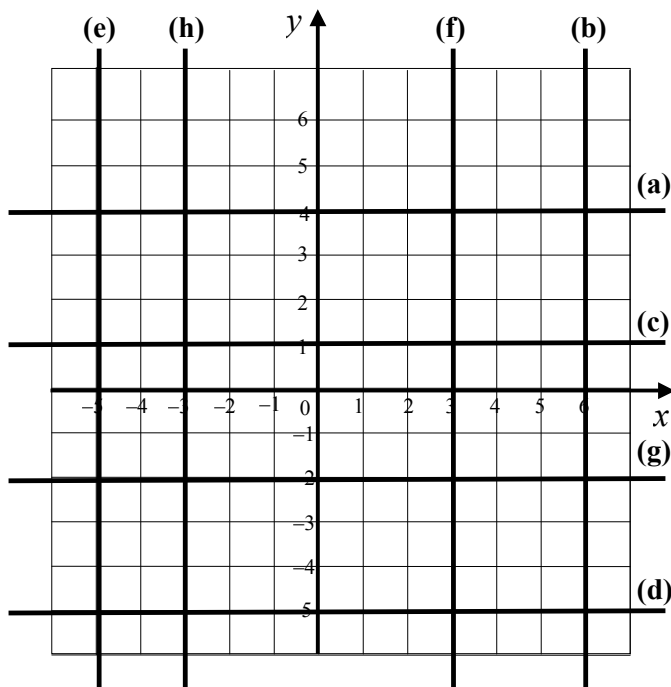
(5) $y = 6x - 2$

(6) $y = 3x - 5$



4. Write down the equations of these lines:
- (a) $m = 4$ passing through the point $(0, 5)$
 - (b) $m = 3$ passing through the point $(0, 1)$
 - (c) $m = 2$ passing through the point $(0, -1)$
 - (d) $m = \frac{1}{4}$ passing through the point $(0, 2)$
 - (e) $m = \frac{1}{2}$ passing through the point $(0, -2)$
 - (f) $m = -2$ passing through the point $(0, -4)$
 - (g) $m = -3$ passing through the point $(0, 3)$
 - (h) $m = -\frac{3}{4}$ passing through the point $(0, -2)$

5. Write down the equation of the lines shown in this diagram.



6. Sketch, on plain paper, the graphs of lines with equations:

(a) $y = -x + 3$

(b) $y = 2x + 3$

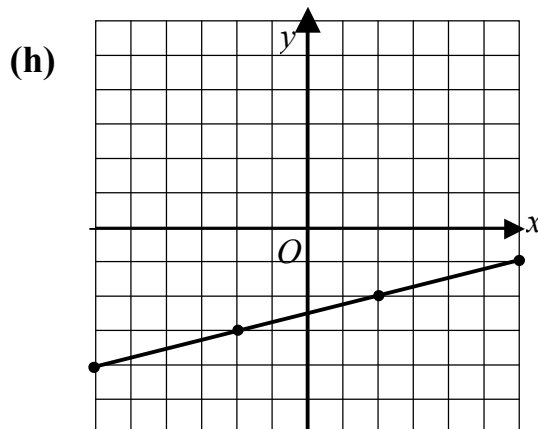
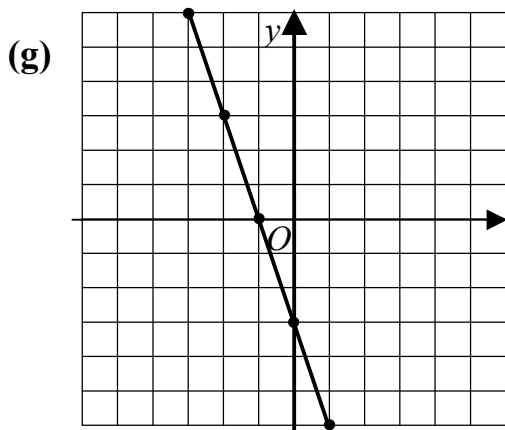
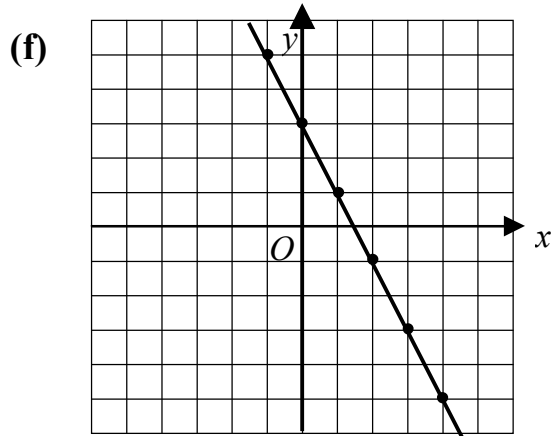
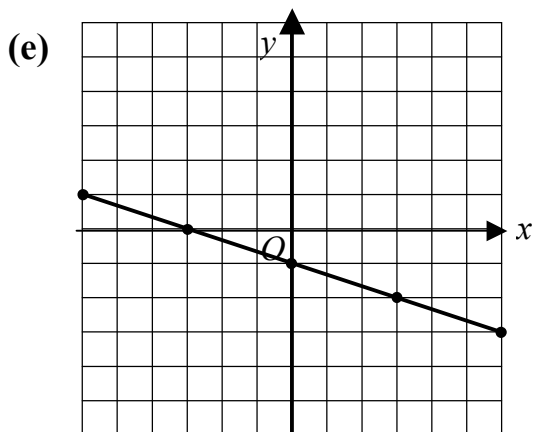
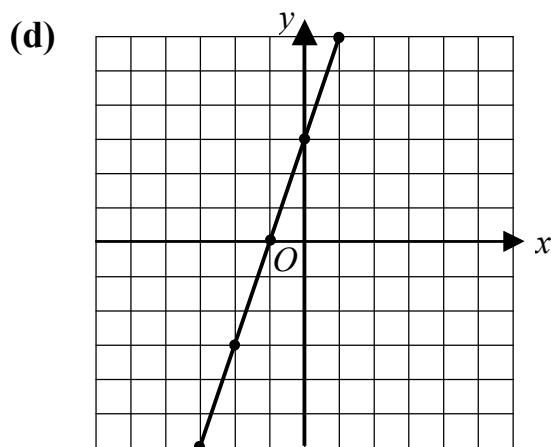
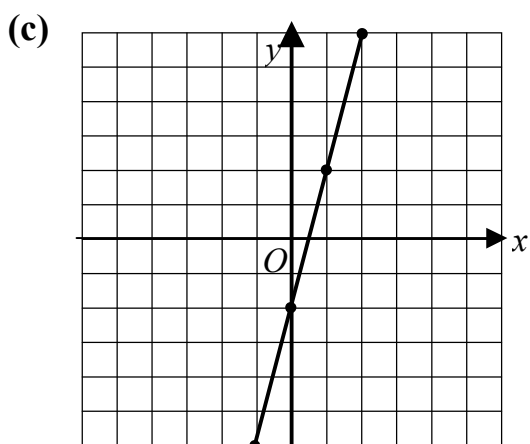
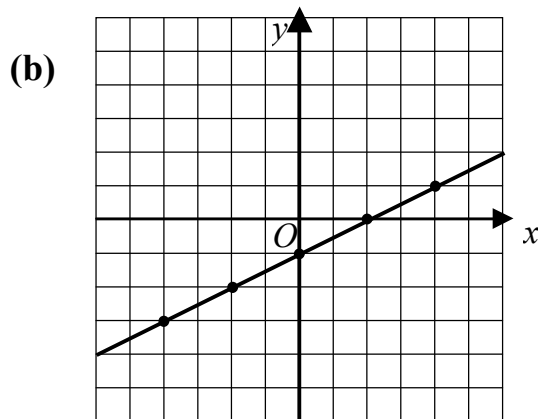
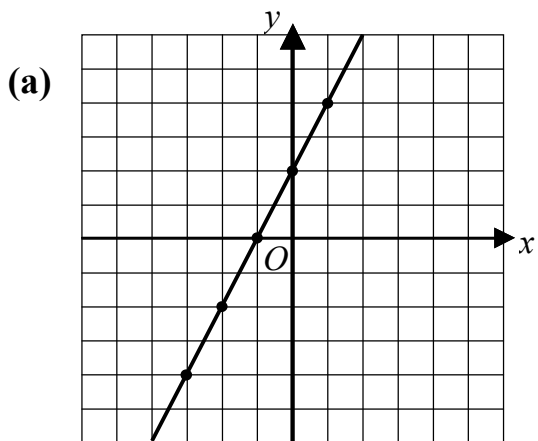
(c) $y = 4x + 1$

(d) $y = \frac{1}{2}x - 2$

(e) $y = -2x - 1$

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

7. Write down the equation of the lines drawn in the diagrams below.



Drawing and recognising the graph of a linear equations

EXAM QUESTIONS

1. (a) Copy and complete this table of values for $y = 3x - 1$.

x	-2	2	4
y			

- (b) Draw the graph of $y = 3x - 1$ onto a coordinate grid.
(c) Onto the same grid draw the graph of the line $y = 8$.
(d) Write down the coordinates of the point of intersection of the two lines.

2. (a) Copy and complete this table of values for $y = -\frac{1}{2}x + 2$.

x	-6	2	8
y			

- (b) Draw the graph of $y = -\frac{1}{2}x + 2$ onto a coordinate grid.
(c) Onto the same grid draw the graph of the line $x = 3$.
(d) Write down the coordinates of the point of intersection of the two lines.

3. (a) Copy and complete this table of values for $y = -3x - 1$.

x	-4	0	3
y			

- (b) Draw the graph of $y = -3x - 1$ onto a coordinate grid.
(c) Onto the same grid draw the graph of the line $y = 2$.
(d) Write down the coordinates of the point of intersection of the two lines.

4. (a) Copy and complete the table of values for $y = \frac{1}{2}x - 3$.

x	-2	2	6
y			

- (b) Draw the graph of $y = \frac{1}{2}x - 3$ onto a coordinate grid.
- (c) Write down the coordinates of the point where the line crosses the y -axis.

5. (a) Copy and complete this table of values for $y = 2x + 1$.

x	-3	-1	0		3
y		-1		3	7

- (b) Use your table to draw the graph of $y = 2x + 1$ onto a coordinate grid.

6. (a) Copy and complete the table below for $y = 4 - x$.

x	-1	0	2	3
y				

- (b) Draw the line $y = 4 - x$ onto a coordinate grid.
- (c) Write down the coordinates of the point where the line crosses the x -axis.

Solving linear equations

1. Solve :

(a) $x + 3 = 5$	(b) $x + 5 = 9$	(c) $x + 9 = 12$	(d) $x + 2 = 7$
(e) $a + 2 = 4$	(f) $y + 3 = 8$	(g) $p + 7 = 11$	(h) $c + 4 = 5$
(i) $b + 7 = 9$	(j) $q + 8 = 8$	(k) $d + 5 = 10$	(l) $x + 1 = 6$
(m) $c + 4 = 6$	(n) $p + 6 = 13$	(o) $a + 2 = 15$	(p) $y + 5 = 14$

2. Solve:

(a) $2x = 6$	(b) $5x = 20$	(c) $8x = 16$	(d) $3x = 27$
(e) $4a = 16$	(f) $7y = 28$	(g) $6p = 18$	(h) $5c = 25$
(i) $9b = 36$	(j) $2q = 18$	(k) $7d = 70$	(l) $4x = 32$
(m) $8c = 56$	(n) $3p = 15$	(o) $5a = 35$	(p) $6y = 42$

3. Solve :

(a) $x - 3 = 4$	(b) $x - 5 = 1$	(c) $x - 9 = 2$	(d) $x - 2 = 7$
(b) $a - 2 = 4$	(f) $y - 3 = 8$	(g) $p - 7 = 11$	(h) $c - 4 = 5$
(j) $b - 7 = 9$	(j) $q - 8 = 8$	(k) $d - 5 = 10$	(l) $x - 1 = 6$
(m) $c - 4 = 6$	(n) $p - 6 = 14$	(o) $a - 2 = 15$	(p) $y - 5 = 14$

4. Solve:

(a) $2a = 36$	(b) $5m = 55$	(c) $8q = 64$	(d) $3y = 48$
(e) $4x = 52$	(f) $7c = 63$	(g) $6d = 72$	(h) $5a = 125$
(i) $9p = 81$	(j) $2q = 17$	(k) $4x = 22$	(l) $6q = 33$
(m) $8c = 28$	(n) $5x = 90$	(o) $10a = 42$	(p) $4y = 42$

5. Solve :

(a) $2x + 3 = 5$ (b) $4x + 5 = 9$ (c) $3x + 3 = 12$ (d) $5x + 2 = 7$
(e) $2a + 2 = 14$ (f) $5y + 3 = 18$ (b) $2p + 7 = 21$ (h) $3c + 4 = 16$
(i) $6b + 7 = 49$ (j) $8q + 8 = 8$ (k) $2d + 5 = 35$ (l) $3x + 5 = 26$
(m) $8c + 4 = 36$ (n) $7p + 6 = 55$ (o) $12a + 2 = 26$ (p) $9y + 5 = 50$

6. Solve :

(a) $3x - 2 = 7$ (b) $4x - 5 = 11$ (c) $2x - 9 = 3$ (d) $3x - 7 = 5$
(e) $7a - 2 = 12$ (f) $5y - 3 = 22$ (g) $6p - 7 = 29$ (h) $4c - 3 = 29$
(i) $8b - 7 = 57$ (j) $10q - 8 = 72$ (k) $3d - 5 = 31$ (l) $9x - 1 = 80$
(m) $4c - 9 = 15$ (n) $6p - 2 = 40$ (o) $5a - 2 = 73$ (p) $3y - 14 = 40$

7. Solve :

(a) $\frac{1}{2}x = 6$ (b) $\frac{1}{4}x = 5$ (c) $\frac{1}{3}x = 7$ (d) $\frac{1}{8}x = 3$
(e) $\frac{1}{5}x = 2$ (f) $\frac{1}{3}x = 3$ (g) $\frac{1}{7}x = 4$ (h) $\frac{1}{2}x = 8$
(i) $\frac{1}{4}x = 1$ (j) $\frac{1}{6}x = 8$ (k) $\frac{1}{5}x = 10$ (l) $\frac{1}{3}x = 9$

8. Multiply out the brackets and solve :

(a) $2(x + 5) = 12$ (b) $5(y + 7) = 45$ (c) $3(a + 6) = 36$
(d) $6(x + 4) = 54$ (e) $4(x + 9) = 48$ (f) $3(c + 8) = 30$
(g) $7(d + 3) = 56$ (h) $5(m + 5) = 55$ (i) $2(y + 14) = 50$
(j) $8(d - 6) = 24$ (k) $3(s - 8) = 9$ (l) $4(x - 15) = 20$
(m) $10(w - 2) = 50$ (n) $5(c - 5) = 35$ (o) $3(a - 10) = 33$

9. Solve :

(a) $6y + 3 = y + 18$

(c) $9c + 5 = c + 21$

(e) $5b + 3 = 2b + 9$

(g) $3x + 2 = x + 14$

(i) $16 + 7y = 2y + 31$

(k) $16 + 25x = 5x + 96$

(m) $19b + 8 = 10b + 80$

(o) $250 + 3x = 295$

(q) $13a + 6 = a + 150$

(s) $19y + 3 = 8y + 80$

(u) $2 + 14x = 2x + 110$

(w) $19x + 10 = 4x + 70$

(b) $5a + 7 = a + 15$

(d) $10x + 1 = 4x + 19$

(f) $7n + 6 = 3n + 18$

(h) $9c + 58 = 6c + 73$

(j) $15a + 4 = 3a + 76$

(l) $6n + 3 \cdot 5 = 3n + 5$

(n) $14x + 4 = 3x + 125$

(p) $20y + 4 = 3y + 55$

(r) $50x + 40 = 10x + 200$

(t) $5b + 2 = 2b + 50$

(v) $20x + 11 = 13x + 60$

(x) $205a + 13 = 10a + 403$

10. Solve :

(a) $6y - 3 = 3y + 15$

(c) $9c - 8 = 4c + 12$

(e) $5b - 3 = 2b + 9$

(g) $7x - 14 = 3x + 2$

(i) $7y - 16 = 2y + 34$

(k) $25x - 16 = 5x + 84$

(m) $b + 13 = 9b - 7$

(o) $x + 25 = 3x - 5$

(q) $a + 6 = 13a - 18$

(s) $8y + 3 = 19y - 74$

(u) $2 + 2x = 10x - 14$

(w) $4x + 10 = 9x - 50$

(b) $5a - 9 = a + 15$

(d) $10x - 1 = 4x + 5$

(f) $3n - 10 = n + 2$

(h) $6c - 13 = 3c + 59$

(j) $15a - 8 = 3a + 76$

(l) $6n - 3 \cdot 5 = 3n + 4$

(n) $3x + 12 = 4x - 4$

(p) $5y + 4 = 20y - 26$

(r) $10x + 40 = 50x - 120$

(t) $2b + 2 = 5b - 16$

(v) $13x + 11 = 20x - 38$

(x) $10a + 13 = 20a - 387$

11. Solve:

(a) $3(a + 2) = a + 12$

(b) $4(x + 3) = 2x + 30$

(c) $5(m + 3) = 2m + 24$

(d) $7(d + 1) = 3d + 15$

(e) $8(h + 3) = 3h + 29$

(f) $6(y + 1) = 2y + 24$

(g) $4(a + 1) = 2(a + 8)$

(h) $7(x + 2) = 4(x + 5)$

(i) $8(a + 2) = 4(a + 28)$

(j) $5(d - 1) = 3d + 7$

(k) $6(x - 2) = 3(x + 1)$

(l) $7(u - 1) = 3(u + 7)$

(m) $8(w - 1) = 6(w + 4)$

(n) $7(x - 2) = 4(x + 1)$

12. Solve each of the following equations

(a) $3x = 12 - x$

(b) $5m = 24 - 3m$

(c) $y = 21 - 2y$

(d) $5t = 42 - t$

(e) $2a = 20 - 2a$

(f) $6x = 40 - 4x$

(g) $2y + 1 = 21 - 3y$

(h) $p - 3 = 21 - 5p$

(i) $8r - 5 = 45 - 2r$

(j) $6 + x = 12 - 2x$

(k) $14 + 4a = 26 - 2a$

(l) $2 + 6d = 24 - 5d$

(m) $1 + 3c = 13 - c$

(n) $9 + x = 27 - 5x$

(o) $6 + 4x = -2x + 12$

(p) $3x + 5 = -4x + 19$

(q) $5v - 1 = -3v + 15$

(r) $8 + 7x = -2x + 35$

13. Solve these equations:

(a) $5x - 7 = -2$

(b) $3x - 12 = -3$

(c) $7y - 15 = -1$

(d) $8v - 8 = 6v - 2$

(e) $4h - 1 = 2h - 4$

(f) $6a - 16 = a - 6$

(g) $3x - 11 = x - 5$

(h) $5m - 18 = m - 6$

(i) $8e - 30 = 2e - 6$

(j) $2x - 12 = -3x - 2$

(k) $5y - 20 = -2y - 6$

(l) $3a - 9 = -2a - 4$

(m) $7x - 13 = -x - 5$

(n) $4k - 24 = -2k - 12$

(o) $3c - 18 = -c - 2$

Solving linear equations

EXAM QUESTIONS

1. Solve $2x + 9 = 5x - 3$
2. Solve $3a + 13 = 7a - 3$
3. Solve $2x + 13 = 5x - 2$
4. Solve $3x - 11 = 7x + 5$
5. Solve, algebraically, the equation: $5x - 19 = 16 - 2x$
6. Solve algebraically $15 + 7x = 4x - 3$
7. Solve algebraically $8w - 9 = 5w + 21$
8. Solve, algebraically, the equation $12x - 11 = 8x + 5$
9. Solve the equation $20y + 6 = 14y + 24$
10. Solve for x $6x - 7 = 4x + 5$

Solving Inequations (extension)

1. Solve :

(a) $x + 4 > 5$	(b) $x + 6 > 9$	(c) $x + 8 > 12$	(d) $x + 3 > 7$
(e) $a + 1 > 4$	(f) $y + 5 > 8$	(g) $p + 2 > 11$	(h) $c + 4 > 5$
(i) $b + 3 > 9$	(j) $q + 8 > 8$	(k) $d + 7 > 10$	(l) $x + 2 > 6$
(m) $c + 1 > 6$	(n) $p + 4 > 13$	(o) $a + 3 > 15$	(p) $y + 2 > 14$

2. Solve :

(a) $x + 5 < 7$	(b) $x + 1 < 8$	(c) $x + 3 < 13$	(d) $x + 5 < 9$
(e) $a + 3 < 6$	(f) $y + 5 < 11$	(g) $p + 2 < 10$	(h) $c + 1 < 5$
(i) $b + 8 < 13$	(j) $q + 3 < 20$	(k) $d + 7 < 7$	(l) $x + 10 < 15$
(m) $c + 3 < 9$	(n) $p + 2 < 16$	(o) $a + 4 < 15$	(p) $y + 9 < 10$

3. Solve:

(a) $2x > 6$	(b) $5x > 20$	(c) $8x > 16$	(d) $3x > 27$
(e) $4a > 16$	(f) $7y > 28$	(g) $6p > 18$	(h) $5c > 25$
(i) $9b < 36$	(j) $2q < 18$	(k) $7d < 70$	(l) $4x < 32$
(m) $8c < 56$	(n) $3p < 15$	(o) $5a < 35$	(p) $6y < 42$

4. Solve

(a) $x - 3 < 4$	(b) $x - 5 > 1$	(c) $x - 9 > 2$	(d) $x - 2 < 7$
(e) $a - 2 < 4$	(f) $y - 3 > 8$	(g) $p - 7 < 11$	(h) $c - 4 > 5$
(i) $b - 7 > 9$	(j) $q - 8 < 8$	(k) $d - 5 > 10$	(l) $x - 1 > 6$
(m) $c - 4 > 6$	(n) $p - 6 < 14$	(o) $a - 2 < 15$	(p) $y - 5 < 14$

5. Solve :

- (a) $2x + 1 < 5$ (b) $4x + 1 > 9$ (c) $3x + 3 > 12$ (d) $5x + 2 > 12$
(e) $2a + 2 < 8$ (f) $5y + 3 < 13$ (g) $2p + 5 > 21$ (h) $3c + 1 < 16$
(i) $6b + 13 > 49$ (j) $8q + 8 < 8$ (k) $3d + 5 < 35$ (l) $4x + 5 > 21$
(m) $8c + 12 < 36$ (n) $7p + 6 < 55$ (o) $12a + 2 > 26$ (p) $9y + 23 < 50$

6. Solve :

- (a) $3x - 1 > 8$ (b) $4x - 3 > 13$ (c) $2x - 7 < 5$ (d) $3x - 5 > 4$
(e) $7a - 1 < 13$ (f) $5y - 2 < 23$ (g) $6p - 5 > 31$ (h) $4c - 7 > 25$
(i) $8b - 3 > 61$ (j) $10q - 7 < 73$ (k) $3d - 2 < 34$ (l) $9x - 8 > 73$
(m) $4c - 5 < 19$ (n) $6p - 1 < 41$ (o) $5a - 4 < 71$ (p) $3y - 24 < 30$

Solving inequations

EXAM QUESTIONS

1. Solve the inequality: $4y + 3 < 15$
2. Solve $\frac{1}{4}x + 5 > 2$
3. Solve $\frac{1}{2}x - 3 > -7$
4. Solve $\frac{1}{4}x + 3 > -5$
5. Solve $\frac{1}{2}y - 7 < 6$
6. Solve the inequality: $\frac{1}{2}d + 12 > 8$
7. Solve the inequality $4t - 5 < 15$
8. Solve the inequality $3x - 4 > 11$
9. Solve $16 + 8y > 64$
10. Solve the inequality: $\frac{1}{4}p > 7$

Changing the subject of a formula

1. Change the subject of each formula to x .

(a) $y = x + 3$

(b) $y = x - 5$

(c) $y = x + a$

(d) $y = x - b$

(e) $y = 3x$

(f) $y = 10x$

(g) $y = kx$

(h) $y = ax$

(i) $y = 3p + x$

(j) $y = x - 5t$

(k) $y = 2x + 1$

(l) $y = 3x - 7$

(m) $y = 7x + 4a$

(n) $y = 3b + 4x$

(o) $y = 8 + 10x$

2. Make a the subject of each formula.

(a) $b = 4 - a$

(b) $d = 12 - a$

(c) $y = 5x - a$

(d) $m = 2 - 2a$

(e) $q = 7 - 5a$

(f) $c = 20 - 3a$

(g) $r = s - 2a$

(h) $t = d - 4a$

(i) $z = 4b - 5a$

(j) $k = 2h - 7a$

(k) $p = 6q - 11a$

(l) $g = 2x - 9a$

3. Change the subject of the formula to x .

(a) $y = ax + b$

(b) $y = mx + c$

(c) $t = sx - r$

(d) $p = qx + 2r$

(e) $m = fx - 3n$

(f) $a = b + cx$

(g) $k = h - mx$

(h) $d = 3b + cx$

(i) $g = kc - hx$

4. Change the subject of each formula to the letter shown in brackets.

(a) $P = 4l$

(l)

(b) $V = IR$

(I)

(c) $S = DT$

(T)

(d) $A = lb$

(b)

(e) $C = \pi d$

(d)

(f) $G = UT$

(U)

(g) $v = u + at$

(t)

(h) $P = 2l + 2b$

(l)

(i) $H = xy + 5m$

(y)

5. Change the subject of each formula to c .

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

(b) $x = \frac{1}{5}c$

(c) $y = \frac{1}{4}c$

(d) $m = \frac{1}{6}c$

(e) $k = \frac{1}{9}c$

(f) $d = \frac{1}{10}c$

(g) $a = \frac{1}{2}c + 2$

(h) $h = \frac{1}{3}c - 5$

(i) $p = \frac{1}{4}c + q$

(j) $y = \frac{1}{10}c - x$

(k) $t = \frac{1}{8}c + 2s$

(l) $r = \frac{1}{5}c - 3q$

6. Make x the subject of each formula.

(a) $y = \frac{3}{x}$

(b) $d = \frac{c}{x}$

(c) $m = \frac{y}{x}$

(d) $s = \frac{a+2}{x}$

(e) $w = \frac{z-1}{x}$

(f) $a = \frac{b+c}{x}$

(g) $a = \frac{x+8}{9}$

(h) $k = \frac{x-5}{2}$

(i) $p = \frac{3-x}{4}$

(j) $y = \frac{2}{x} + 1$

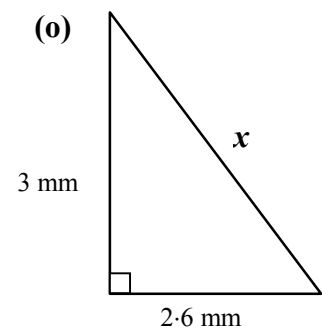
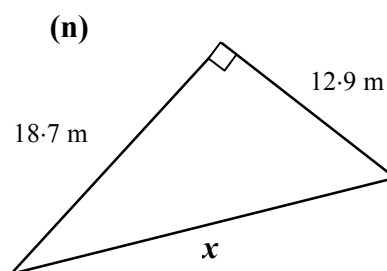
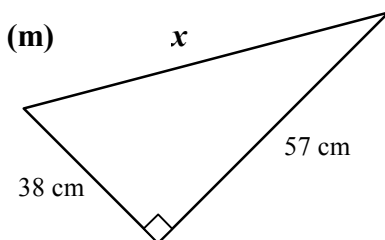
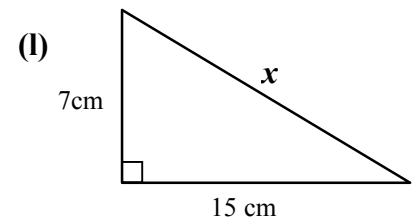
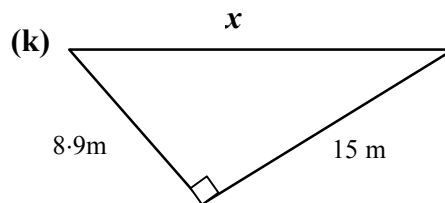
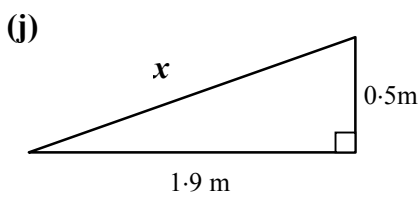
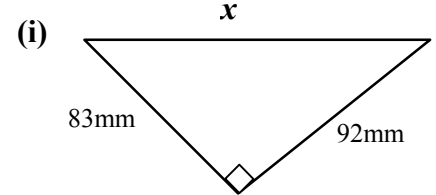
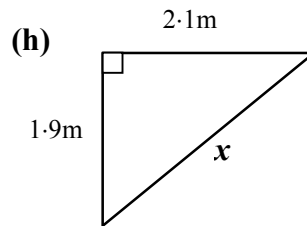
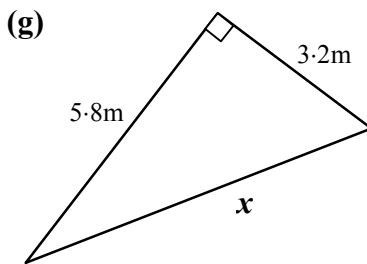
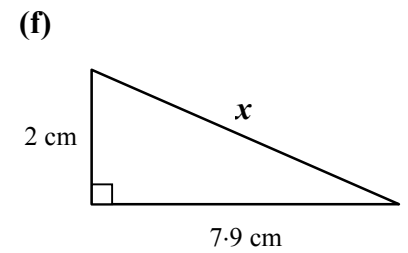
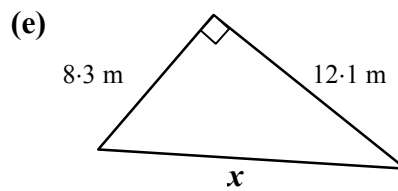
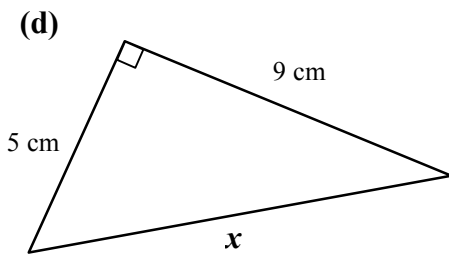
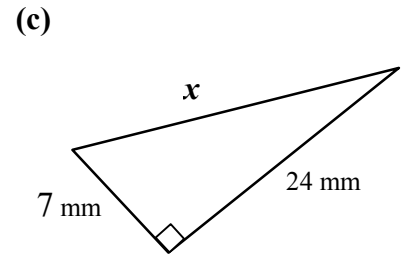
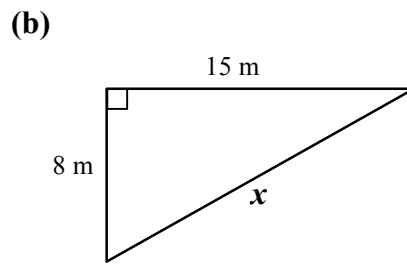
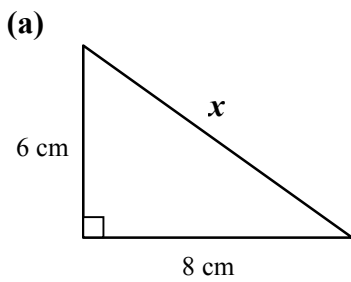
(k) $z = \frac{6}{x} - 7$

(l) $h = \frac{m}{x} + k$

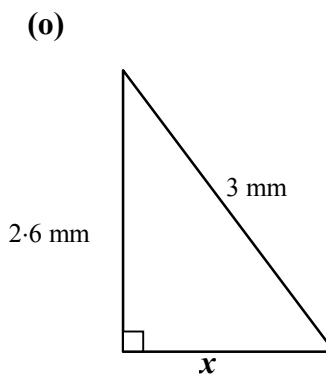
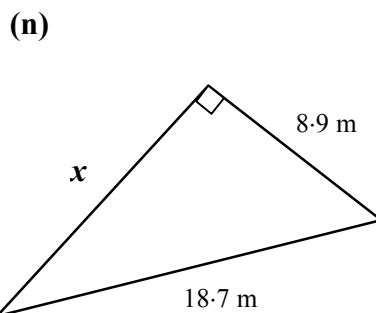
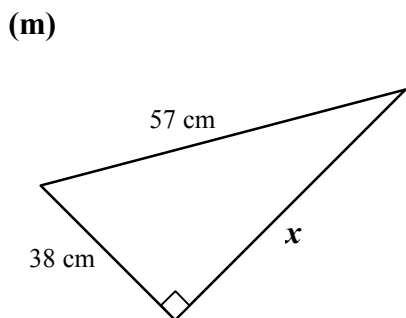
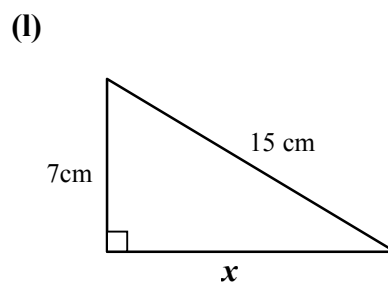
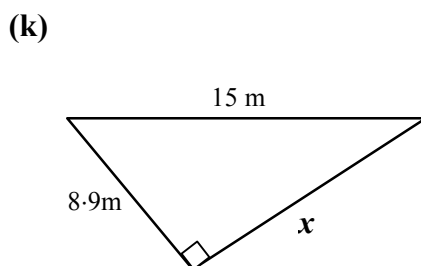
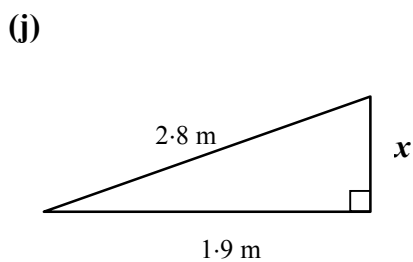
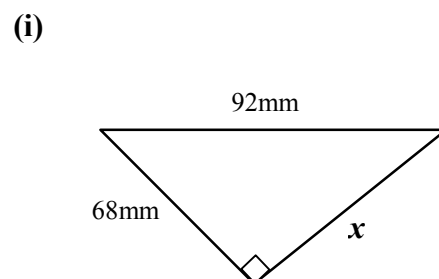
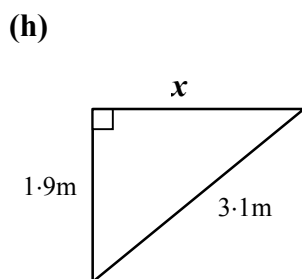
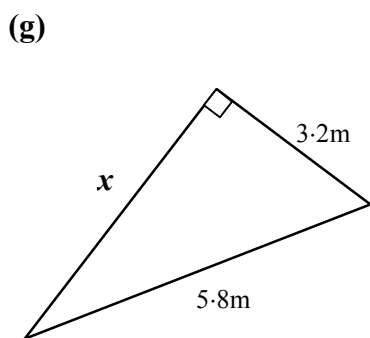
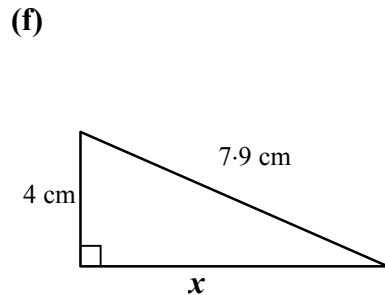
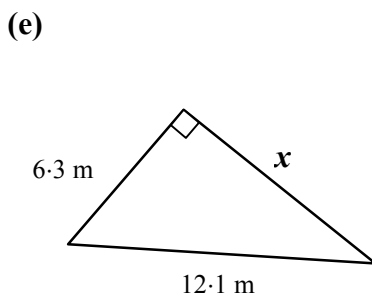
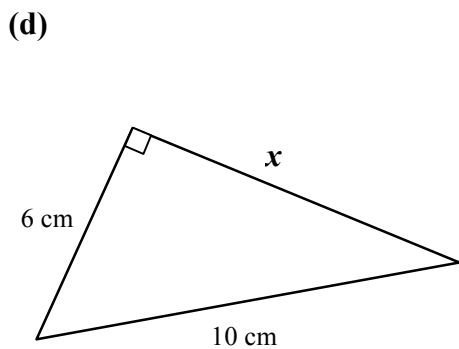
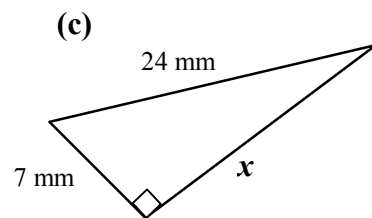
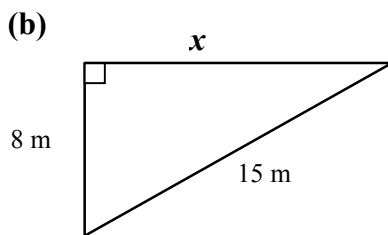
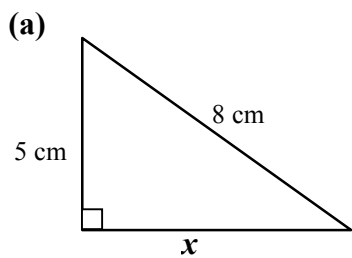
Applying Geometric Skills to Sides and Angles of a Shape

Using Pythagoras' Theorem

1. Find the length of the hypotenuse, marked x , in each of the following triangles.

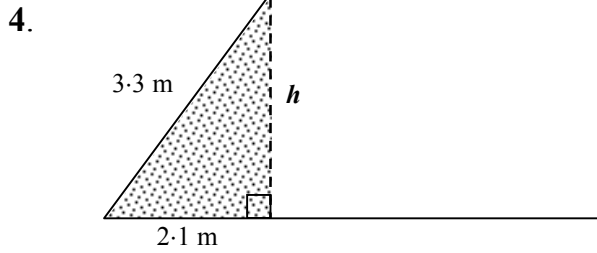
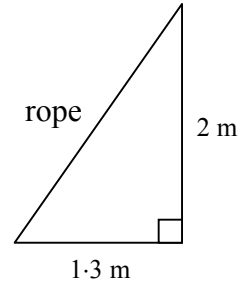


2. Find the length of the side, marked x , in each of the following triangles.

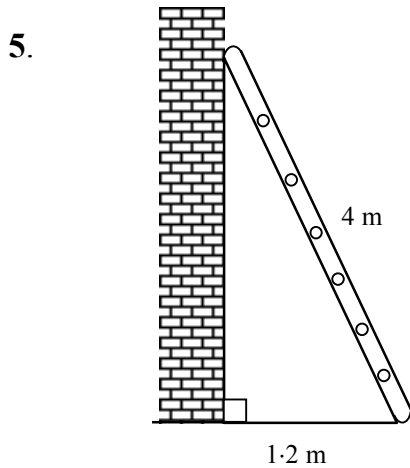


3. Guy ropes are used to support a tent pole. The pole is 2 metres high and the guy rope is fixed 1.3 metres from the bottom of the pole.

What is the length of the guy rope?



Jim's house has an attic room with a sloping end wall. He is going to make a fitted cupboard. What will be the height of the cupboard, h ?

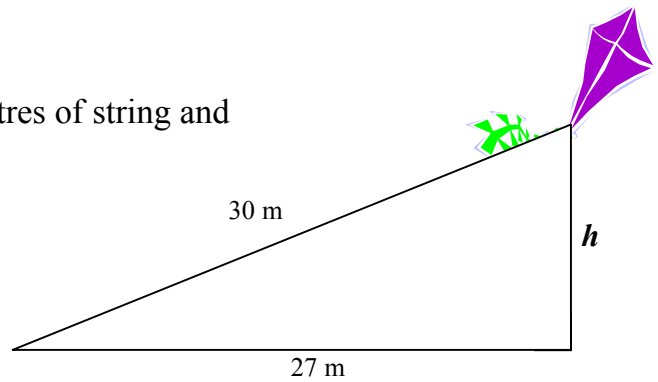


John's ladder is 4 metres long. He sets it up so that the foot of the ladder is 1.2 metres from the wall.

How far up the wall will the ladder reach?

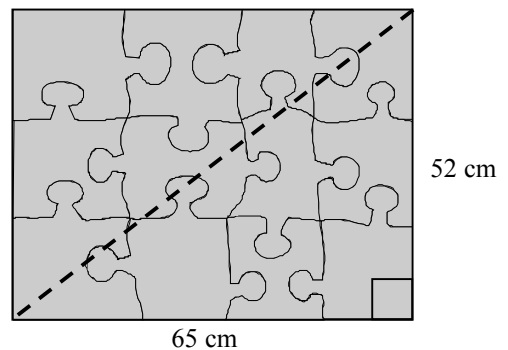
6. Eddie is flying his kite. He lets out 30 metres of string and moves 27 metres from his starting point.

How high is the kite above the ground?



7. A rectangular jigsaw measures 65 cm by 52 cm.

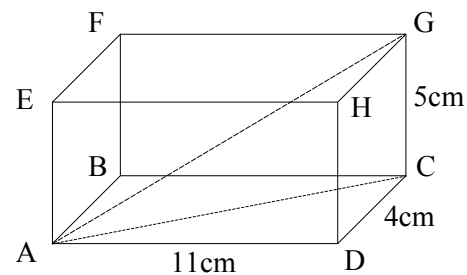
What length is its diagonal?



8. Consider the cuboid opposite.

(a) Calculate the length of the face diagonal AC.

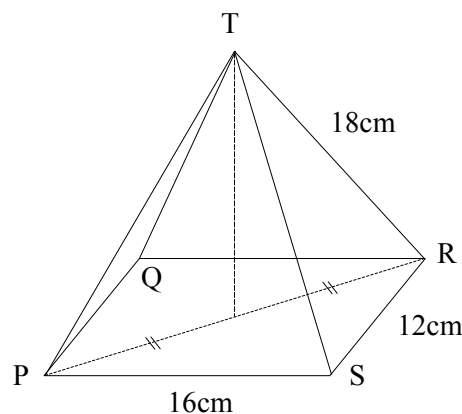
(b) Hence calculate the length of the space diagonal AG.



9. The pyramid opposite has a rectangular base.

(a) Calculate the length of the base diagonal PR.

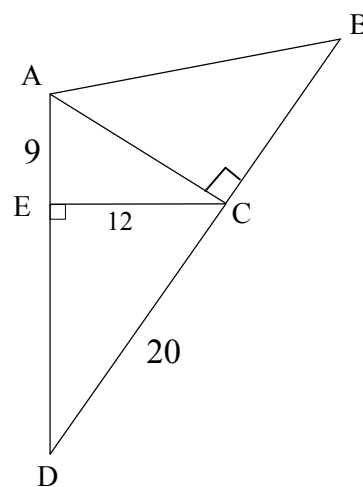
(b) Given that edge TR = 18cm, calculate the vertical height of the pyramid.



10. Consider the diagram opposite. All lengths are centimetres.

(a) Calculate the length of AC.

(b) Calculate the length of ED.



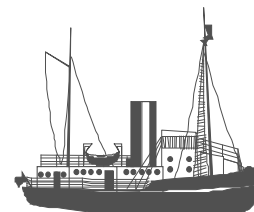
Draw a diagram to help you answer question 11 – 18

11. A ship sails 9km due North and then a further 17km due East.

How far is the ship from its starting point?

12. An aircraft flies 400km due West and then a further 150km due South.

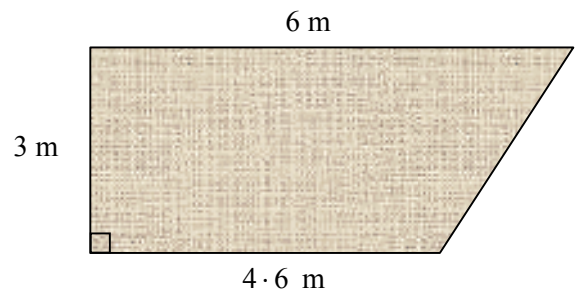
How far is the aircraft from its starting point?



13. A ship sailed 8.42 km due East followed by 4.7 km due South.
How far would it have sailed if it had followed a direct course?
14. A ship sails 9 km due North and then a further distance x km due West.
The ship is now 12 km from its starting point. Calculate x .
15. How long is the diagonal of a square of side 11 mm?
16. A rectangle measures 14 cm by 9 cm. Calculate the length of its diagonals.
17. A ladder of length 5 metres leans against a vertical wall with the foot of the ladder 2 metres from the base of the wall. How high up the wall does the ladder reach?
18. A ladder is placed against a vertical wall. If the distance between the foot of the ladder and the wall is 1.8 metres, and the ladder reaches 4 metres up the wall, calculate the length of the ladder.

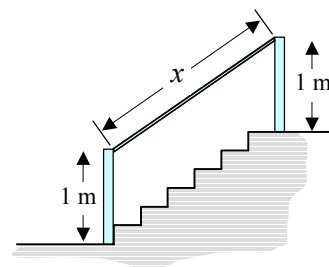
19. The room shown opposite has two parallel sides.

Using the given dimensions calculate the perimeter of the room.



20. Calculate the length of the banister rail shown in the diagram if there are 6 stairs, and if each tread measures 25 cm and each riser 20 cm.

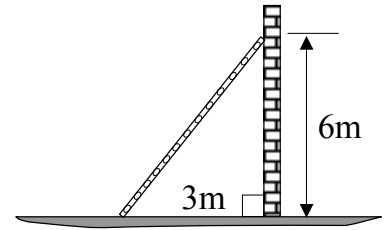
Give your answer in metres.



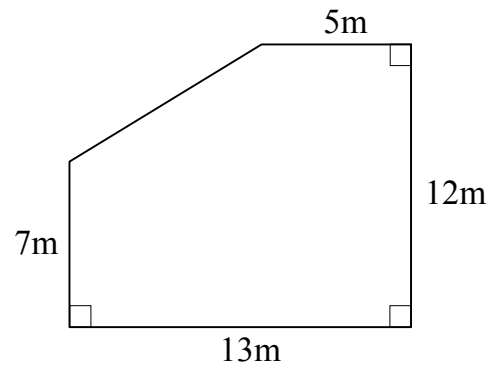
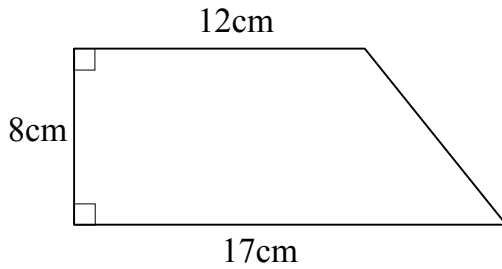
Pythagoras' Theorem (more practice)

Answers should be rounded to 1-decimal place where necessary.

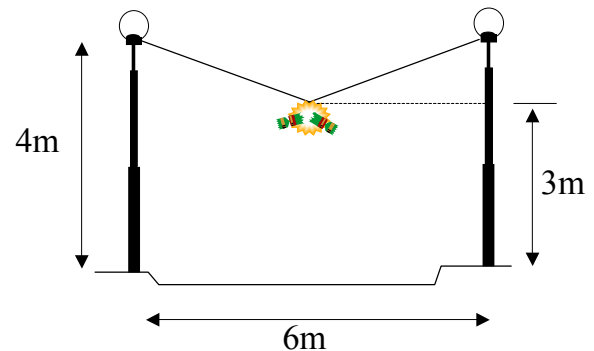
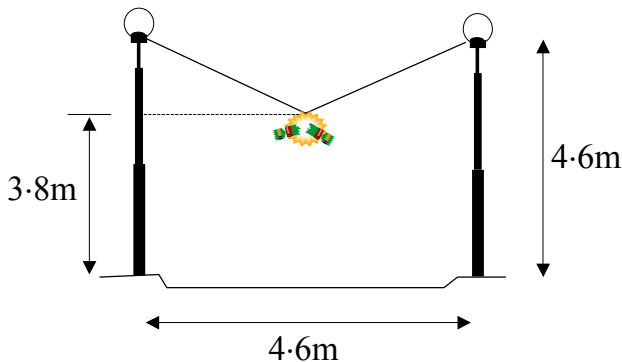
1. A ladder leans against a wall as shown in the diagram opposite. From the information given calculate the length of the ladder.



2. Calculate the perimeter of each shape below.

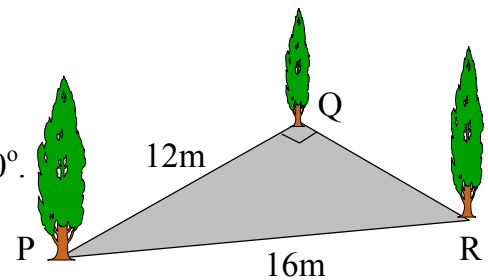


3. Blackpool's light decorations are suspended above the street by wire cables as shown below.

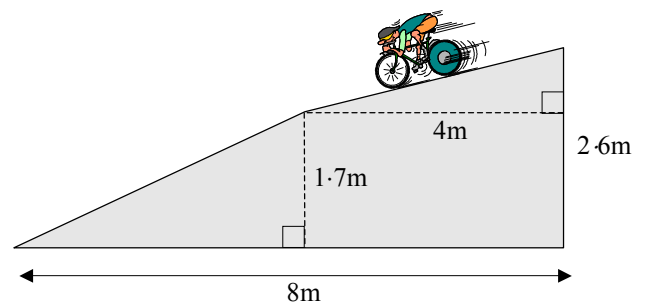
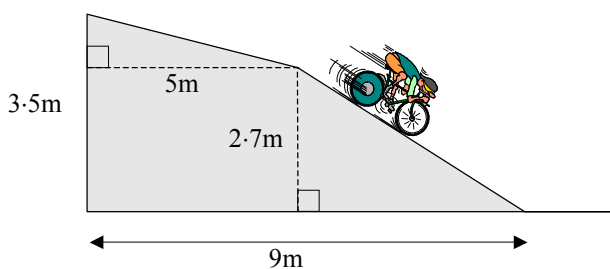


Calculate the total length of cable in each diagram.

4. Three trees are situated as shown with angle $PQR = 90^\circ$. Calculate the distance between the trees Q and R. (careful !)

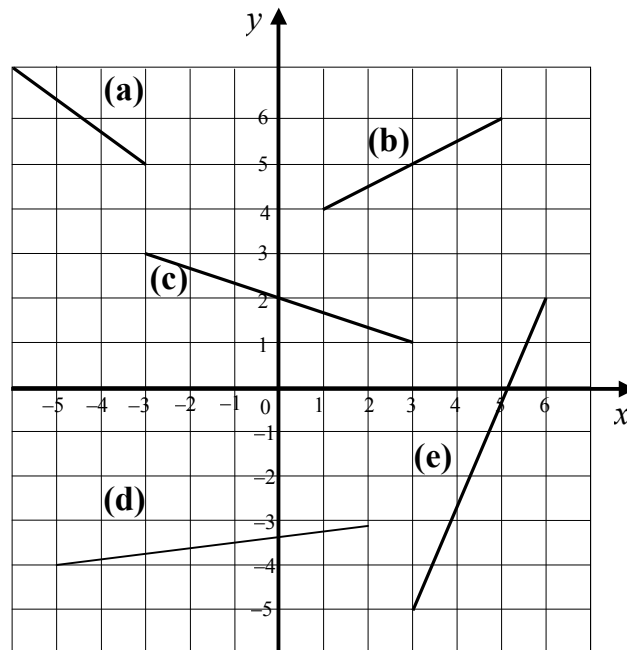


5. Calculate the total length of each mountain bike ramp shown below.



Finding the distance between two points

1. Calculate the length of each line in this diagram



2. Calculate the distance between each pair of points below :

Round your answers to 1-decimal place where necessary.

*Plot each pair of points on a coordinate diagram and join them with a line.
Construct a right angled triangle and use Pythagoras' Theorem to calculate the distance between the points.*

- | | |
|-------------------------|--------------------------|
| (a) P(2, 1) and Q(5, 3) | (b) A(1, 3) and B(6, 5) |
| (c) E(3, 3) and F(5, 8) | (d) R(1, 6) and S(8, 1) |
| (e) M(0, 2) and N(5, 5) | (f) G(7, 2) and H(2, 10) |
| (g) K(9, 0) and L(2, 7) | (h) U(1, 1) and V(6, 13) |

3. Calculate the distance between each pair of points below :

Round your answers to 1-decimal place where necessary.

- | | |
|---------------------------|----------------------------|
| (a) A(-3, 4) and B(4, 1) | (b) C(4, -6) and D(-2, -2) |
| (c) E(3, 4) and F(-2, -6) | (d) G(-2, 1) and H(7, -5) |
| (e) I(0, -4) and J(-2, 8) | (f) K(-4, -3) and L(6, 1) |

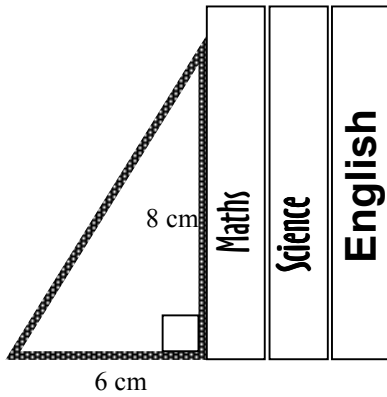
4. (a) Triangle PQR has corner points $P(1, 5)$, $Q(3, 8)$ and $R(6, 1)$.
Calculate the lengths of the three sides PQ, QR and RP.
- (b) Repeat part (a) for the triangle with corners $P(-3, 7)$, $Q(-1, -4)$ and $R(5, 2)$.
5. (a) Triangle ABC has corner points $A(2, 3)$, $B(6, 3)$ and $C(4, 7)$.
Calculate the length of the three sides.
- (b) What kind of triangle is ABC?
6. (a) Quadrilateral KLMN has corners at points $K(1, 4)$, $L(2, 7)$, $M(5, 8)$ and $N(4, 5)$.
Calculate the lengths of the four sides of the quadrilateral.
- (b) Use your answers in part (a) to say what kind of quadrilateral KLMN **could** be.
7. Triangle EFG has corner points $E(2, -3)$, $F(-1, 5)$, and $G(-4, -2)$.
By calculating the lengths of EF, FG and EG, say what kind of triangle EFG is.
8. Quadrilateral VWXY has corner points $V(-3, 2)$, $W(4, 5)$, $X(8, 1)$ and $Y(1, -2)$.
By calculating the lengths of its sides, deduce what kind of quadrilateral VWXY **could** be.

Applying Geometric Skills to Sides and Angles of a Shape

Using Pythagoras' Theorem

EXAM QUESTIONS

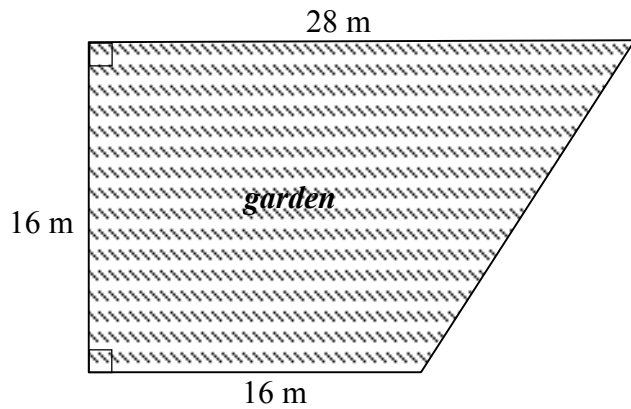
1.



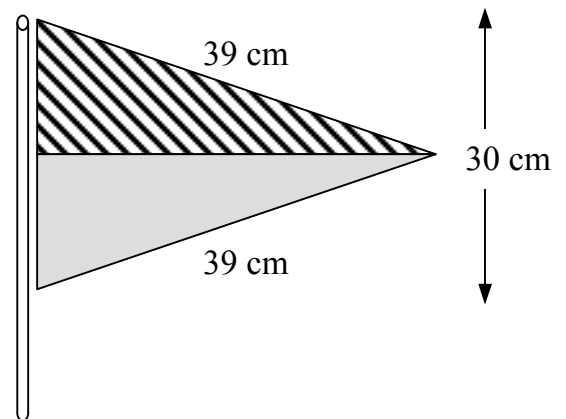
Simon makes a triangular book-end in his metalwork class.

What is the **total** length of metal needed to make it?

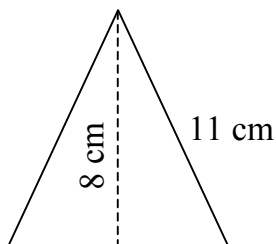
2. Calculate the perimeter of this garden.



3. Calculate the area of this triangular flag.



4.

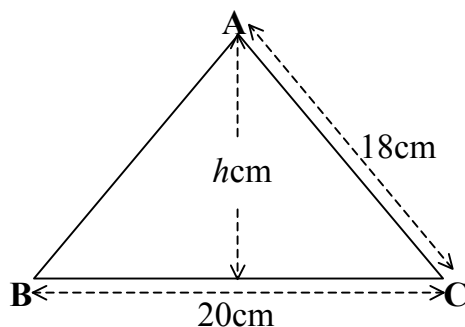
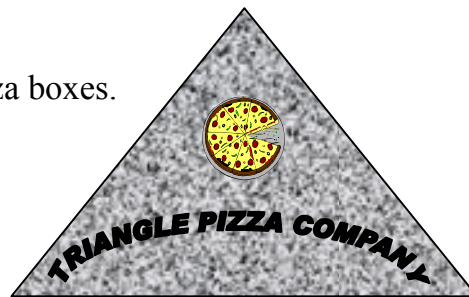


An isosceles triangle has its longest side 11 cm and height 8 cm.

Find the perimeter of the triangle.

5. The Triangle Pizza Company uses this logo on their pizza boxes.

The logo is in the shape of the isosceles triangle ABC as shown in the diagram below.

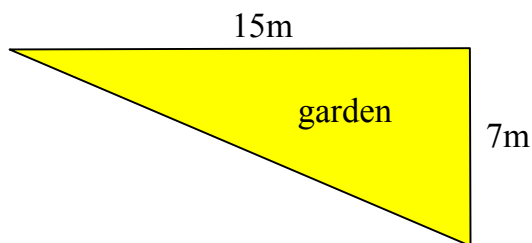


Calculate the height, h cm, of the logo.

Give your answer to the nearest centimetre.

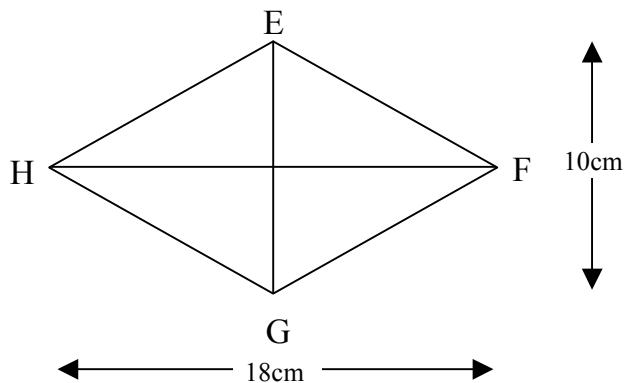
6. A garden is in the shape of a right-angled triangle. New fencing is being erected around the garden.

Calculate the **total** length of the fence needed to surround the garden, giving your answer correct to 1 decimal place.



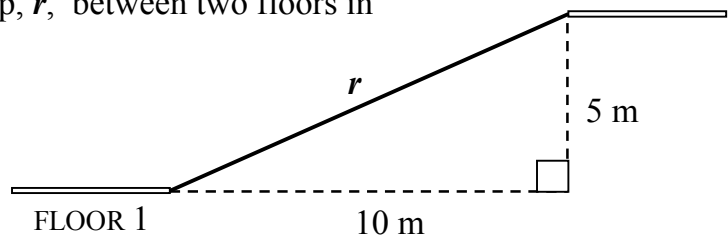
7. EFGH is a rhombus. EG is 10 cm and HF is 18 cm.

Calculate the perimeter of the rhombus.

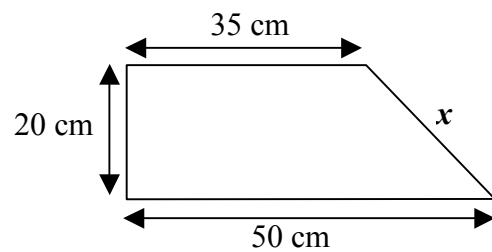
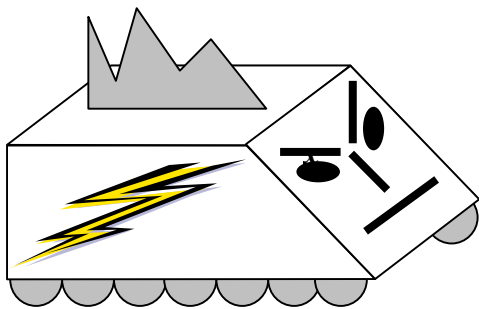


8. The diagram shows a moving ramp, r , between two floors in a shopping centre.

Find the length of the ramp.



9. Jack is building a robot for a competition. The sloping edges are to be mounted with sensor strips.



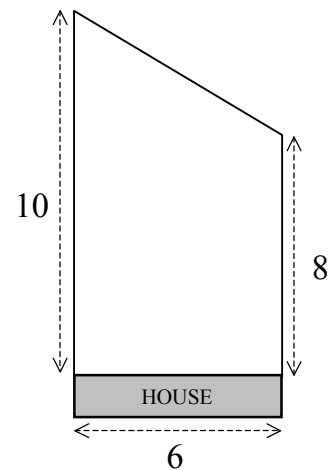
Calculate the length of each strip, x .

10. Gillian's lawn is shaped as in the diagram.

All lengths are in metres.

Gillian is going to put a decorative border round her lawn. **The border does not go along the side of the house.**

The border is sold in 2 metre lengths and costs £4.95 a length.



Calculate how much it would cost Gillian to put the border round her lawn.

11. *Diagram 1* shows a section of a garden fence.

It has a protective strip along the top.

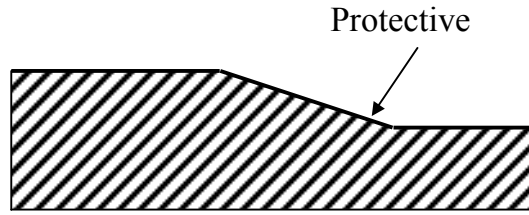


Diagram 1

The dimensions of the fence are shown in *Diagram 2*.

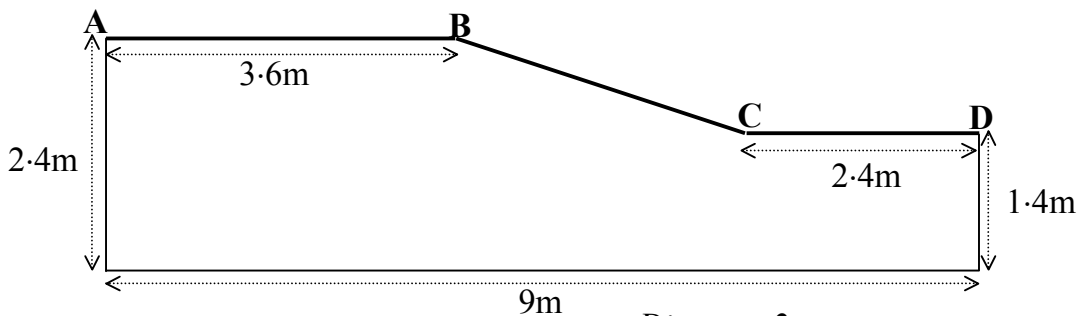


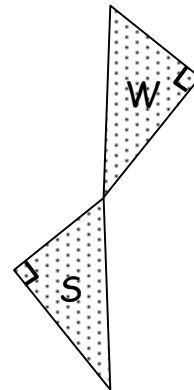
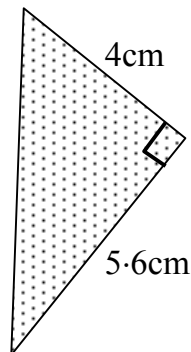
Diagram 2

Calculate the total length of protective strip that would be required for this section of fence. (i.e. the total distance from A to B to C to D).

12. The diagram shows the logo of the junior section of a sailing club called the 'Windy Sails' Club.

It consists of two identical right-angled triangles.

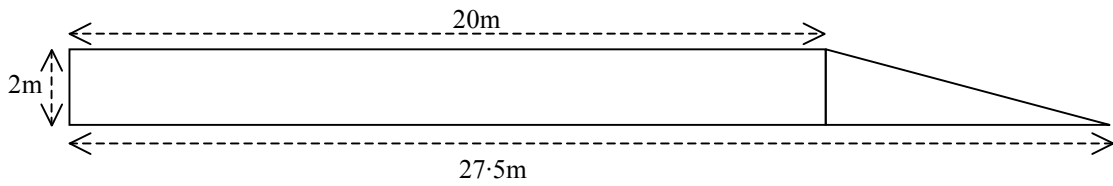
The dimensions of each right-angled triangle are shown in this diagram.



The **outline** of the logo is sewn on to the sailing suits.

Calculate the length of the stitching needed to sew the **complete** logo.

13. A special stage is being built for an outdoor concert. It has to be 20 metres wide, 2 metres high and have a ramp on one side.

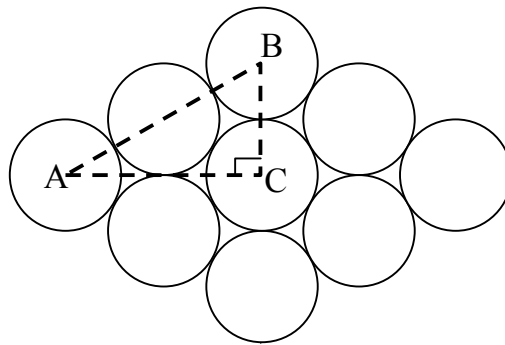


Special non-slip matting has to be laid along the stage and down the ramp.

The cost of the matting is £34 a metre and it is sold in complete metres.

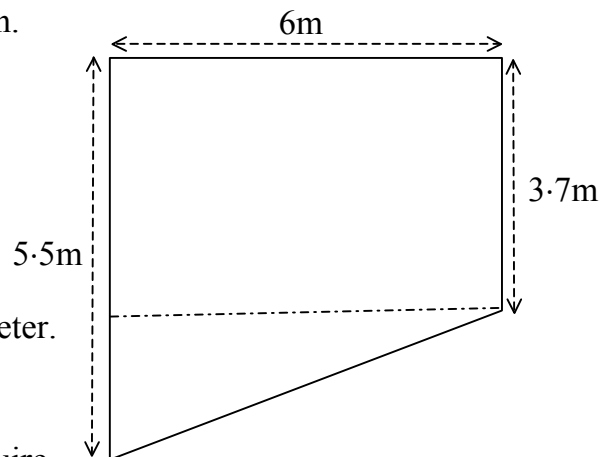
Calculate the cost of the matting.

14. The stones in an engagement ring are arranged as shown in the diagram.
The diameter of each stone is 4 mm and A, B and C are the centres of 3 of the stones.



- (a) Write down the lengths of AB and BC.
(b) Calculate the length of AC.
15. I have just built a new patio area in my garden.

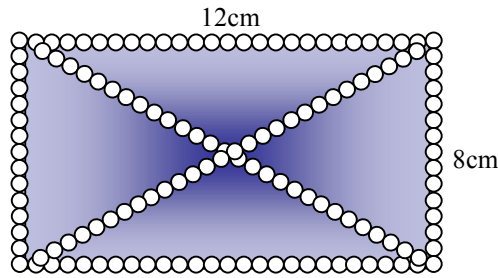
The diagram shows the measurements of it.



I am going to put a low fence round its perimeter.

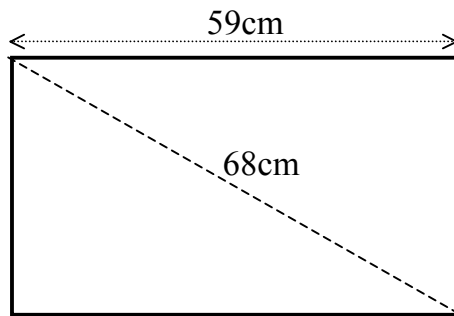
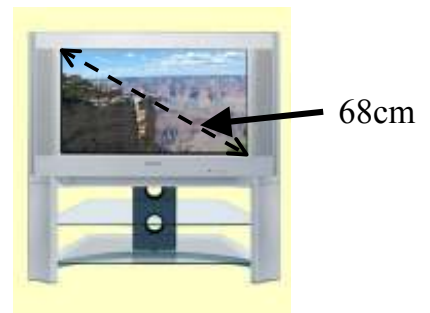
Calculate the length of fencing that I will require.

16. Anne has a tee shirt which has a rectangular motif on it. Strips of sequins run along the diagonals and round the perimeter of the rectangle.



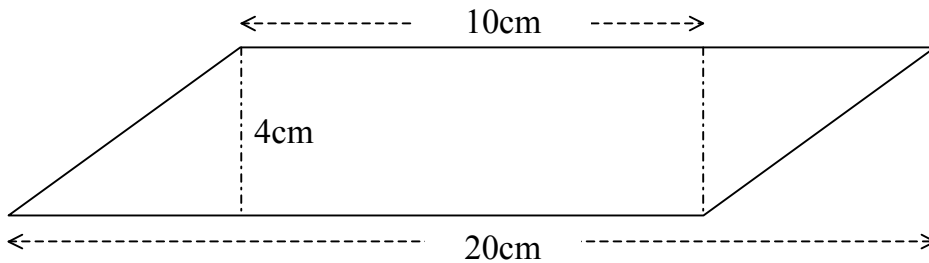
Calculate the total length of sequins required for this motif.

17. The television in my lounge has a 68cm screen which means that the diagonal of it measures 68cm.
The width of the screen is 59cm



Calculate the area of the picture.

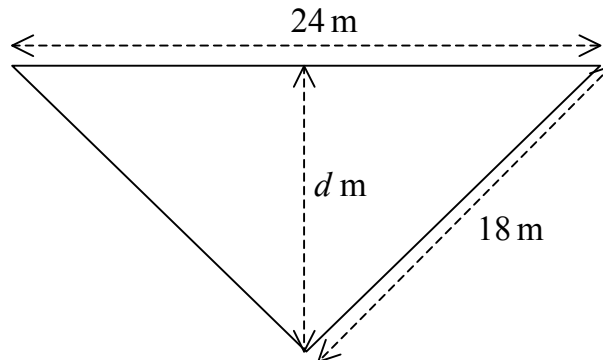
18. Calculate the perimeter of this parallelogram.



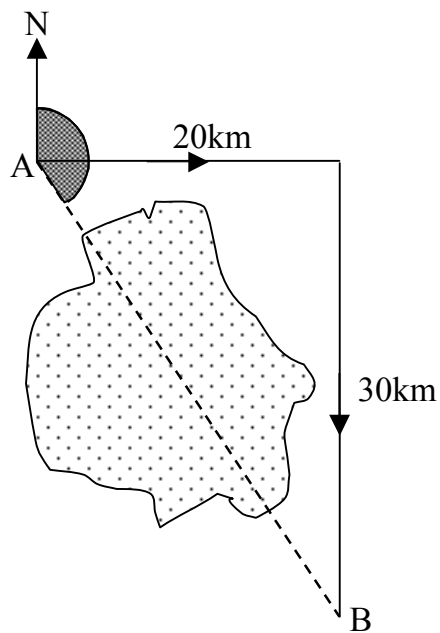
19. At a golf range each golfer has an area for practice shots. It is in the shape of an isosceles triangle with dimensions as shown in the diagram.

In the diagram, d represents the distance from the tee to the end of the range.

Calculate the distance, d m.



20. To avoid running aground on an island a ship sails due East for 20km and then due South for 30km as shown in the diagram.

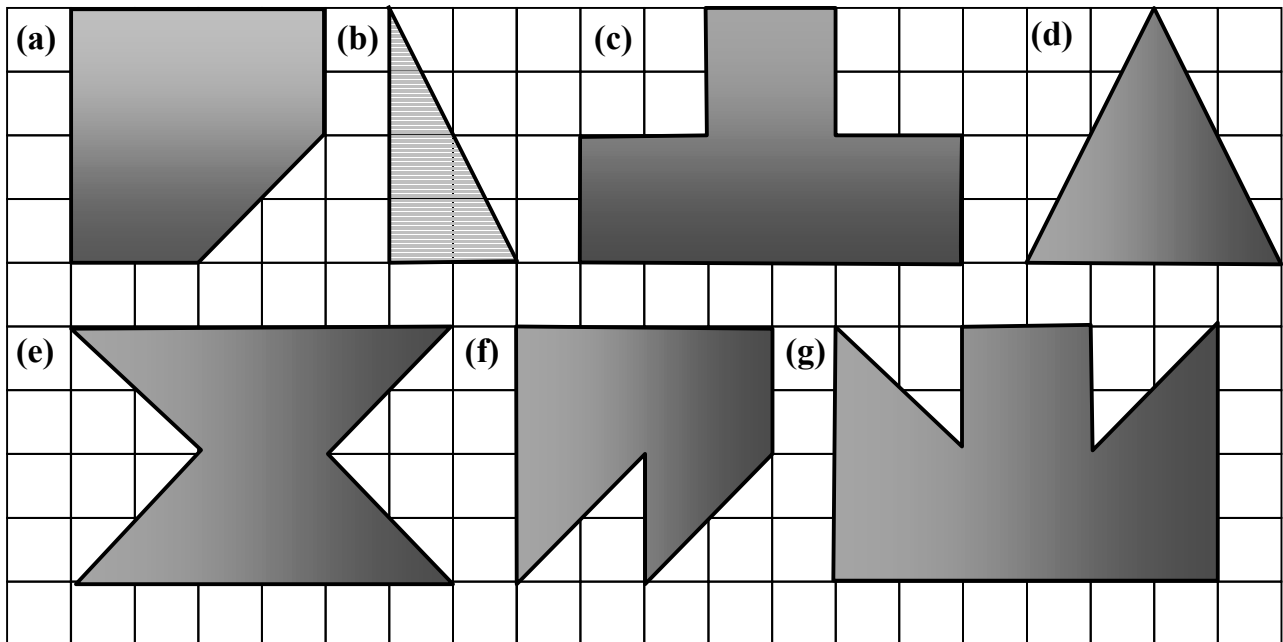


Calculate how far the ship is from its starting point. i.e. the distance shown by the broken line AB in the diagram.

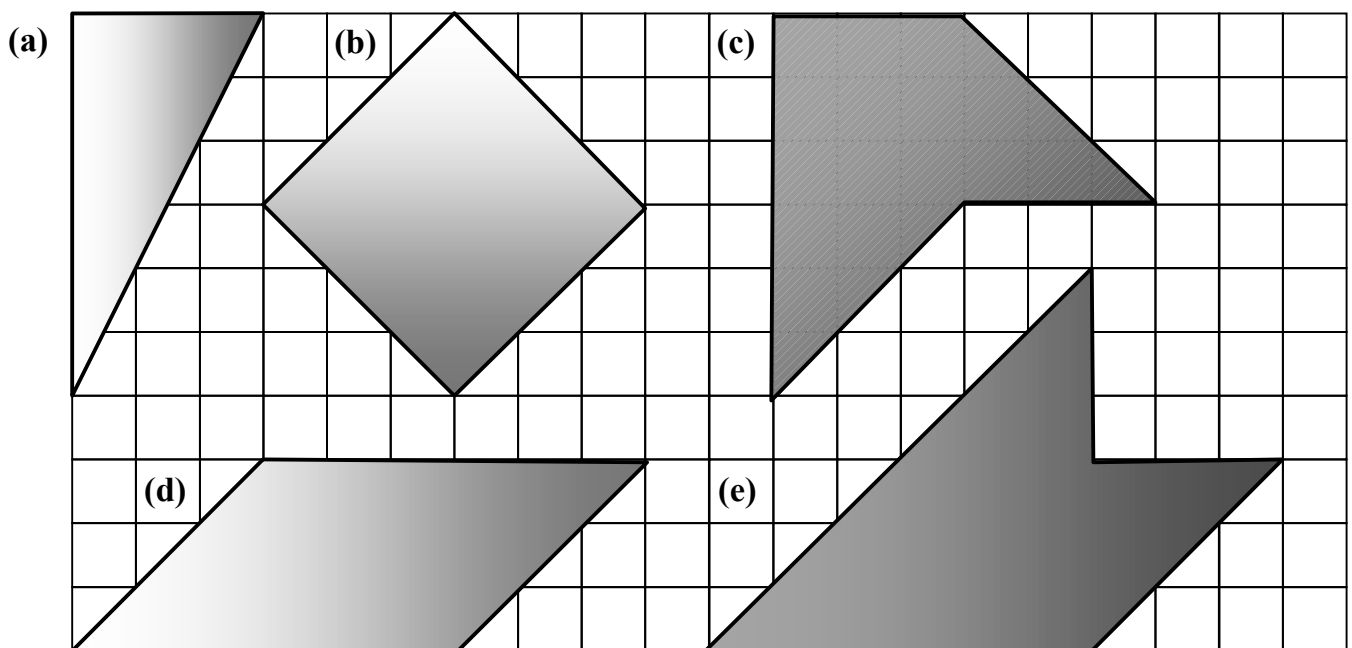
Applying Geometric Skills to Sides and Angles of a Shape

Using a Fractional Scale Factor to Enlarge or Reduce a Shape

1. Enlarge these shapes using a scale factor of $1\frac{1}{2}$ ($\frac{3}{2}$).



2. Repeat question 1 using a scale factor of $2\frac{1}{2}$ ($\frac{5}{2}$).
3. Repeat question 1 using a scale factor of $0\frac{1}{2}$ ($\frac{1}{2}$).
4. Enlarge these shapes using a scale factor of $\frac{4}{3}$.

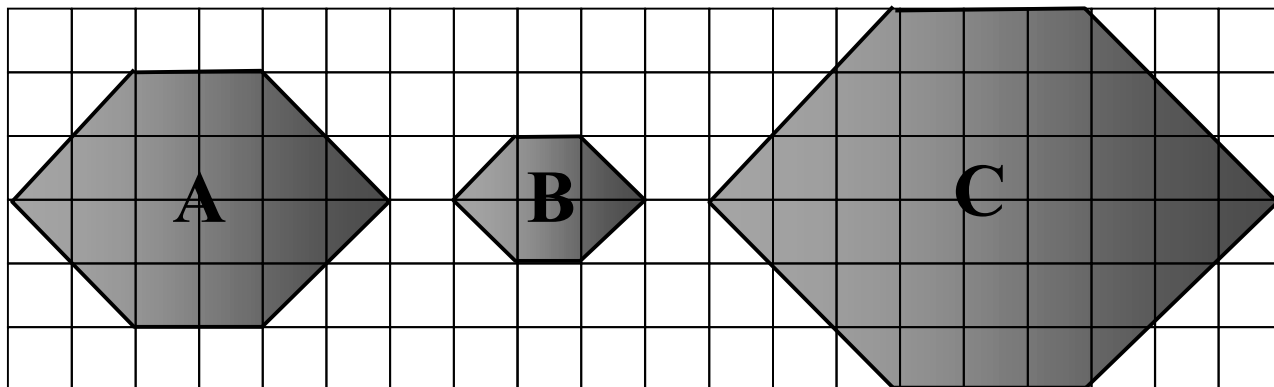


5. Repeat question 4 using a scale factor of $\frac{1}{3}$.

6. Repeat question 4 using a scale factor of $\frac{2}{3}$.

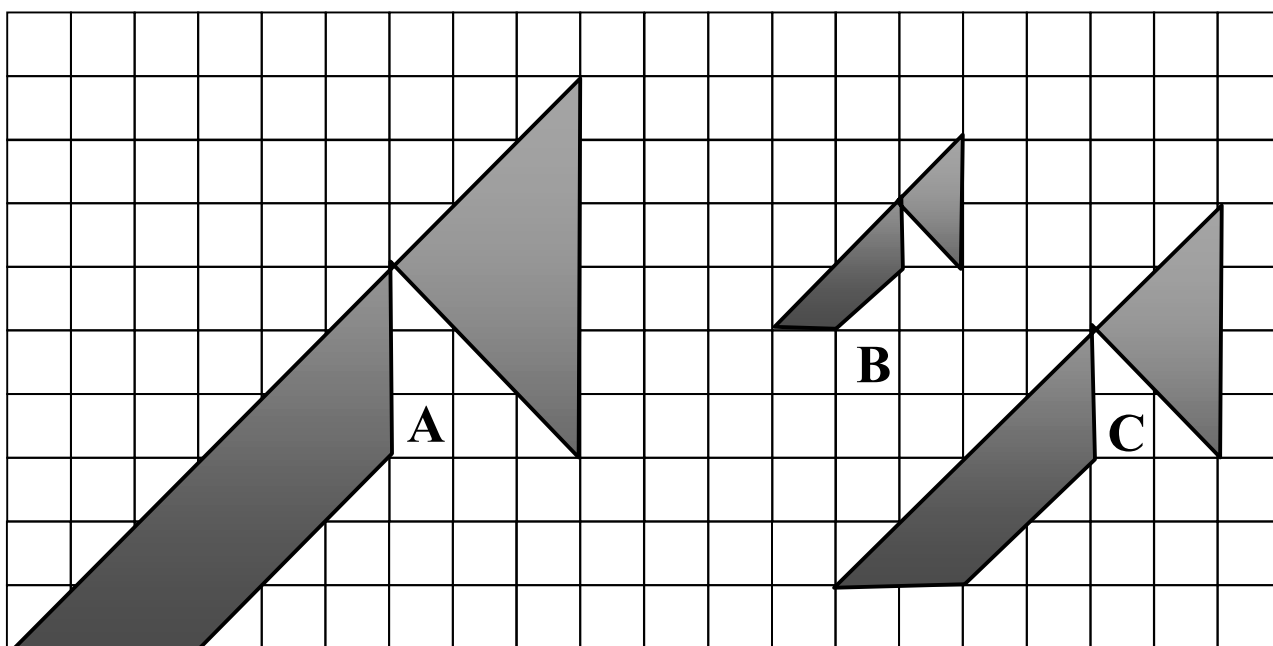
7. From the diagram below, state the scale factor that has been used to:

- (a) create shape B from A
- (b) create shape C from A
- (c) create shape A from C



8. From the diagram below, state the scale factor that has been used to:

- (a) create shape B from shape A
- (b) create shape C from shape A
- (c) create shape A from shape C
- (d) create shape B from shape C

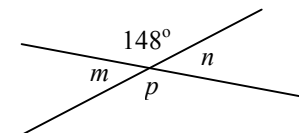
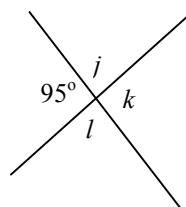
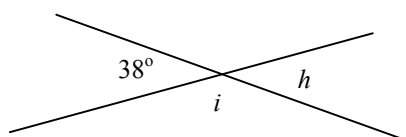
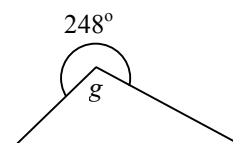
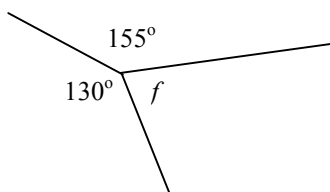
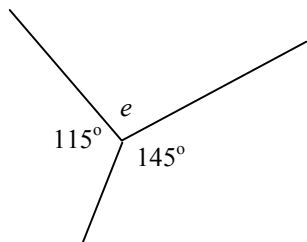
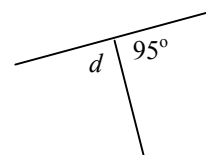
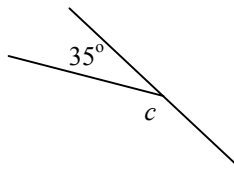
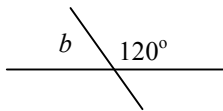
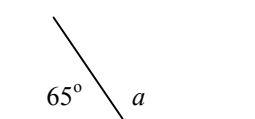


Applying Geometric Skills to Sides and Angles of a Shape

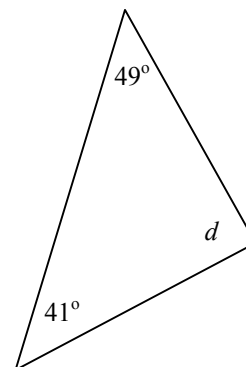
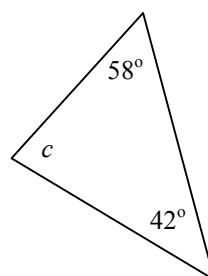
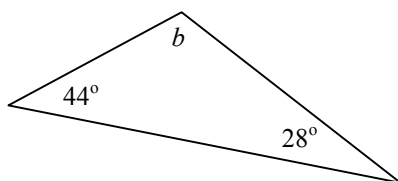
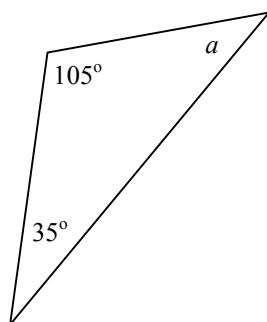
Using Parallel Lines, Symmetry and Circle Properties to Calculate Angles

REMINDERS

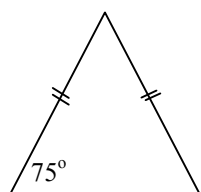
1. Calculate the size of each lettered angle below:



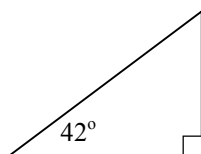
2. Calculate the size of each missing angle in the triangles below:



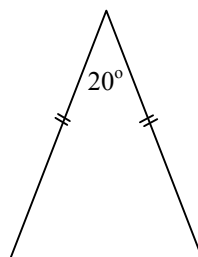
3. Copy each triangle below and fill in all the missing angles:



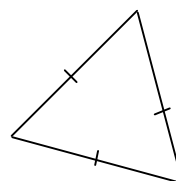
(a)



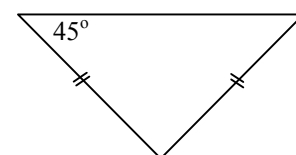
(b)



(c)



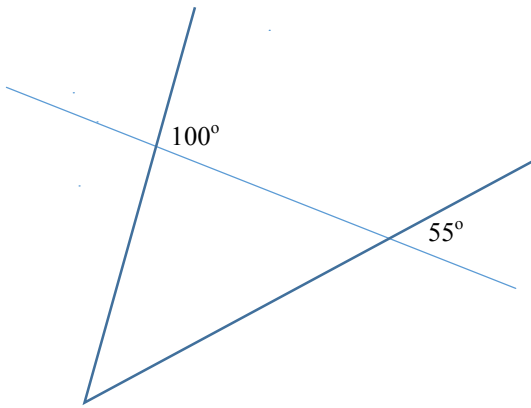
(d)



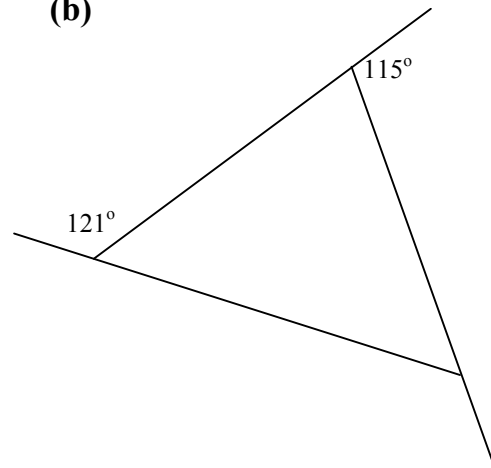
(e)

4. Copy these diagrams and fill in the sizes of all the missing angles.

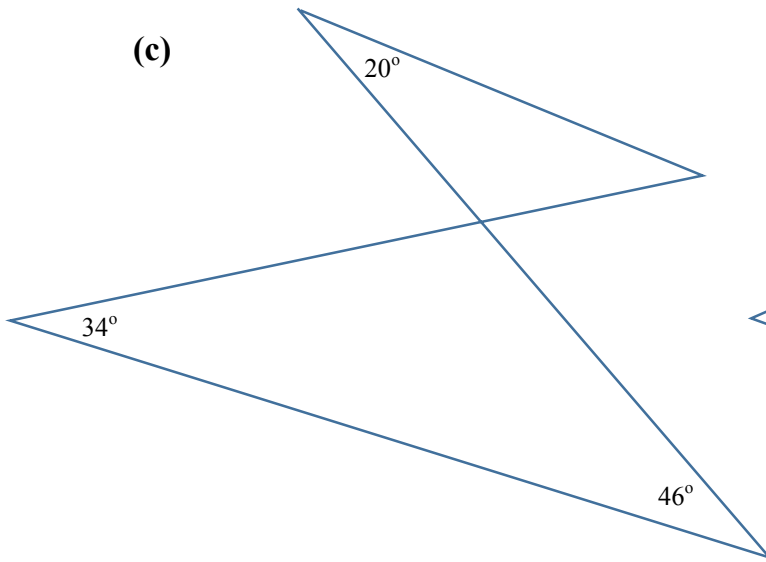
(a)



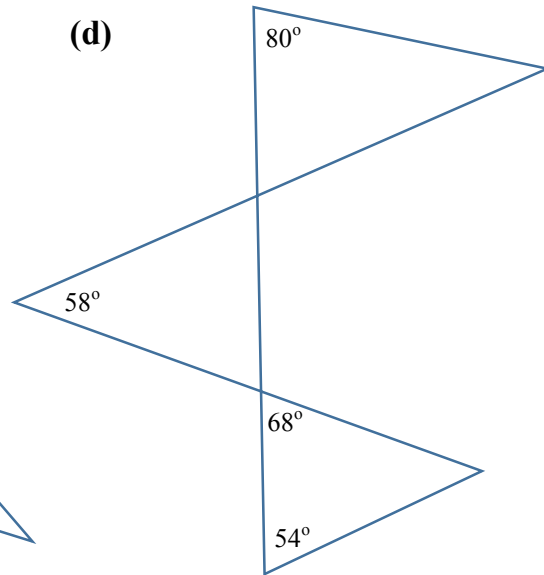
(b)



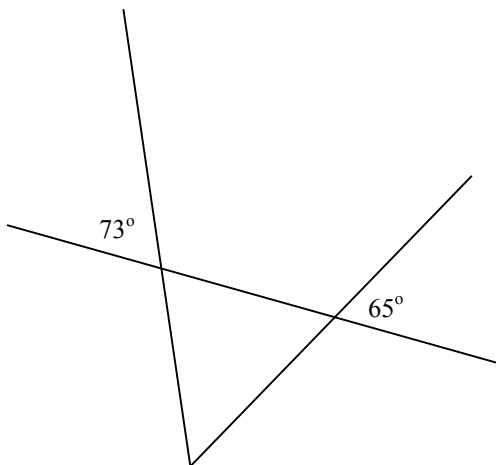
(c)



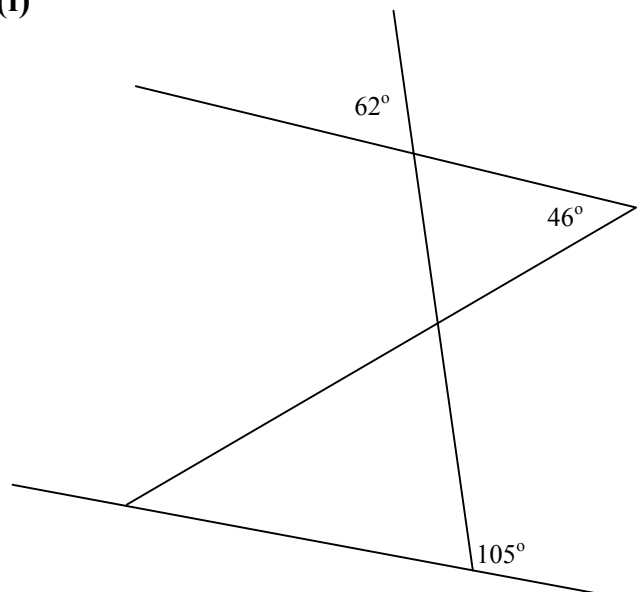
(d)



(e)



(f)



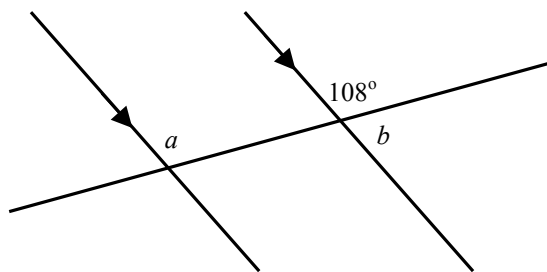
Applying Geometric Skills to Sides and Angles of a Shape

Using Parallel Lines, Symmetry and Circle Properties to Calculate Angles

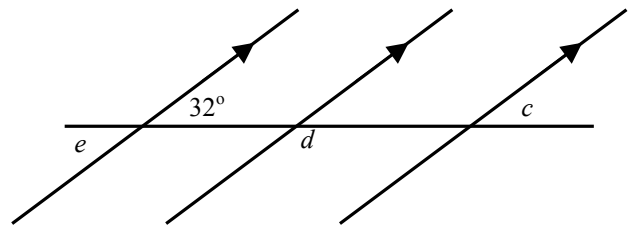
PART 1

1. Calculate the sizes of the angles marked with letters in these diagrams.

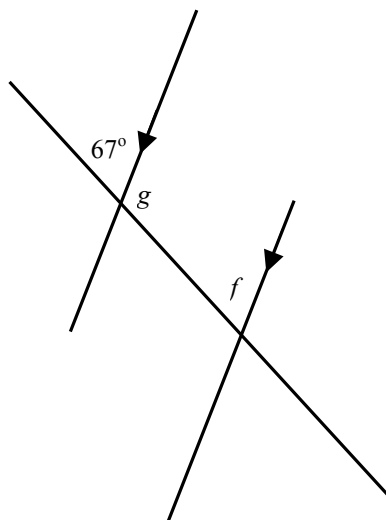
(a)



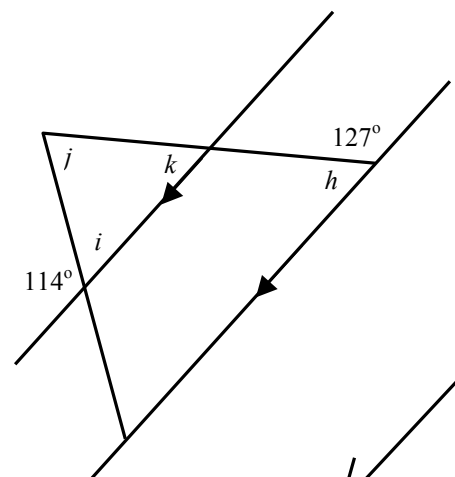
(b)



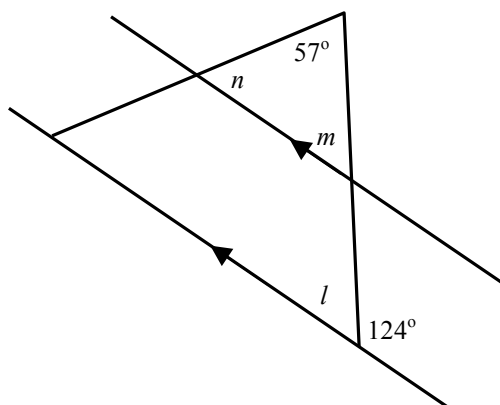
(c)



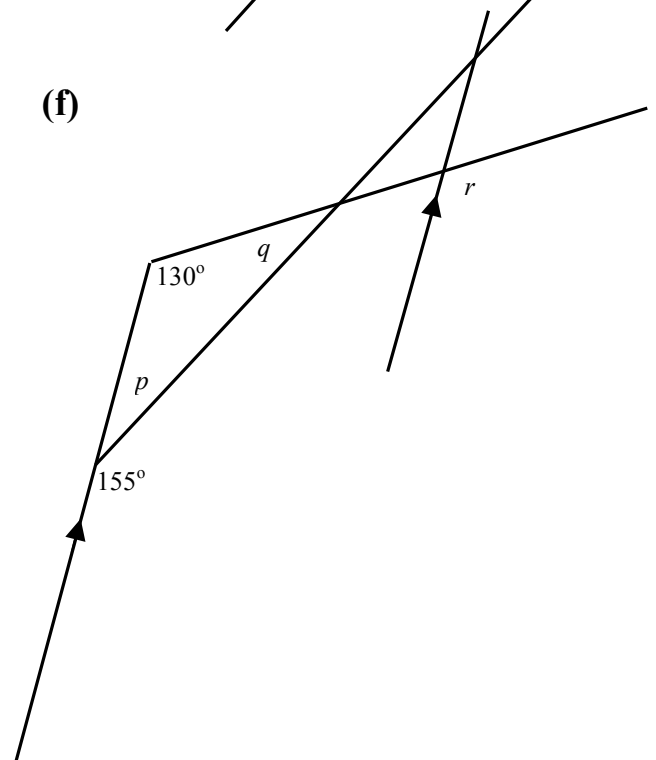
(d)



(e)

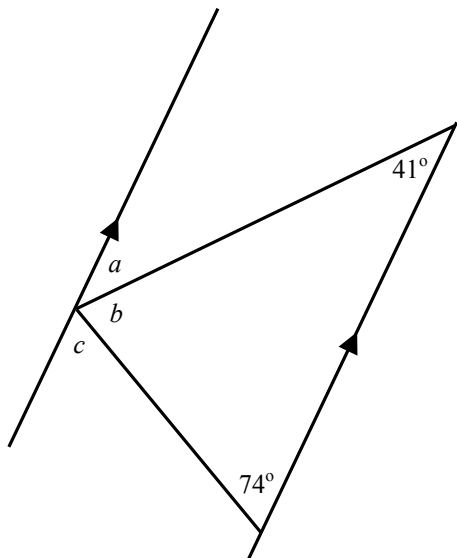


(f)

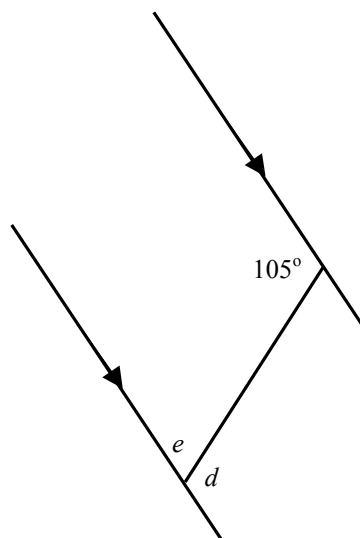


2. Calculate the sizes of the angles marked a to i in these diagrams.

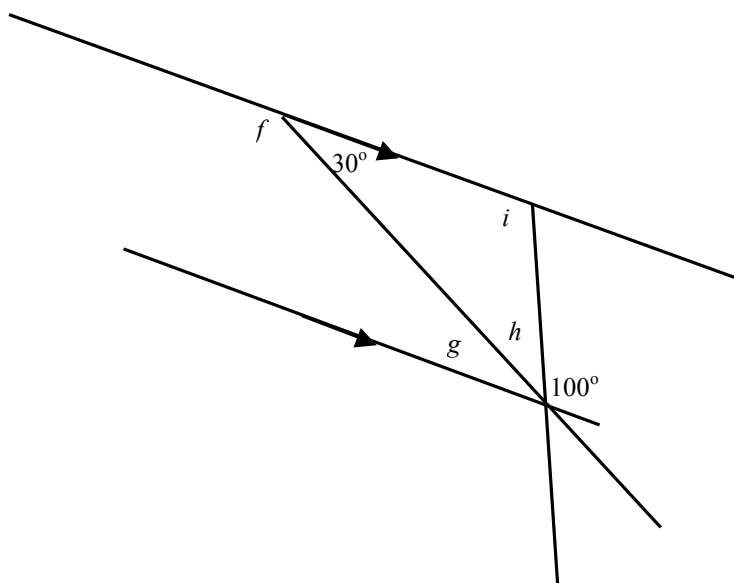
(a)



(b)

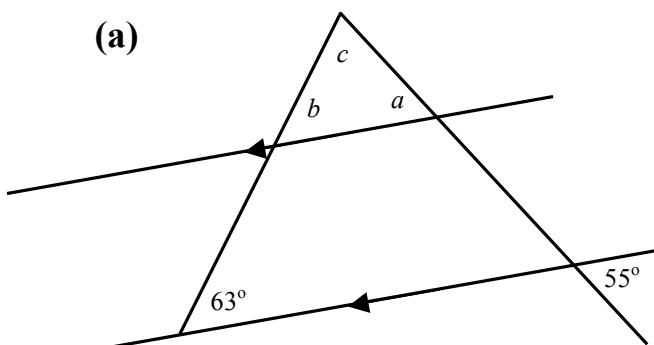


(c)

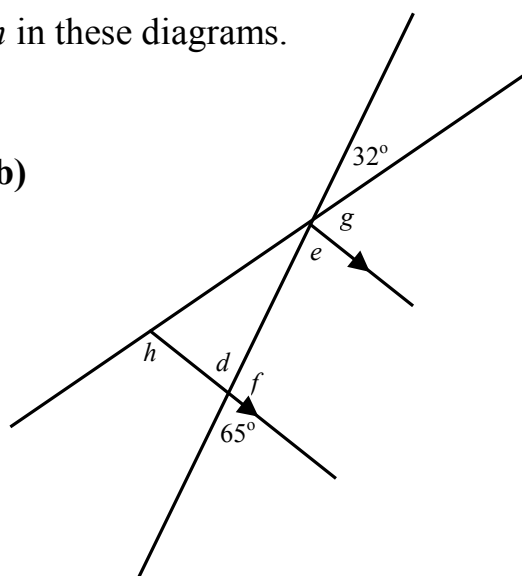


3. Calculate the sizes of the angles marked a to h in these diagrams.

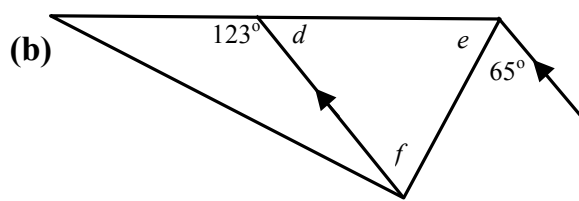
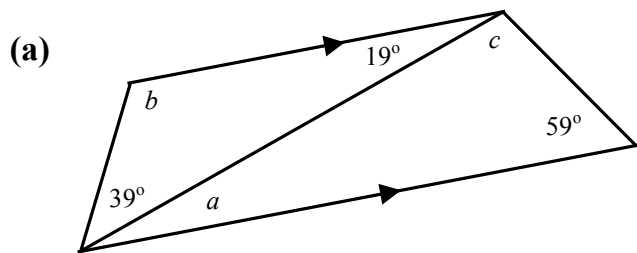
(a)



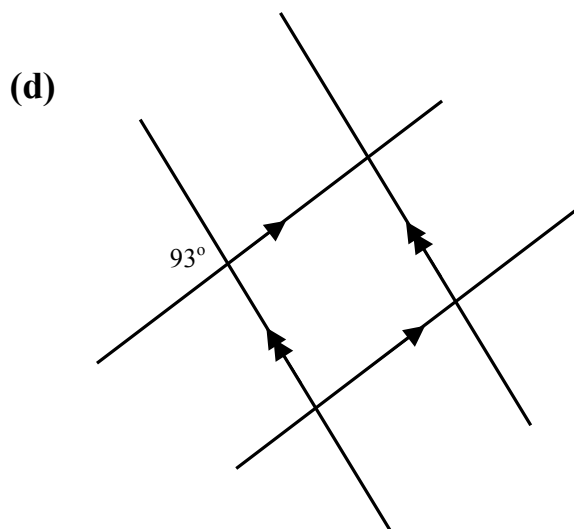
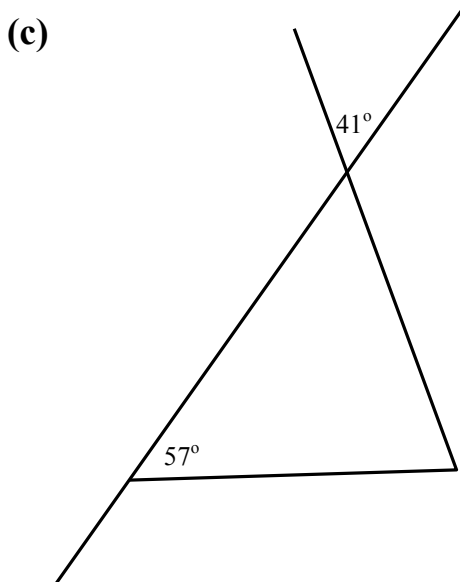
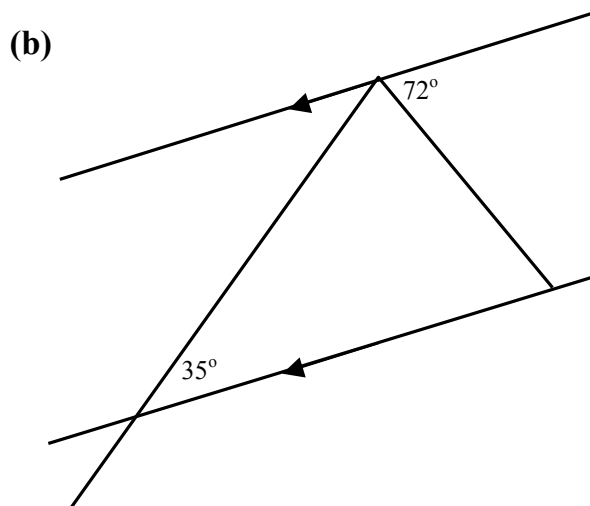
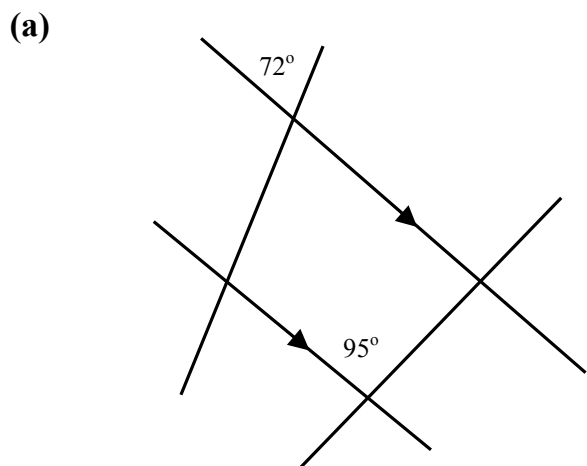
(b)



4. Calculate the sizes of the angles marked a to f in these diagrams.

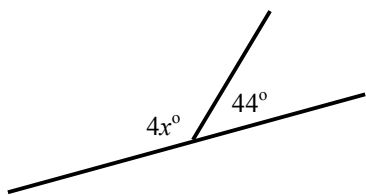


5. Copy these diagrams and fill in the sizes of as many angles as you can.

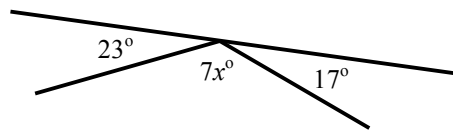


6. Find the value of x in each of these diagrams:

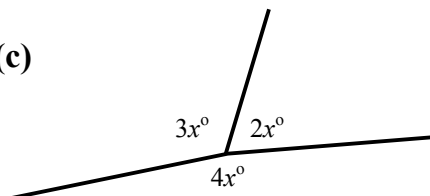
(a)



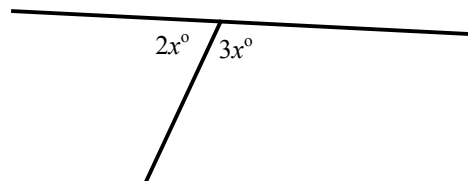
(b)



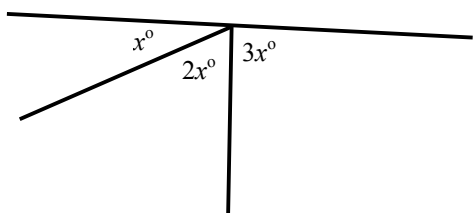
(c)



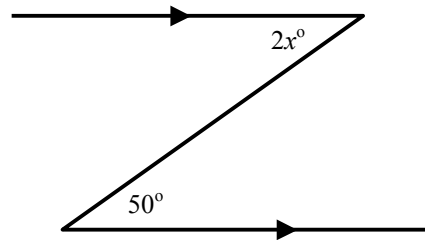
(d)



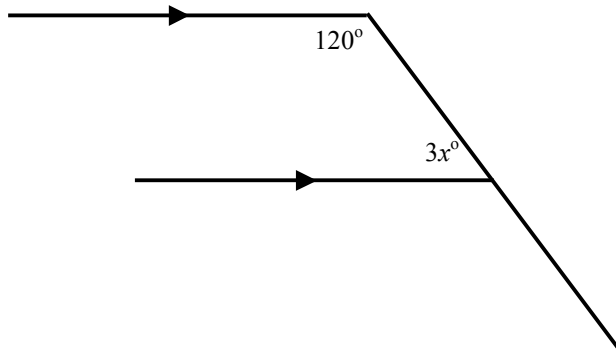
(e)



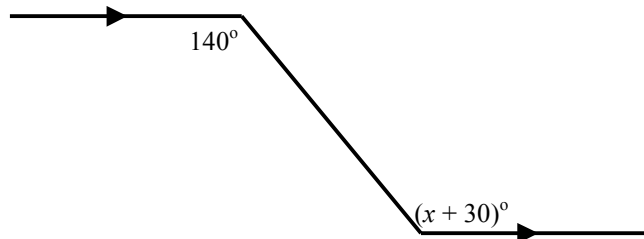
(f)



(g)



(h)



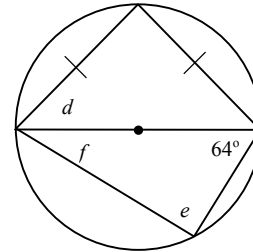
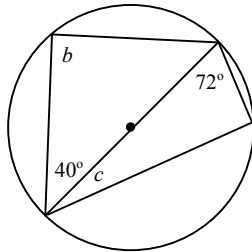
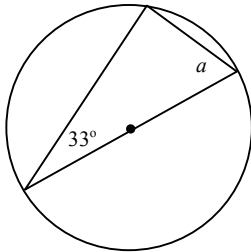
Applying Geometric Skills to Sides and Angles of a Shape

Using Parallel Lines, Symmetry and Circle Properties to Calculate Angles

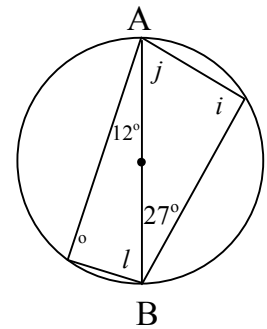
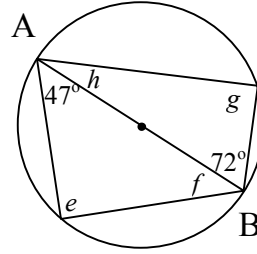
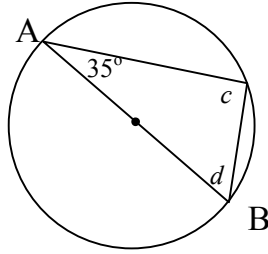
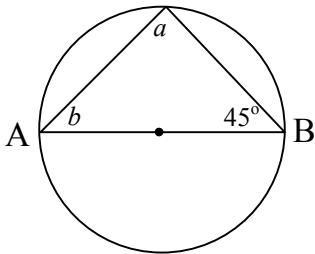
PART 2

- marks the centre of each circle

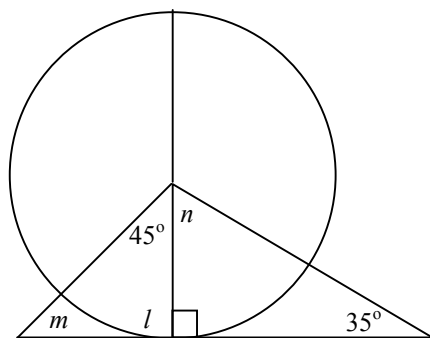
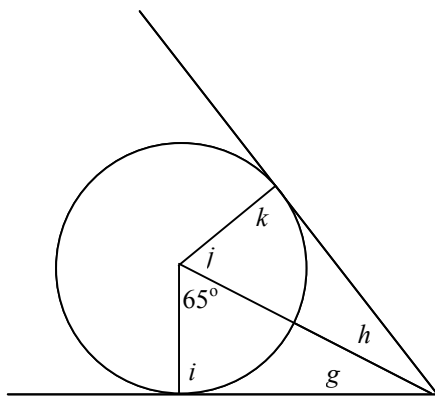
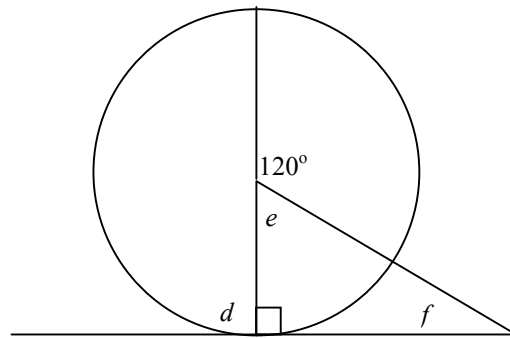
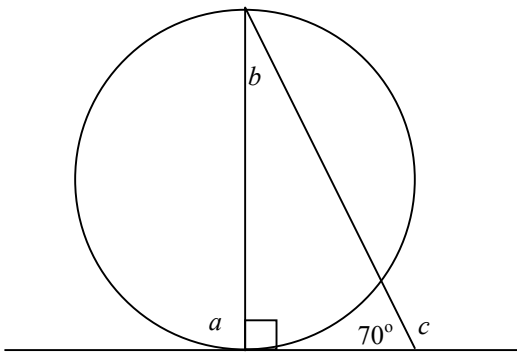
1. Calculate the size of each of the angles marked with letters in the diagrams below.



2. In each of the diagrams below AB is a diameter. Find the missing angles in each diagram.



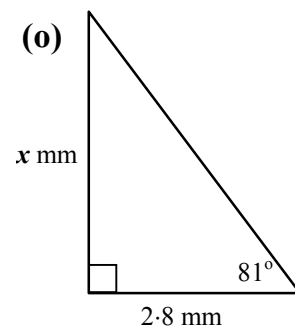
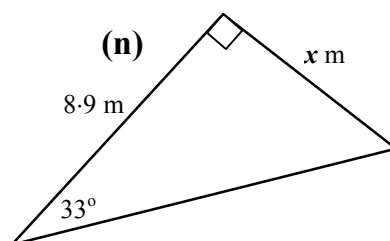
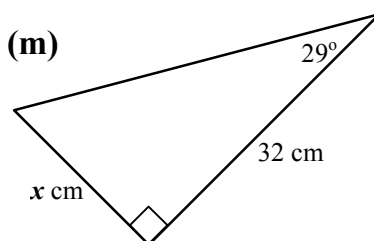
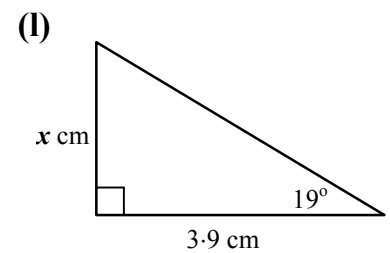
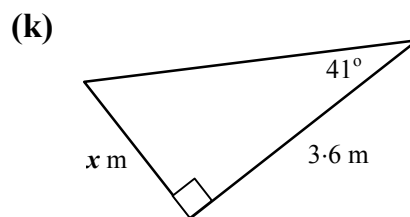
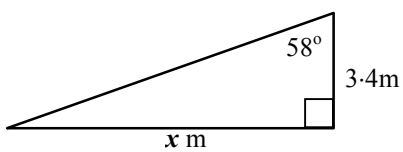
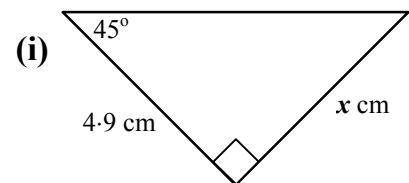
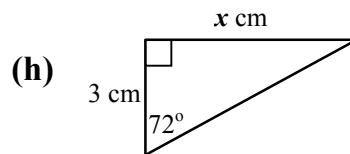
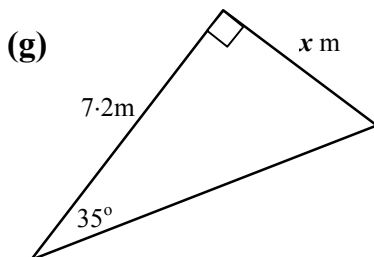
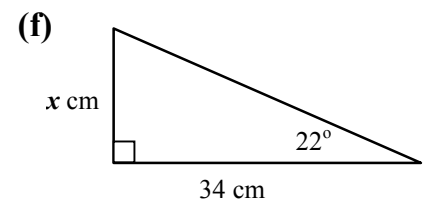
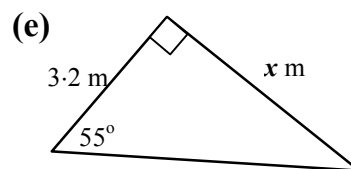
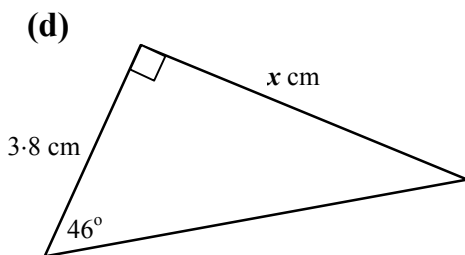
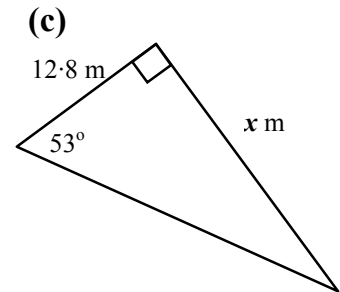
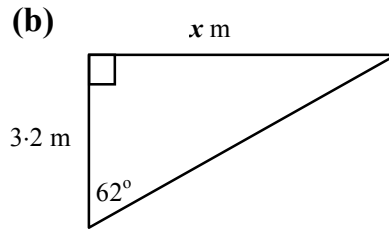
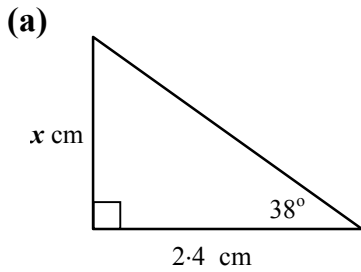
3. Calculate the sizes of the angles marked a, b, \dots, n , in the diagrams below.



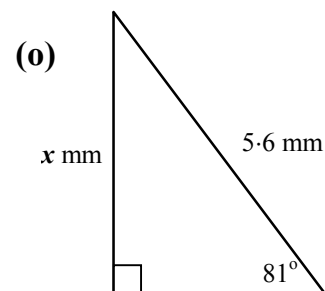
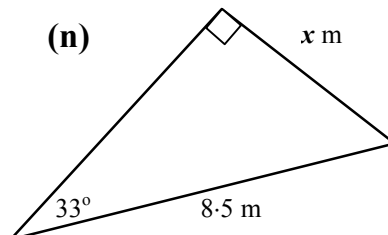
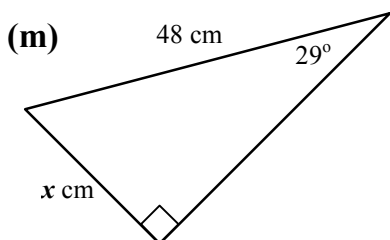
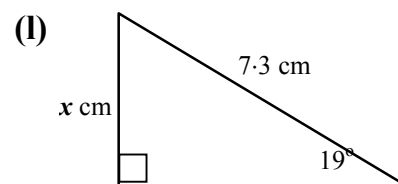
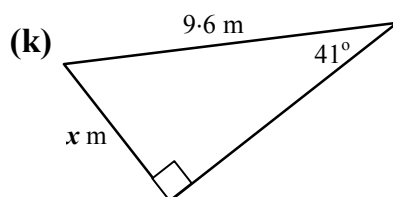
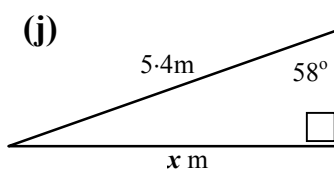
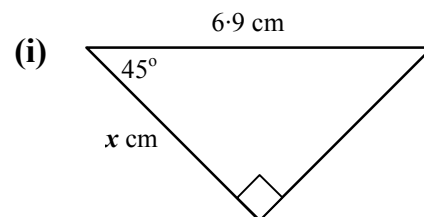
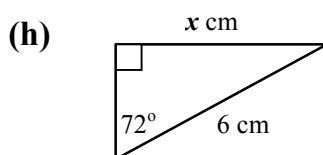
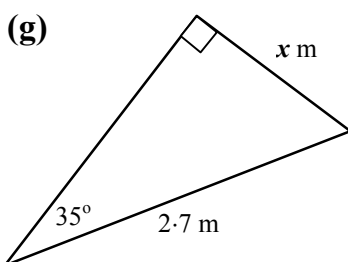
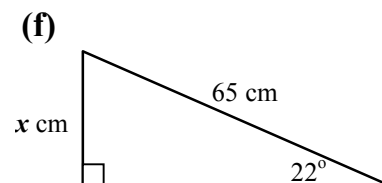
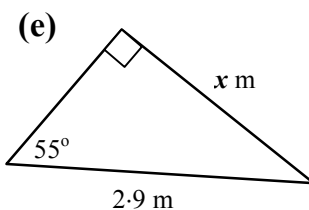
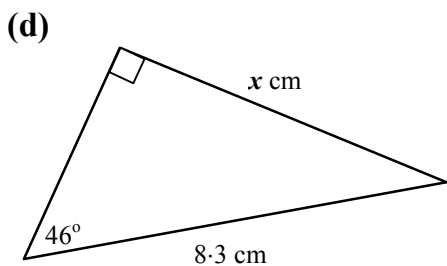
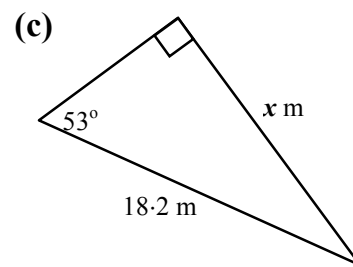
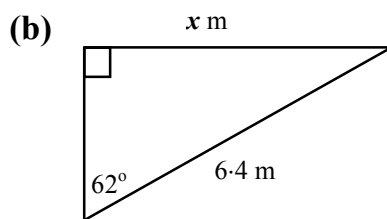
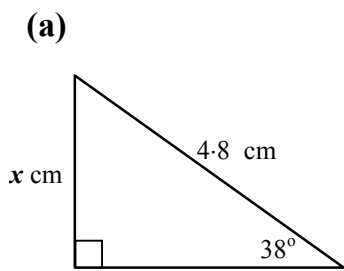
Applying Trigonometric Skills to Right-angled Triangles

Calculating a side in a right-angled triangle

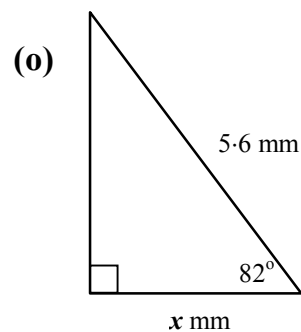
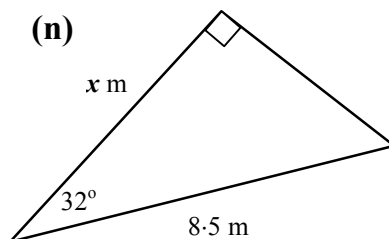
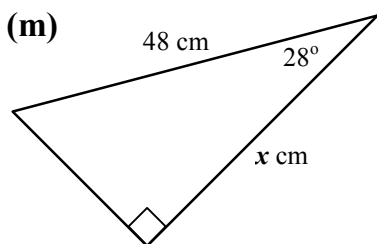
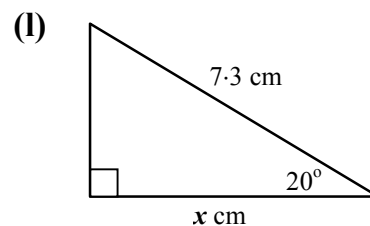
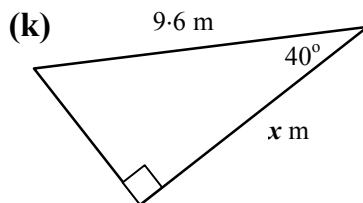
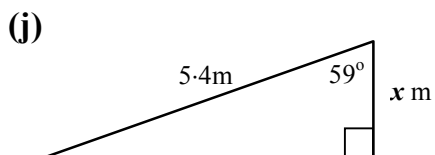
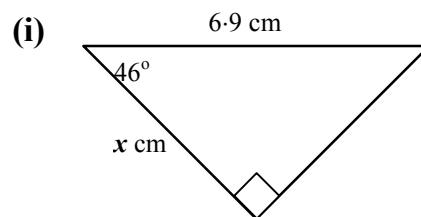
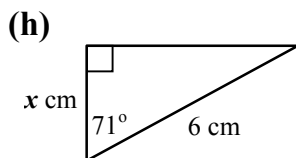
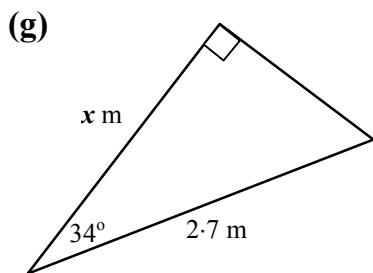
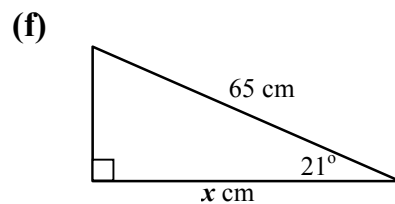
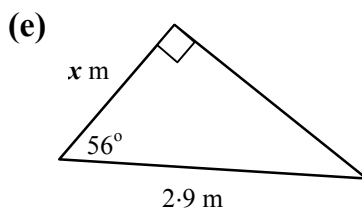
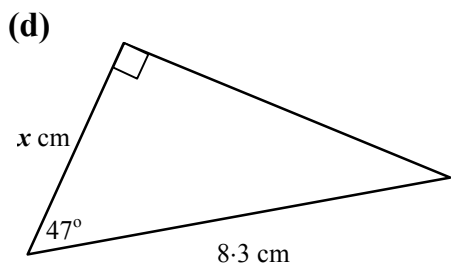
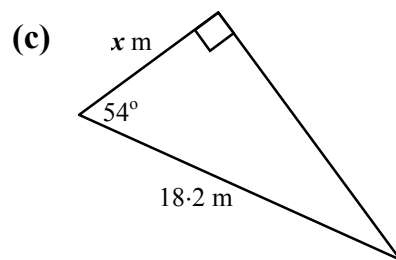
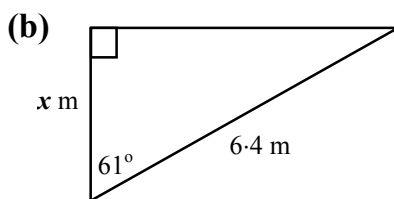
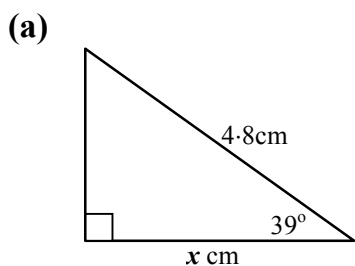
1. Use the **tangent** ratio to calculate the length of the side marked x in these right-angled triangles.



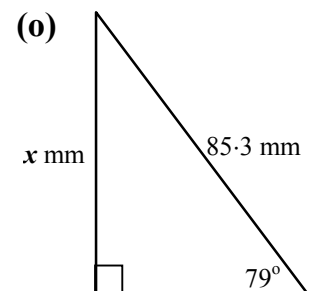
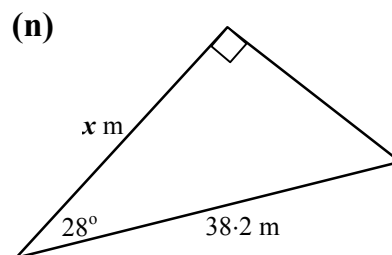
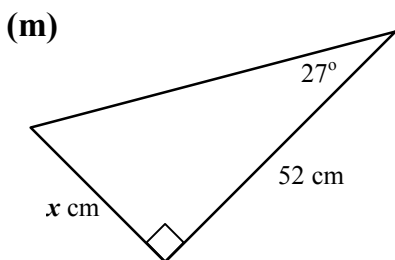
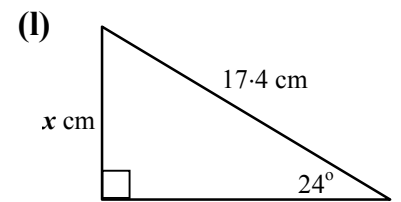
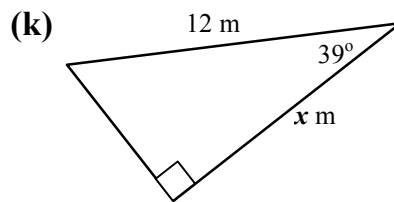
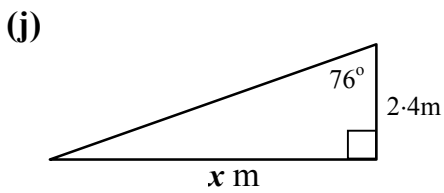
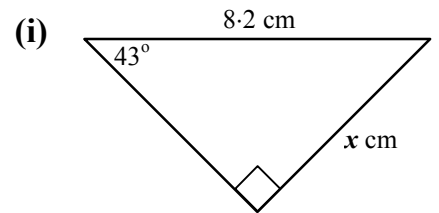
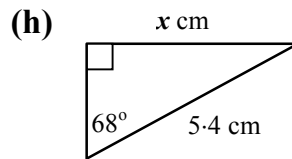
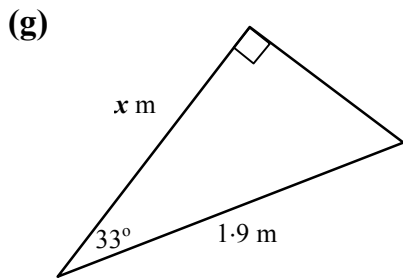
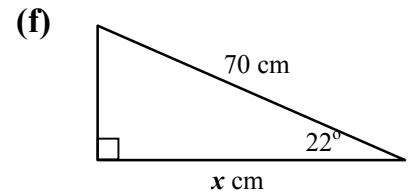
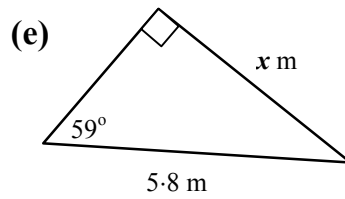
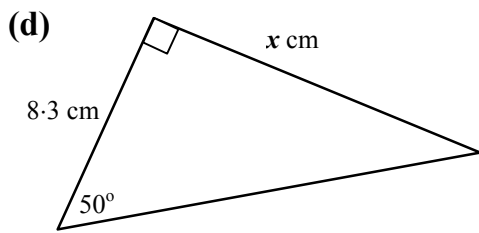
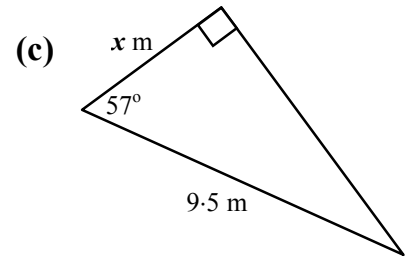
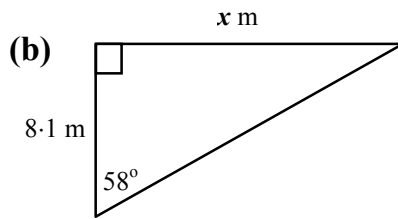
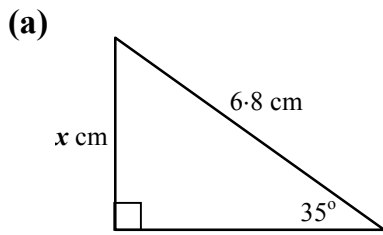
2. Use the **sine** ratio to calculate the length of the side marked x in these right-angled triangles.



3. Use the **cosine** ratio to calculate the length of the side marked x in these right-angled triangles.



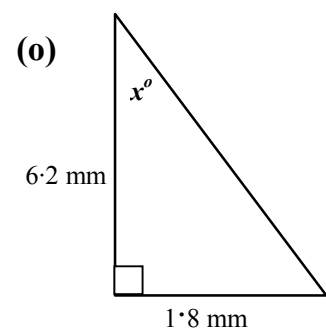
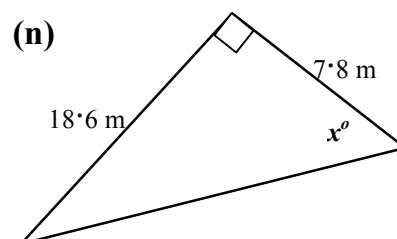
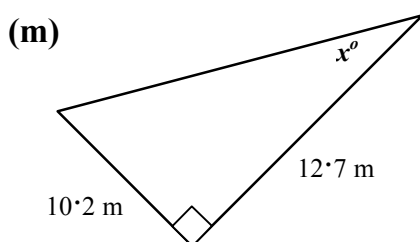
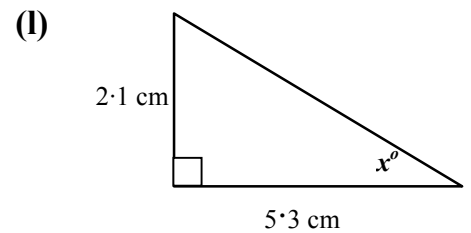
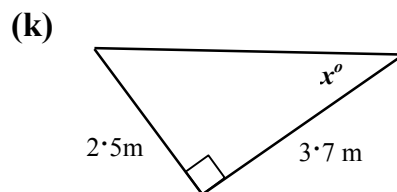
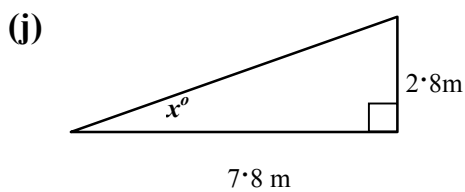
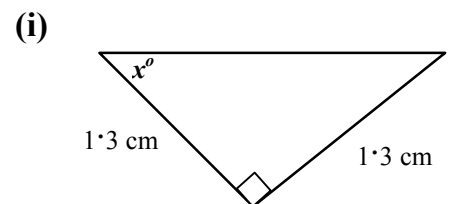
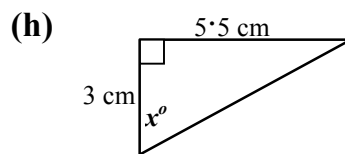
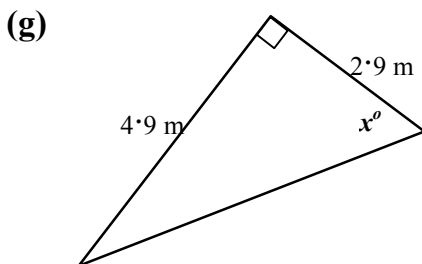
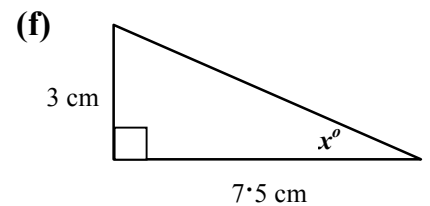
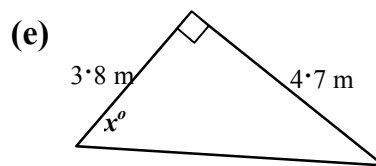
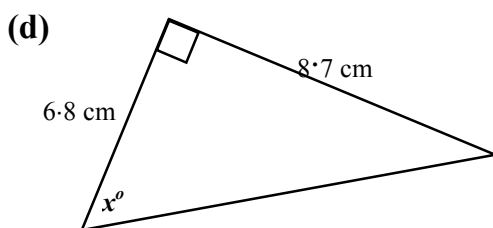
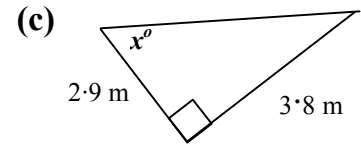
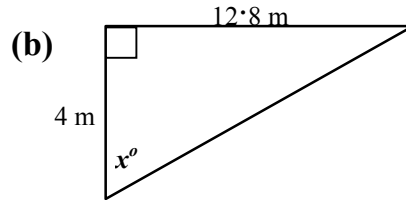
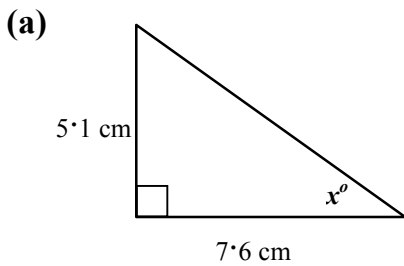
4. Calculate the length of the side marked x in these right-angled triangles. You will have to choose which ratio to use.



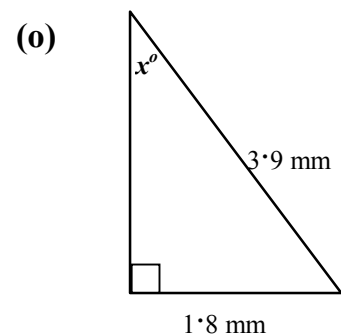
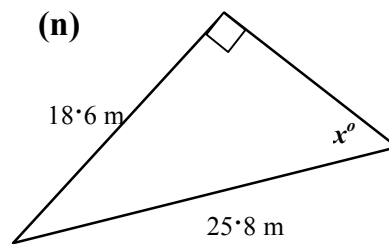
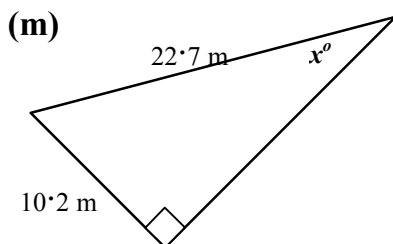
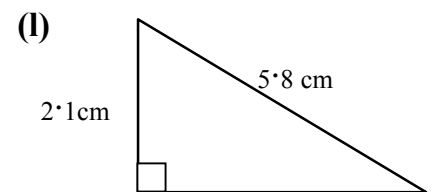
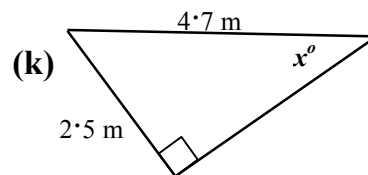
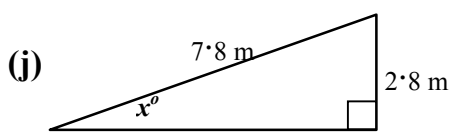
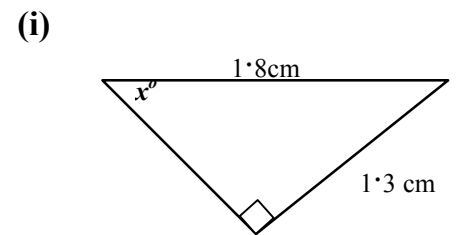
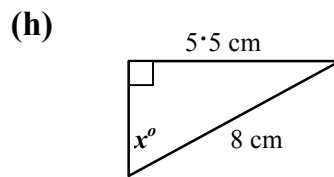
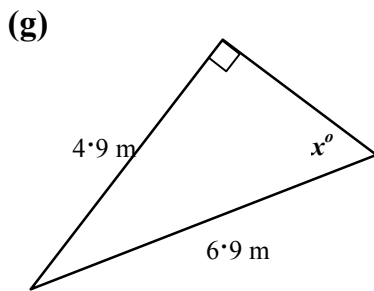
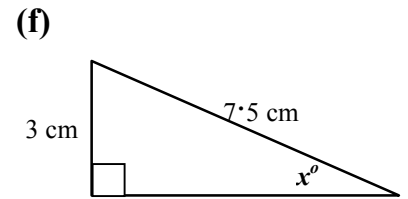
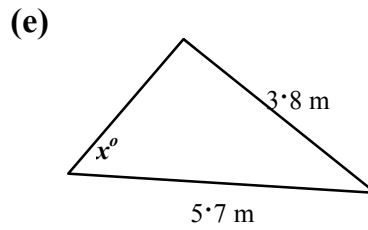
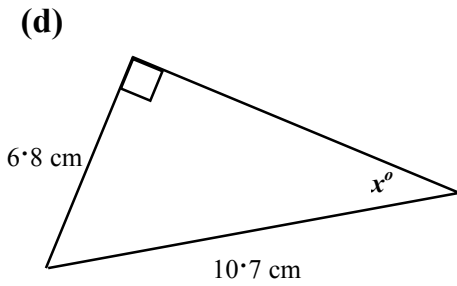
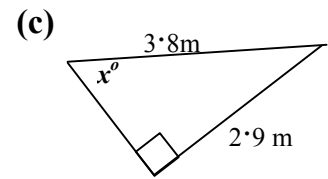
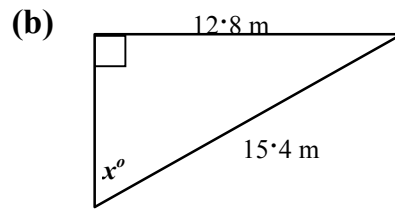
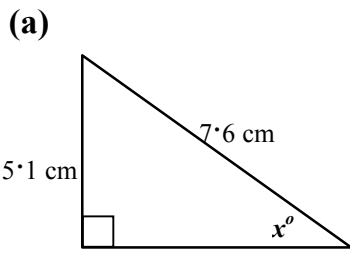
Applying Trigonometric Skills to Right-angled Triangles

Calculating an angle in a right-angled triangle

1. Use the **Tangent** ratio to calculate the size of the angle marked x° in these right-angled triangles.

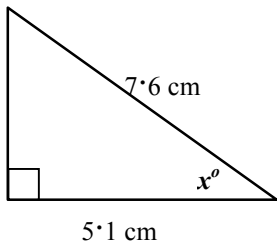


2. Use the **Sine** ratio to calculate the size of the angle marked x° in these right-angled triangles.

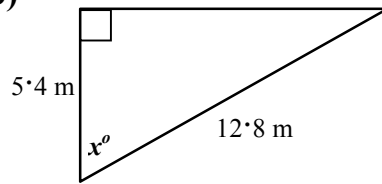


3. Use the **Cosine** ratio to calculate the size of the angle marked x° in these right-angled triangles.

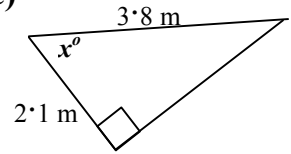
(a)



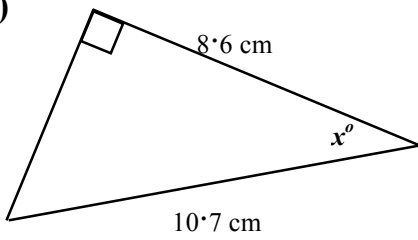
(b)



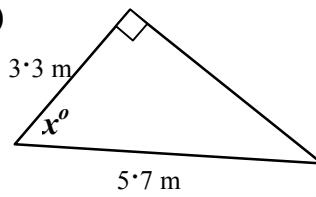
(c)



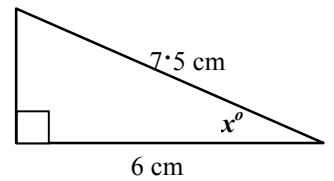
(d)



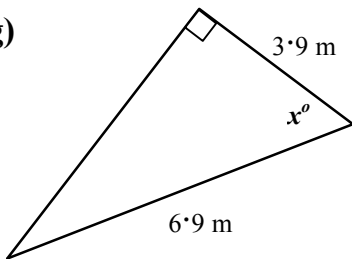
(e)



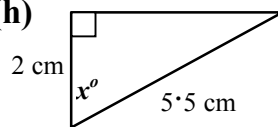
(f)



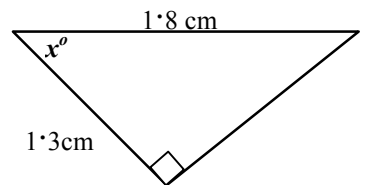
(g)



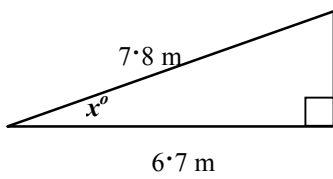
(h)



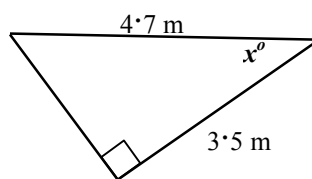
(i)



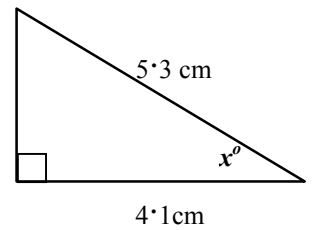
(j)



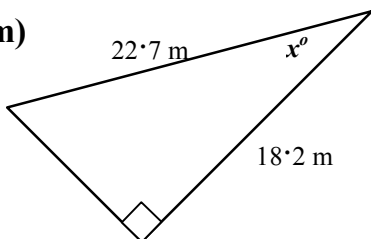
(k)



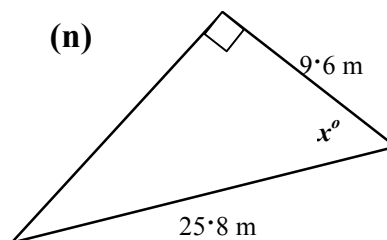
(l)



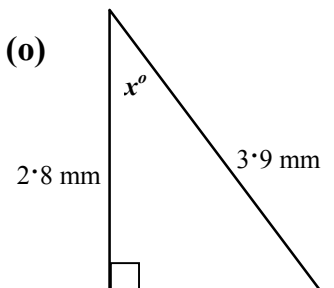
(m)



(n)

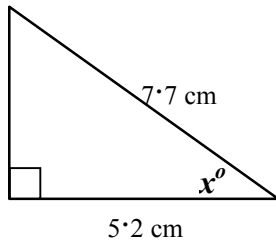


(o)

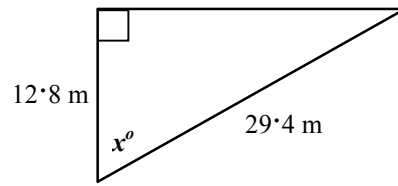


4. Calculate the size of the angle marked x° in these right-angled triangles. You will have to choose which ratio to use.

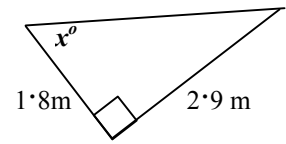
(a)



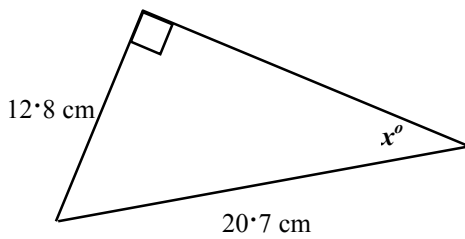
(b)



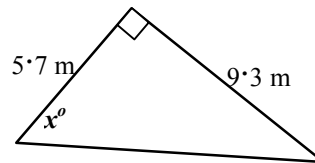
(c)



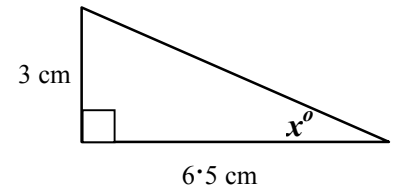
(d)



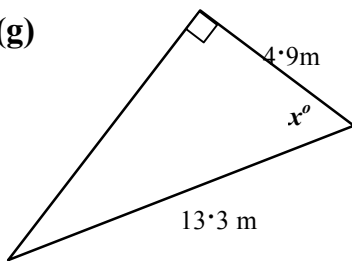
(e)



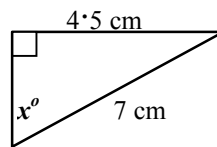
(f)



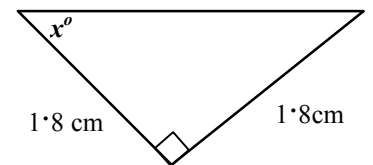
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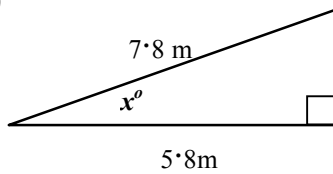
(h)



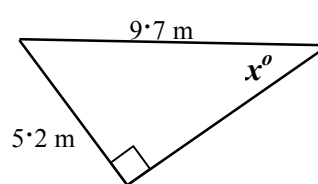
(i)



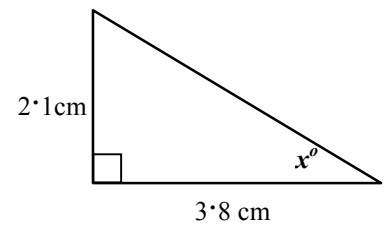
(j)



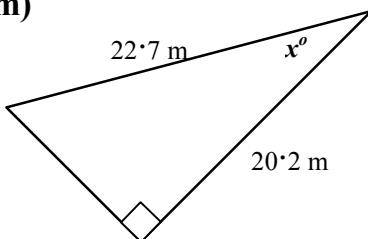
(k)



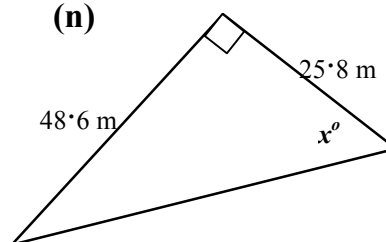
(l)



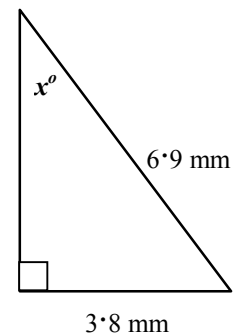
(m)



(n)



(o)



Applying Trigonometric Skills to Right-angled Triangles

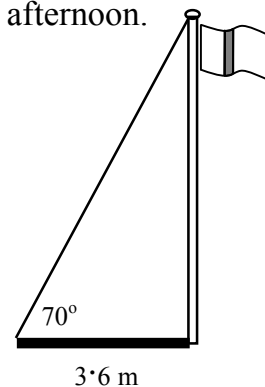
Problem Solving Examples

1. This diagram shows the shadow cast by a flagpole early in the afternoon.

The shadow's length is 3.6 metres.

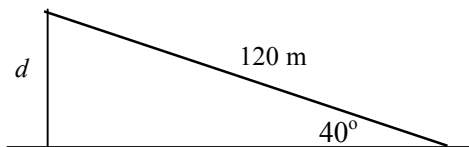
What is the height of the flagpole?

(Give your answer to 1 d.p.)



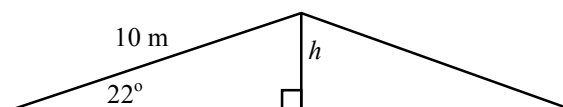
2. A 120 m long anchor holds a fishing boat in position. The line makes an angle of 40° with the sea floor.

How deep is the sea at this position?



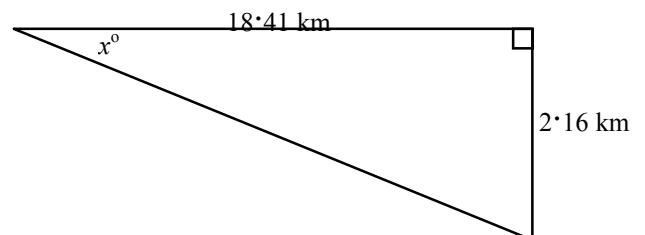
3. The diagram shows the symmetrical cross-section of a roof.

Find the height, h .

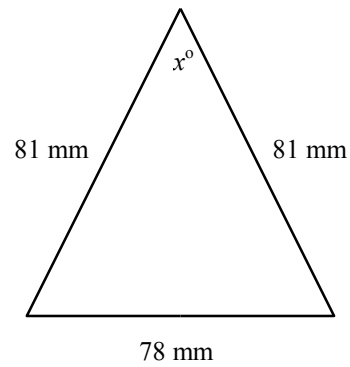


4. An aircraft making a steady descent decreases height by 2.16 km in 18.41 km.

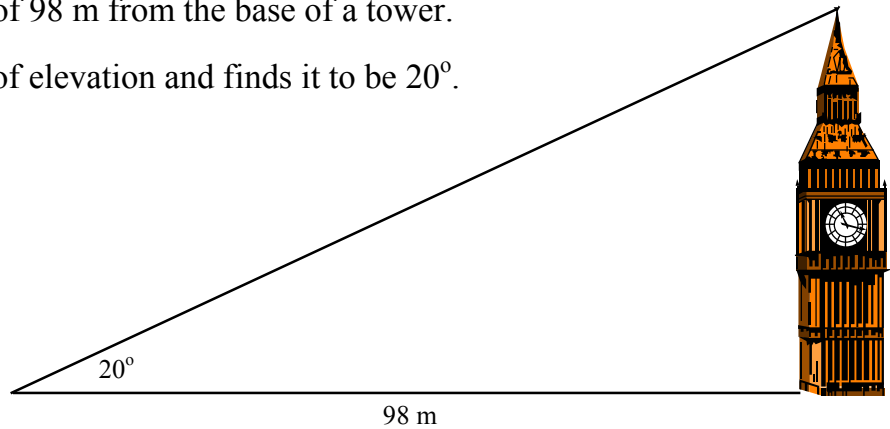
What is the angle of descent, x° ?



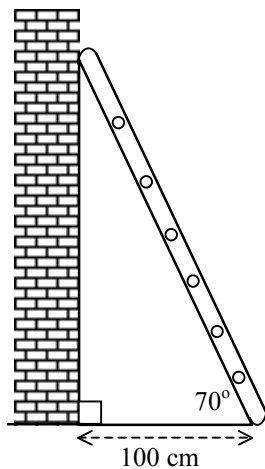
5. Find angle x in this isosceles triangle



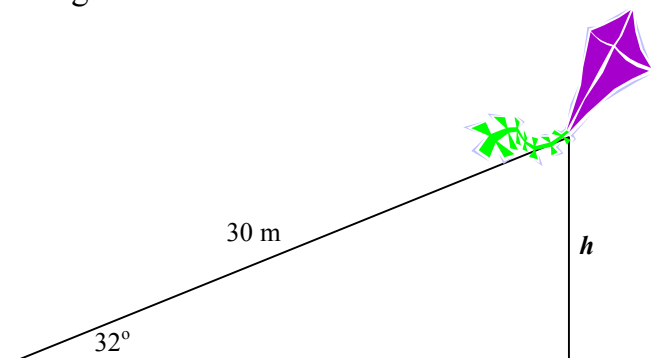
6. Peter stands a distance of 98 m from the base of a tower.
He measures the angle of elevation and finds it to be 20° .
How high is the tower?



7. A ladder rests against a wall with its foot 100 cm from the wall.
How high up the wall does the ladder reach?



8. Eddie is flying his kite. The string is at an angle of 32° to the horizontal.
He lets out 30 metres of string.
How high is the kite above the ground?

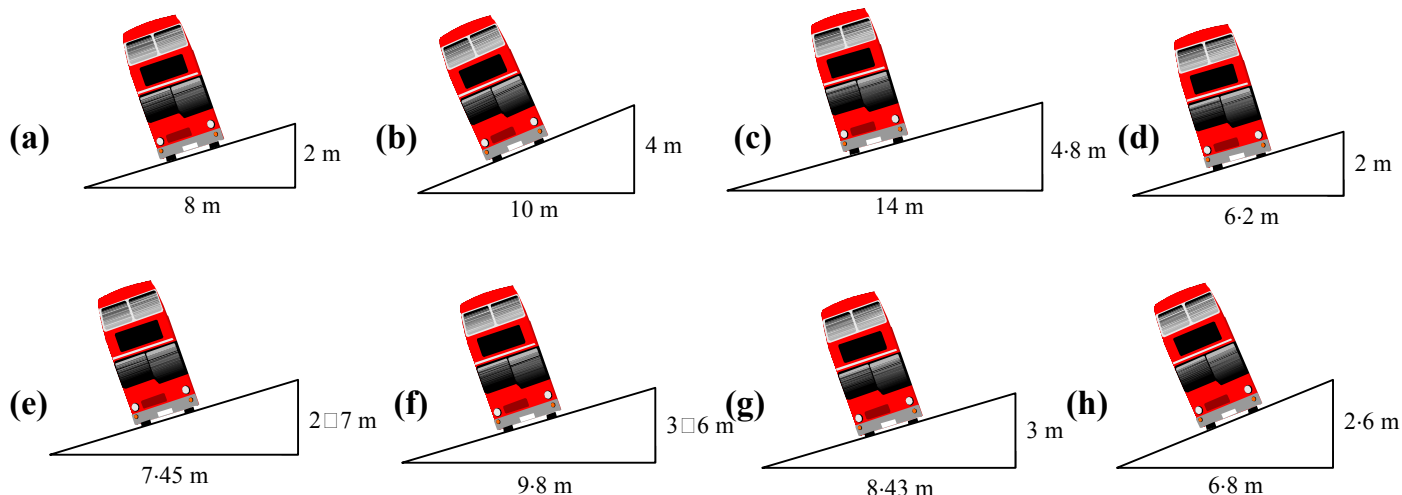


9. To test the stability of a bus a tilting platform is used.

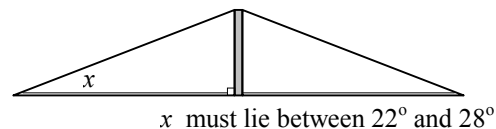
It is known that a bus will topple if the angle between the platform and the ground is greater than 20° .

Which of the buses below would topple?

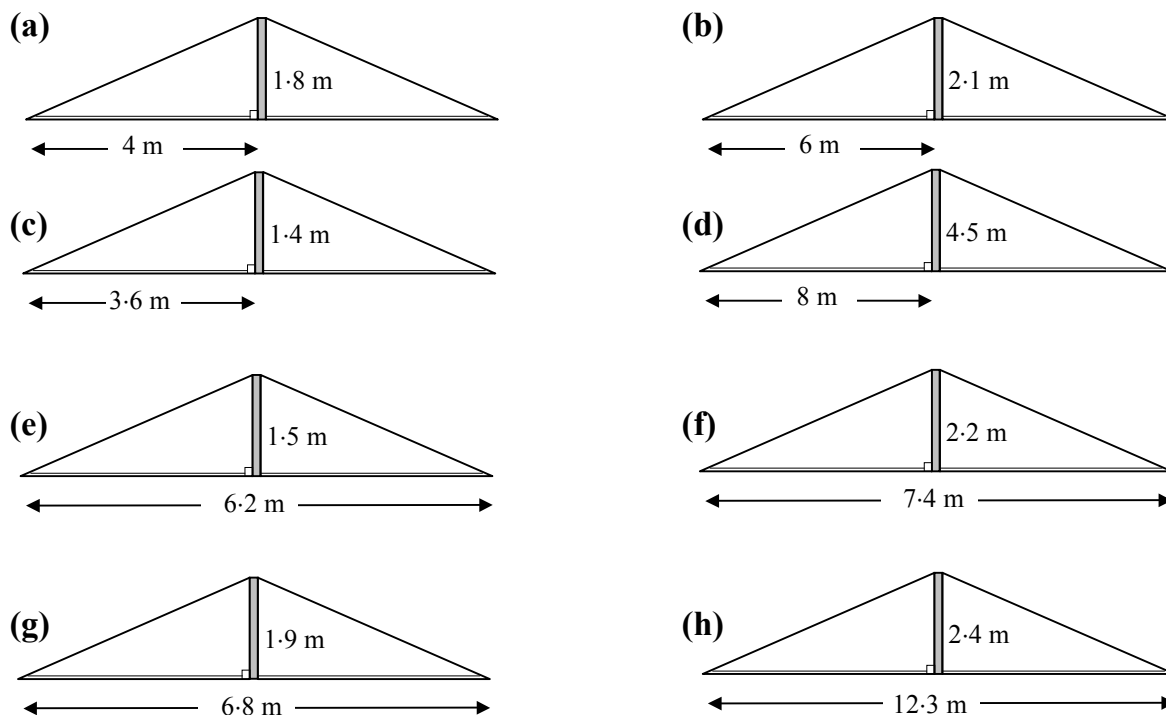
Each answer must be accompanied with the appropriate working.



10. To comply with building regulations a roof must have an angle of between 22° and 28° to the horizontal (see diagram opposite).



Which of the roofs below comply, and which do not comply with building regulations?

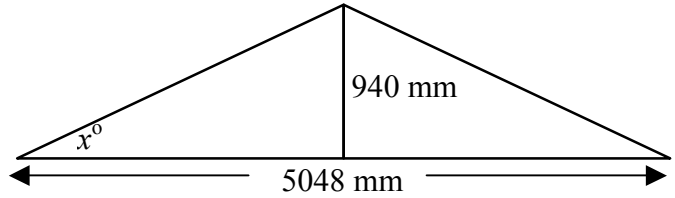


Applying Trigonometric Skills to Right-angled Triangles

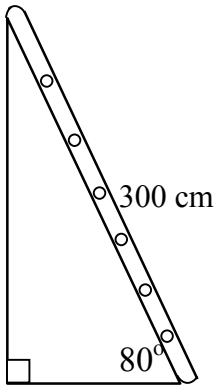
EXAM QUESTIONS

1. A manufacturer of concrete roof tiles states that to be suitable for concrete tiles the angle of a roof (pitch) must be greater than 21° .

This roof is symmetrical. Is this roof suitable for concrete tiles?

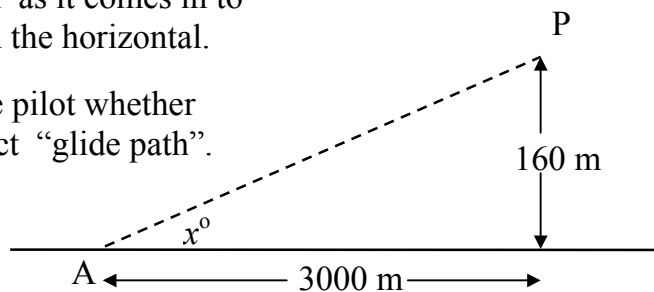


2. A ladder 300 cm long rests against a wall at an angle of 80° . How high up the wall does the ladder reach?



3. The angle of approach, x° , of a plane P as it comes in to land should be between 3° and 5° with the horizontal.

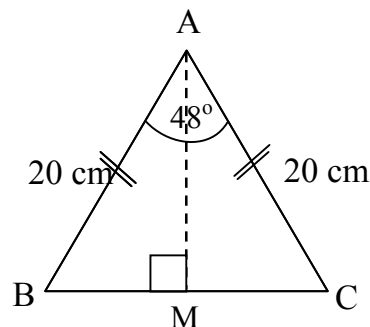
The air traffic controller has to tell the pilot whether he is too high, too low or on the correct “glide path”.



An incoming plane is 3000 m away from its landing point A and is at a height of 160 m as shown in the diagram.

Is the plane too high, too low or on the correct “glide path”?

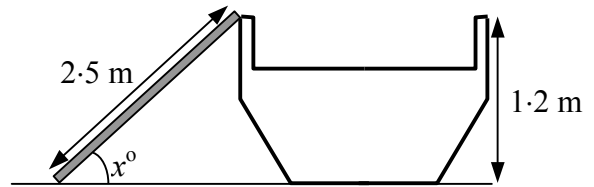
4. In triangle ABC, angle BAC is 48° . Calculate the length of BC.



5. The rim of a rubbish skip is 1.2 m from the ground.

A workman places a plank 2.5 m long so that it just reaches the rim.

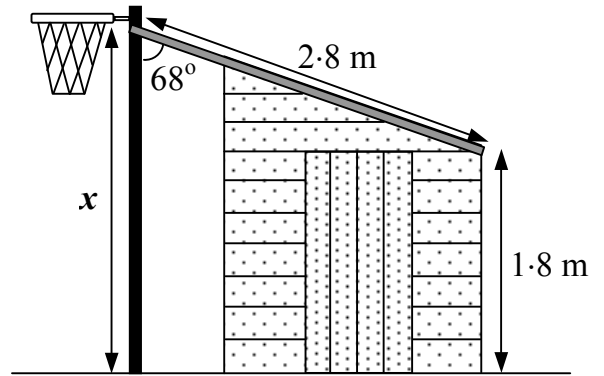
What angle, x° , will the plank make with the ground?



6. Craig has put a basketball set on pole in his garden. To secure the pole he intends to fix it with a baton nailed to his garden shed.

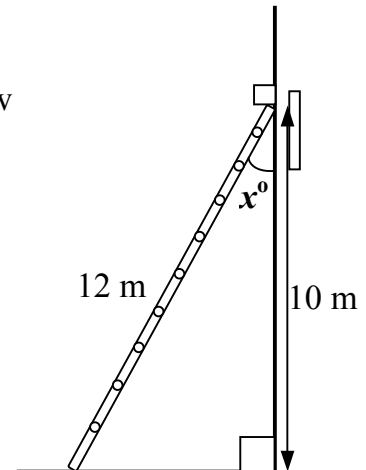
The baton makes an angle of 68° with the pole and is 2.8 m long.

How far up the pole will the baton reach, x ?



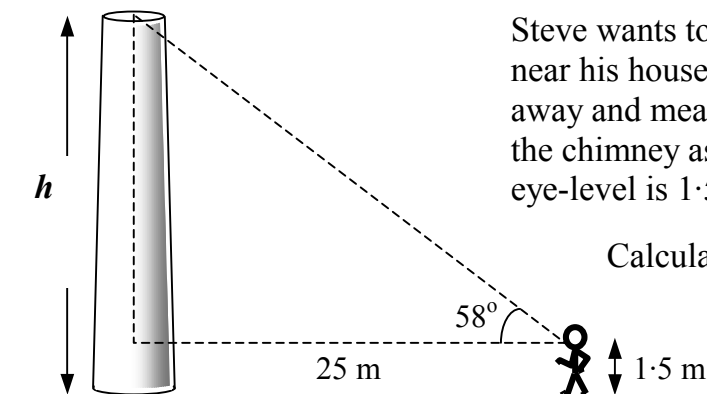
7. A firefighter has a 12 metre ladder and needs to reach a window 10 metres from the ground.

What angle, x° , will the ladder make with the building?



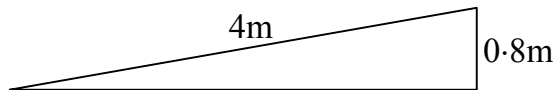
8. Steve wants to find the height of a chimney near his house. He stands at a point 25 m away and measures the angle to the top of the chimney as 58° . The height to Steve's eye-level is 1.5 m.

Calculate the height, h , of the chimney.



9. Mr and Mrs Hamilton are building a ramp to allow their disabled daughter easier access to the house.

The ramp has to rise by 0.8m and has to be 4 metres long.



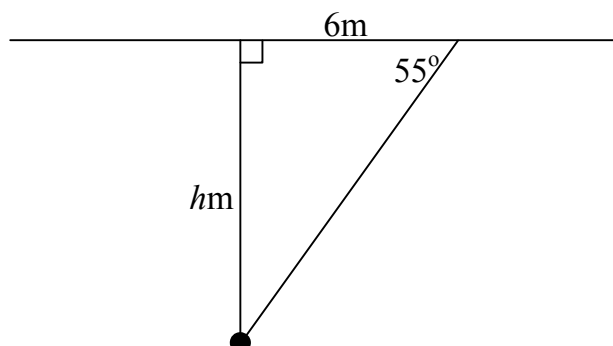
Planning regulations state that the angle between the ground and the ramp has to be between 10° and 12° .

Would Mr and Mrs Hamilton's ramp meet these conditions?

Show all working and give a reason for your answer.

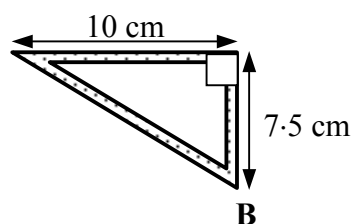
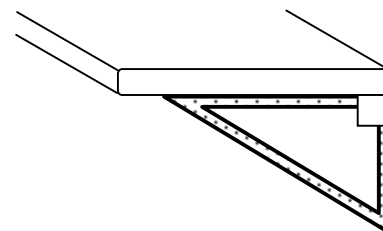
10. Two spotlights on a stage are set 6 metres apart. The beams are set so that the light from them hits one particular spot on the stage. One light is directly above the spot and the other beam of light is at an angle of 55° to the horizontal. The diagram illustrates the situation.

Calculate how far, h m, above the stage the lights are set.



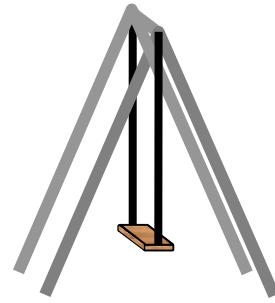
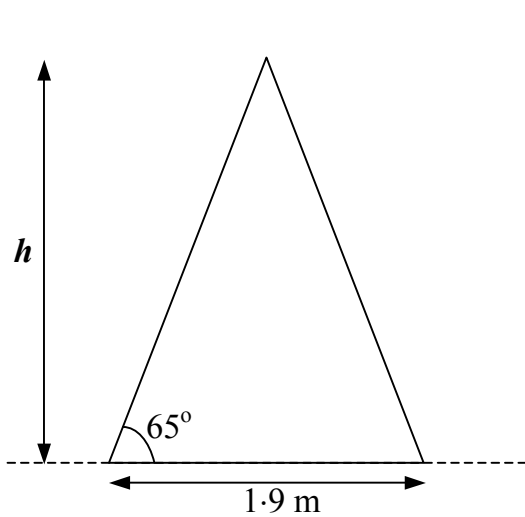
11. A triangular bracket is designed to support a shelf.

Its length is 10 cm and its height is 7.5 cm.

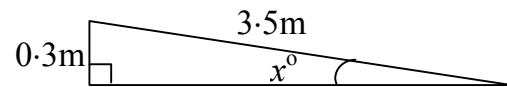
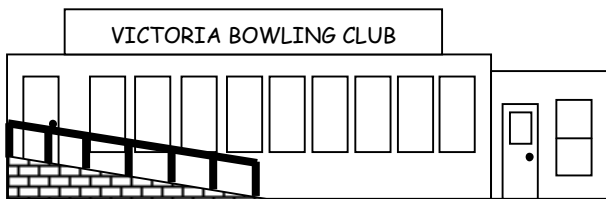


Calculate the angle at the base of the bracket, angle B.

12. The frame of a child's swing is in the shape of an isosceles triangle.



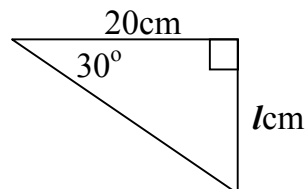
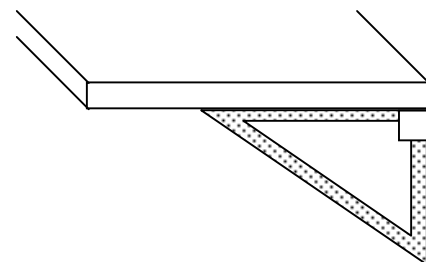
13. A ramp has been constructed at a bowling club. It is 3.5 metres long and rises through 0.3 metres.



Calculate the angle, x° , that the ramp makes with the horizontal.

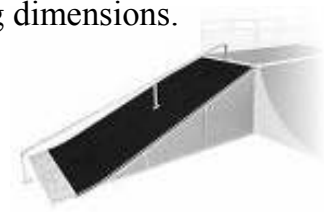
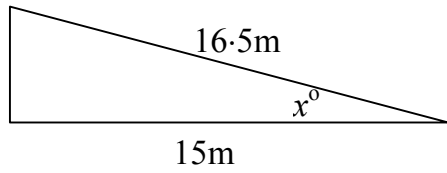
14. A triangular bracket is designed to support a shelf.

Its width is 20cm and it makes an angle of 30° with the horizontal shelf.



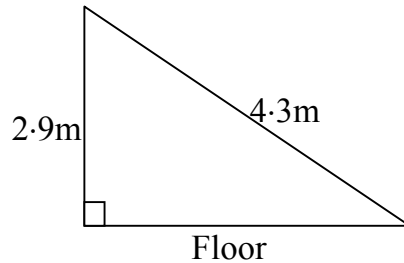
Calculate the length, $l\text{ cm}$, of the bracket.

15. A skateboard ramp has been designed to have the following dimensions.



The ramp can only be used in competitions if the angle, x° , is between 24 and 26 degrees.
Can this ramp be used in a competition? You must show all working and give a reason for your answer.

16. I have just had a new staircase fitted in my house. It rises by a height of 2.9m and is 4.3m long.

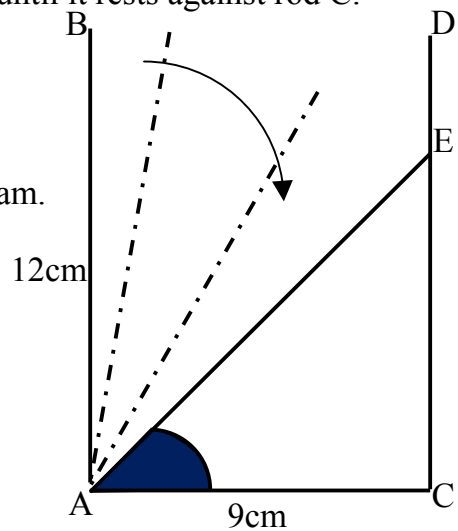


Find the angle, x° , which the staircase makes with the floor.

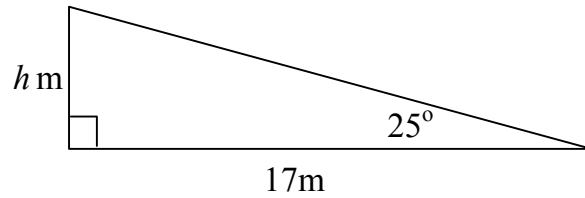
17. In a switch mechanism lever AB rotates round A until it rests against rod C.
Point B touches rod CD at E.

$AB = 12\text{cm}$ and $AC = 9\text{cm}$ as shown in the diagram.

Calculate the size of the shaded angle when the switch is closed.



18. A skateboard ramp has been designed to have the dimensions shown in the diagram.



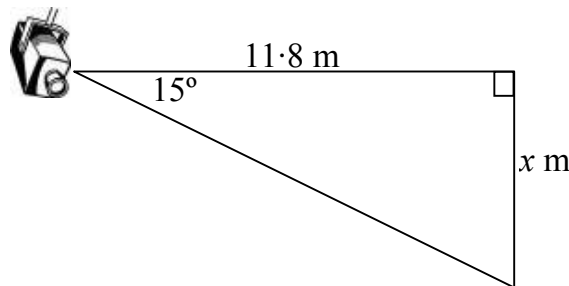
- (a) Calculate the height, h m, of the ramp.

Safety regulations state that the angle that the ramp makes with the ground should be a **maximum** of 23° .

- (b) Calculate how much the height of the ramp would have to be lowered for it to be considered safe. Give your answer in centimetres.

19. A security camera is secured to a beam on a ceiling in a warehouse. The length of the warehouse is 11.8 metres and the angle of depression of the camera is 15° .

Calculate the height of the warehouse.

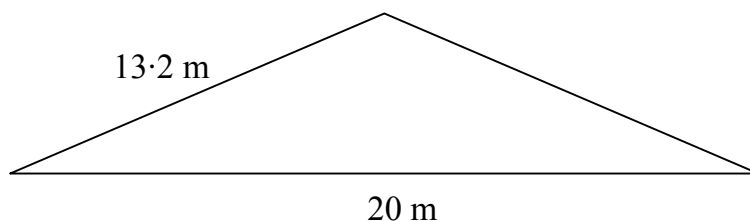


20. A builder wants to measure the angle made between the roof of the building and the attic floor below.

The length of the attic floor is 20 metres long and the length of the sloping roof is 13.2 metres.

For the roof to meet building regulations the angle between the floor and the roof must measure between 38° and 40° .

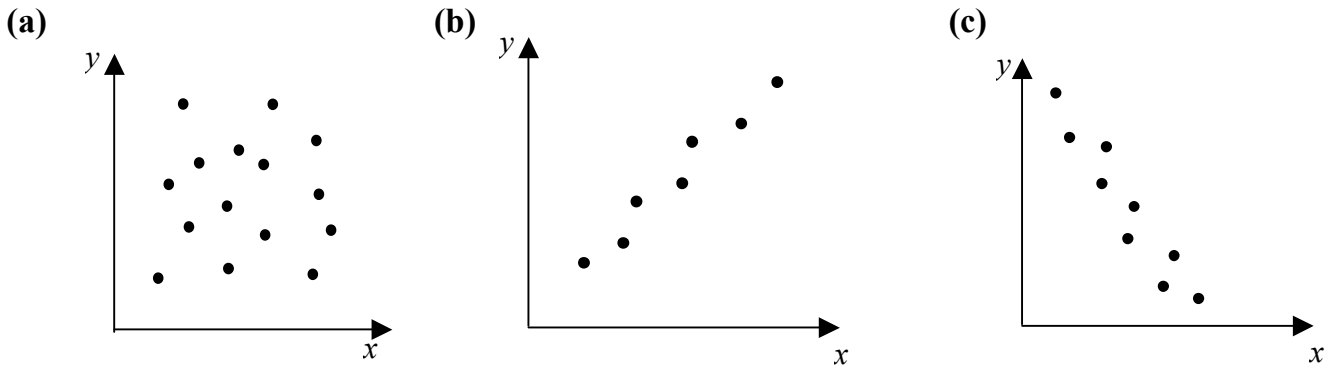
Does the roof meet regulations? *Give a reason for your answer.*



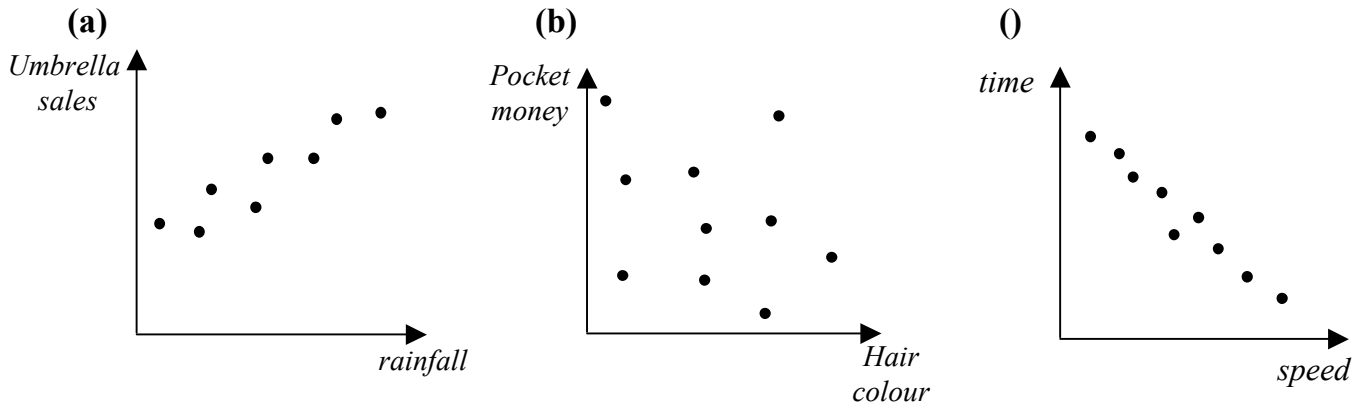
Applying Statistical Skills to Representing Diagrams

Constructing a scattergraph.

1. Using the words positive, negative or no relation, describe the correlation in each of the diagrams below.



2. What do the diagrams tell you about the correlation between the two variables involved?



3. A random survey of 20 pupils gave the following results:

Pupil	1	2	3	4	5	6	7	8	9	10
Age	16	17	14	17	14	12	12	16	18	15
Height(cm)	182	199	171	200	183	159	170	179	198	180
Weight (kg)	71	78	65	70	60	55	50	66	76	63
Cash carried (£)	4.23	10.90	25.50	1.43	2.98	6.24	3.18	0.72	1.98	0.25

Pupil	11	12	13	14	15	16	17	18	19	20
Age	18	18	17	16	11	11	13	12	14	14
Height (cm)	190	179	187	169	160	151	150	171	170	182
Weight (kg)	68	75	72	76	49	41	48	53	58	67
Cash carried (£)	12.06	4.31	2.38	12.30	2.15	4.12	2.71	0.40	1.80	3.10

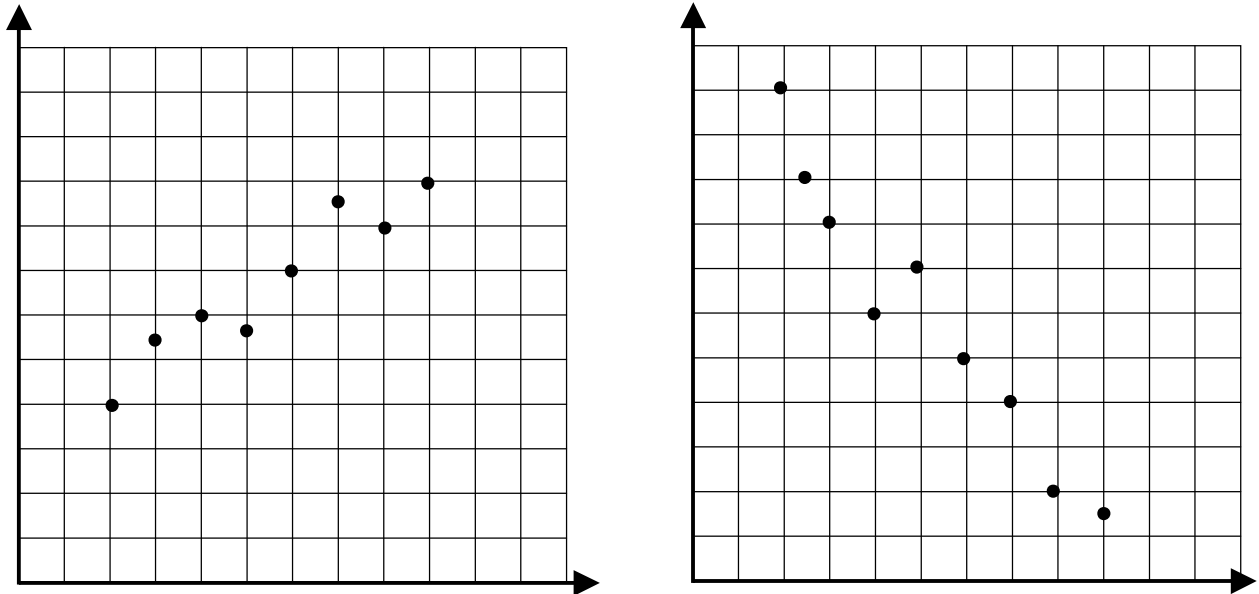
Draw scatter diagrams to find out if there is a correlation between

- (a) age and height
- (b) height and weight
- (c) age and weight
- (d) age and amount of cash carried.

Applying Statistical Skills to Representing Diagrams

Drawing and applying the line of best fit

1. Copy these graphs and use your ruler to draw what you think is the line of best fit.



2. For the following sets of data, draw a scatter diagram and draw a line of best fit.

(a)

x	1	2	3	4	5
y	5	7	8	10	12

(b)

x	1	2	3	4	5
y	2	$2\frac{1}{5}$	$2\frac{1}{5}$	35	3

(c)

x	6	7	8	9	10
y	1	2	4	$4\frac{1}{5}$	6

(d)

x	1	2	3	4	5
y	8	6	5	4	2

(e)

x	1	2	3	4	5
y	8	10	8	5	3

(f)

x	5	6	7	8	9
y	6	$5\frac{1}{5}$	$5\frac{1}{4}$	$5\frac{1}{5}$	5

3. The height of a plant measured over five days is shown below.

Days (D)	1	2	3	4	5
Height (H)	$1\frac{1}{6}$	$1\frac{1}{9}$	$2\frac{1}{5}$	$3\frac{1}{4}$	$3\frac{1}{5}$

- (a) Plot the points and draw the best fitting straight line through them
- (b) Use your line to estimate the height after $1\frac{1}{2}$ days

4. The table shows the results of an experiment.

x	1	2	3	4	5	6
y	9.2	12.0	18.3	19.0	25.1	30.2

- (a) Plot the points and draw a best fitting straight line.
- (b) Use your graph to estimate the value of y when $x = 3.5$.

5. The following table gives the temperature of a bottle of water as it cools.

<i>Time, min (T)</i>	1	3	5	7	9
<i>Temperature (°C)</i>	66	61	57	53	50

- (a) Plot the points and draw the best fitting straight line through them.
- (b) Use your graph to estimate the temperature after $2\frac{1}{2}$ minutes.

6. The results of an experiment are shown in the table below.

V	0	0.35	0.6	0.95	1.2	1.3
R	0.60	0.48	0.33	0.18	0.11	0.05

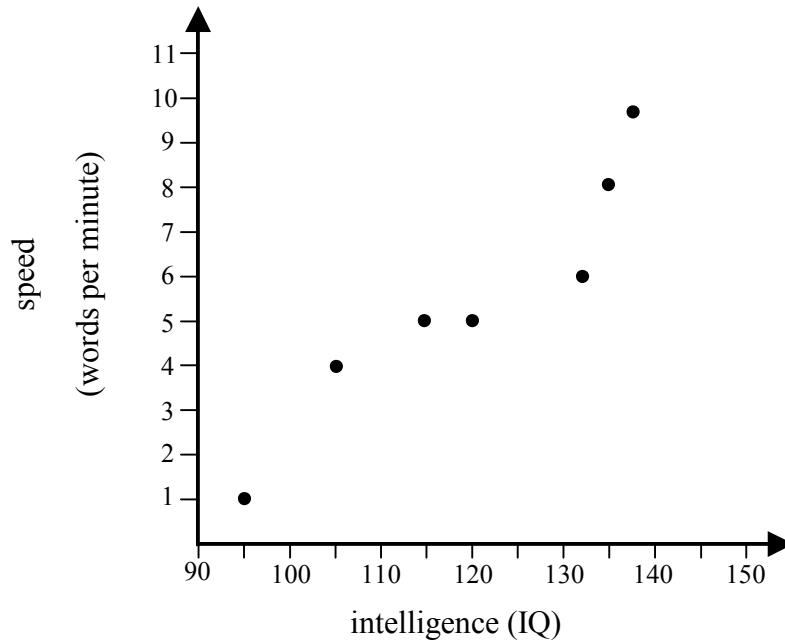
- (a) Plot the points and draw the best fitting straight line through them.
- (b) Use your graph to estimate R when V is 0.8

Applying Statistical Skills to Representing Diagrams

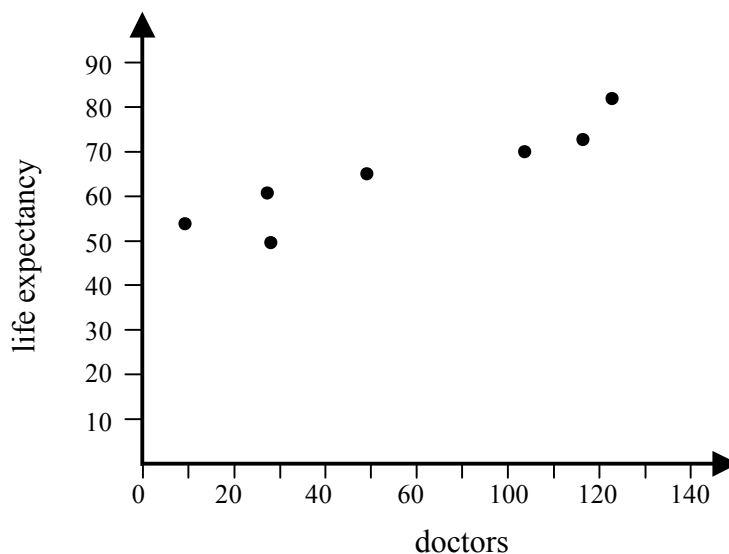
Copies of the graphs can be found on the worksheet after this exercise

EXAM QUESTIONS

1. In an experiment to test the relationship between intelligence and reading speed in a group of 5-year olds the following graph was drawn.

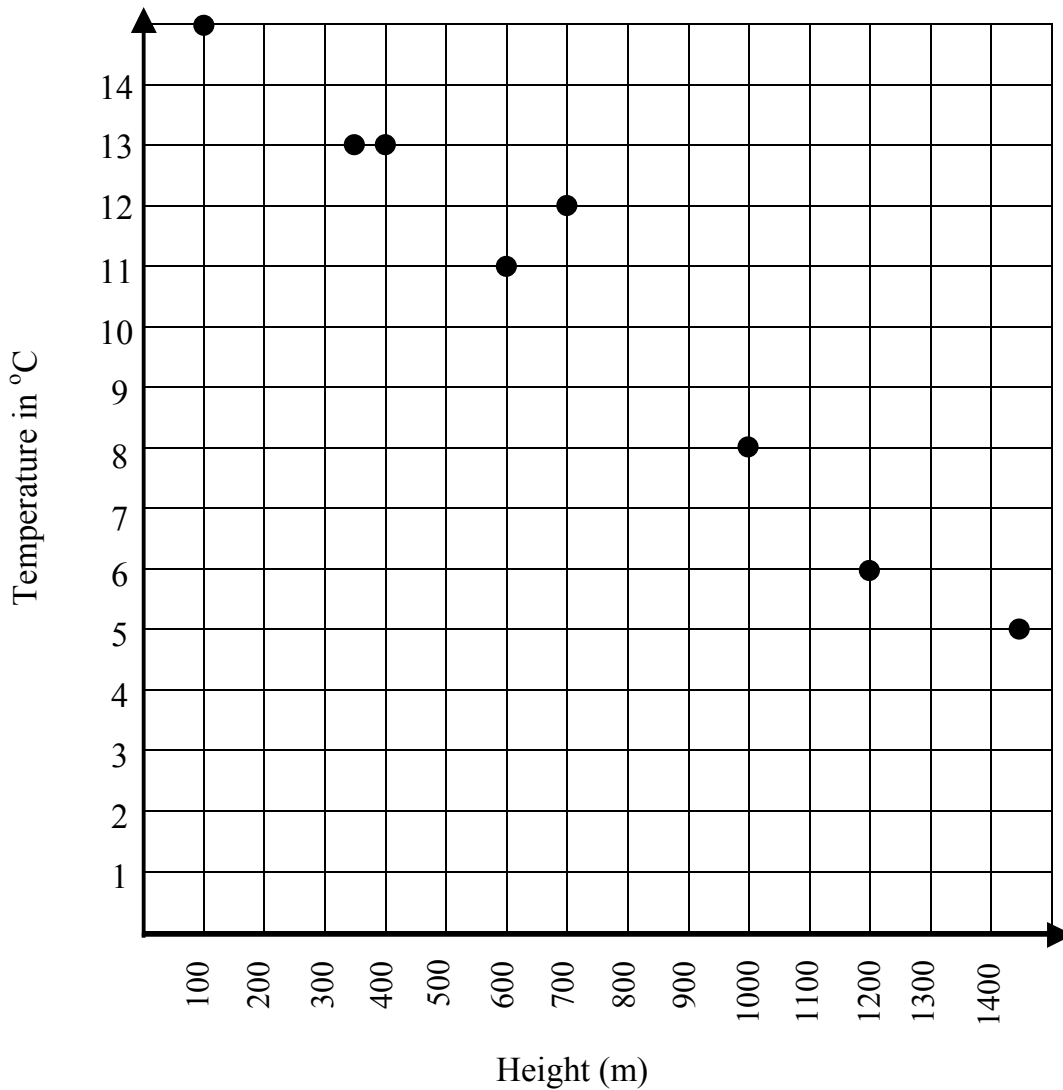


- (a) Draw the line of best fit onto the diagram.
- (b) Use your line to estimate the reading speed of a 5-year old child with an IQ of 110.
2. The graph below shows the relationship between the number of doctors per 10 000 of population and life expectancy in seven countries.



- (a) Draw the line of best fit onto the diagram.
- (b) Use your line to estimate life expectancy in a country with 80 doctors .

3. The graph shows the height above sea-level, in metres, of eight places in Scotland and the corresponding temperatures.

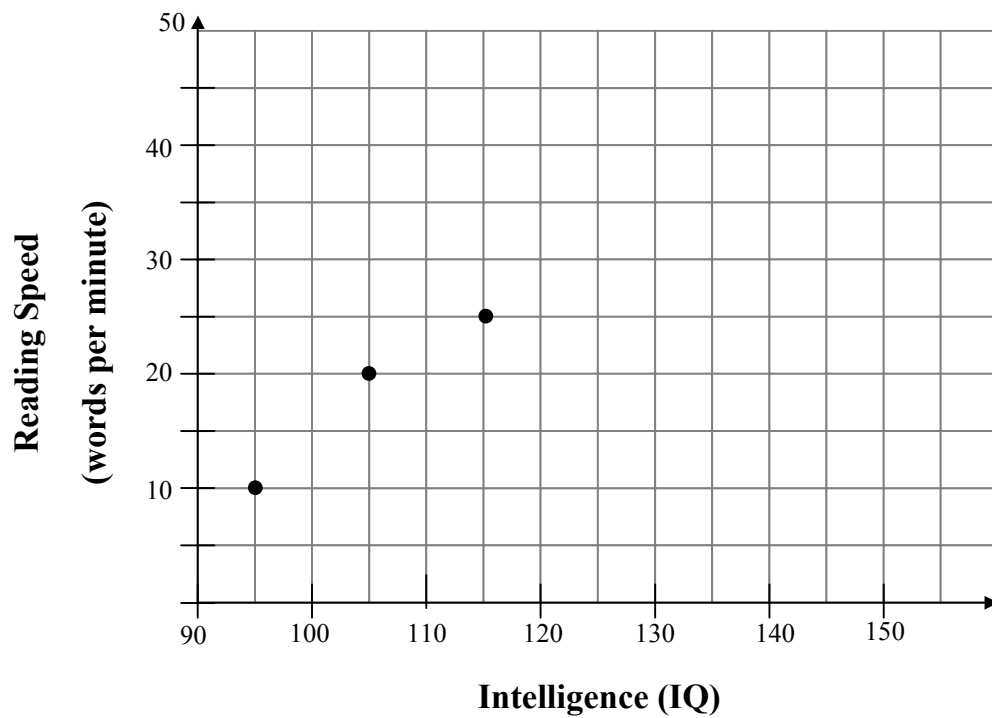


- (a) Draw a line of best fit through the points on the graph.
- (b) Use your line of best fit to estimate the temperature of a place which is 800metres above sea-level.

4. The table below shows the results of an experiment to test the relationship between intelligence and reading speed (words per minute) in a group of 8 year olds.

Intelligence(IQ)	95	105	115	125	135	140	150
Reading Speed	10	20	25	25	40	35	50

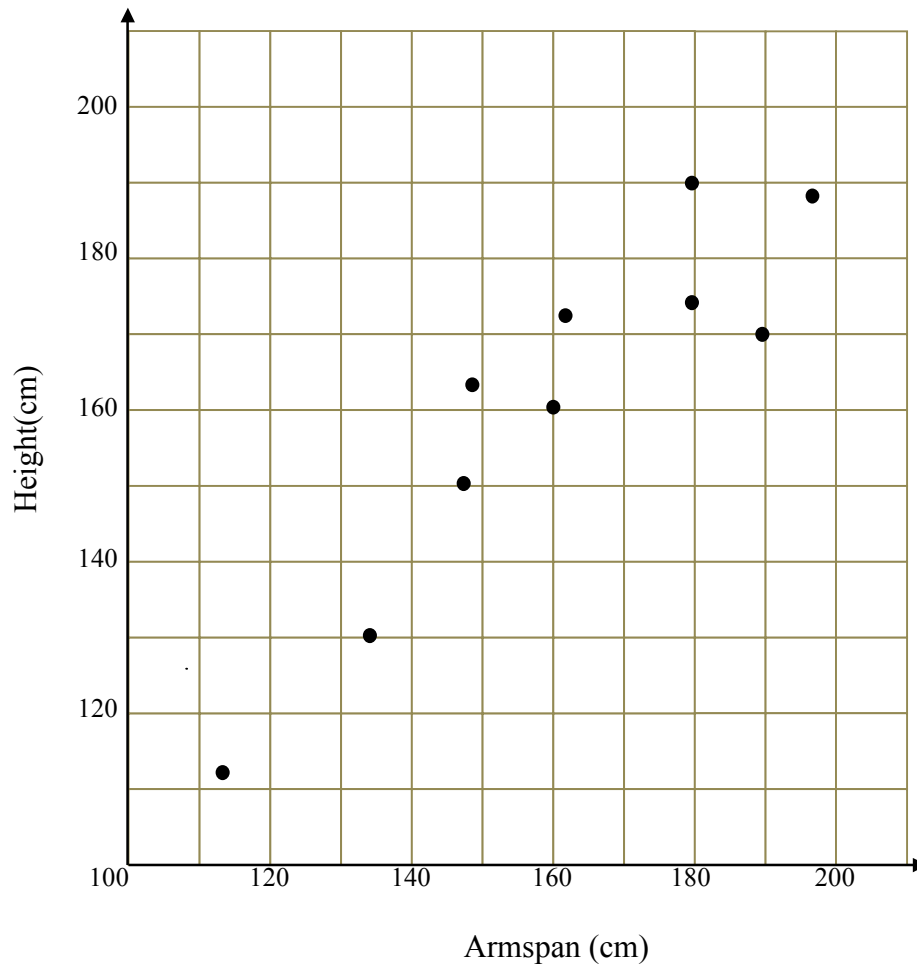
- (a) Complete the scatter graph below to illustrate this.



- (b) Draw the line of best fit on your graph.

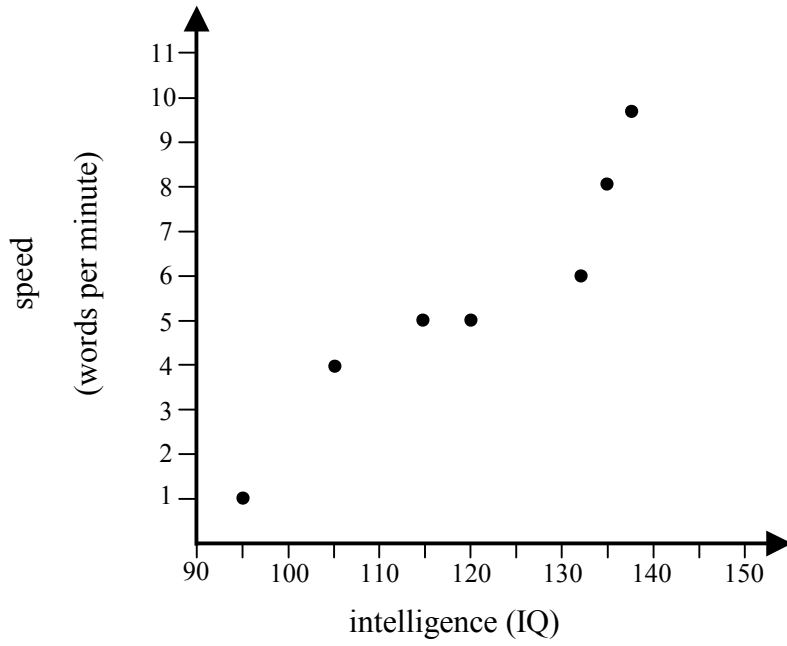
5. The graph shows the arm span and height of 10 people.

(a) Draw a line of best fit on the diagram.

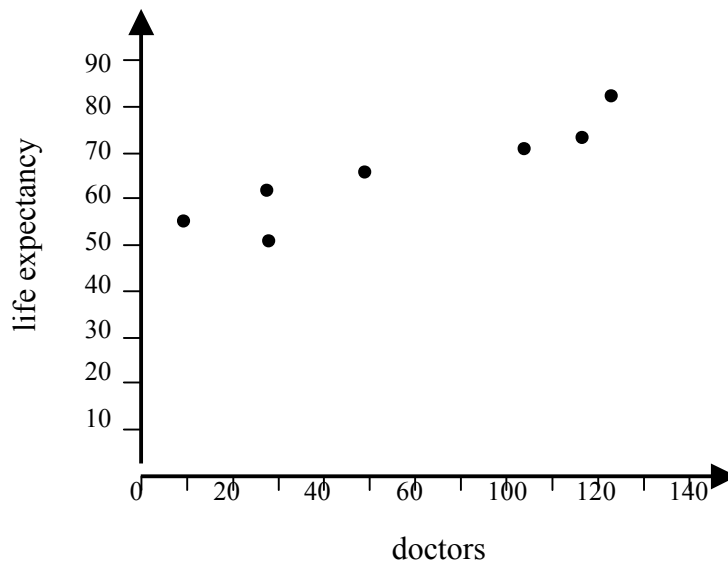


(b) Use your line of best fit to estimate the height of a person who has an arm span of 170cm.

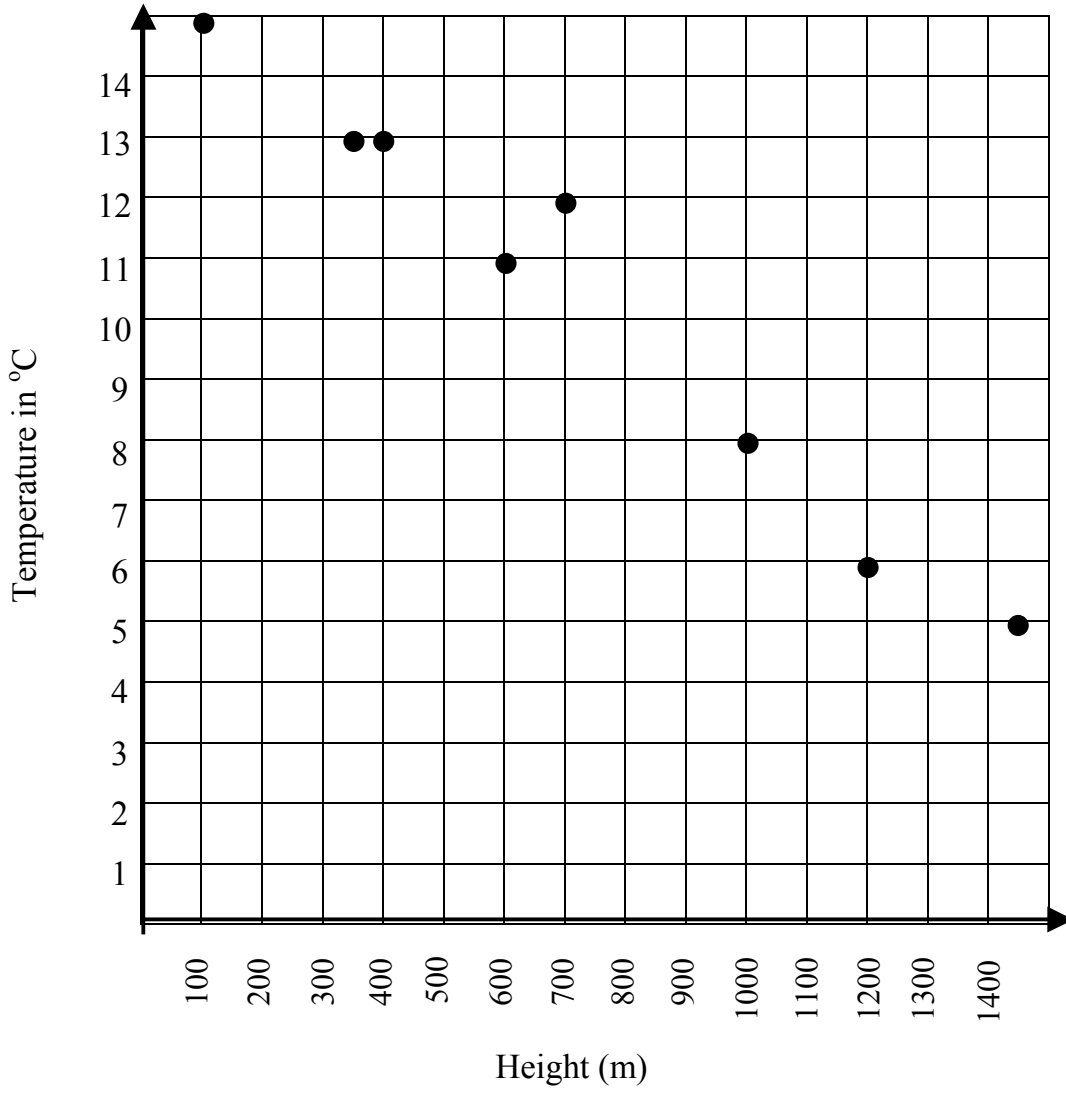
1.



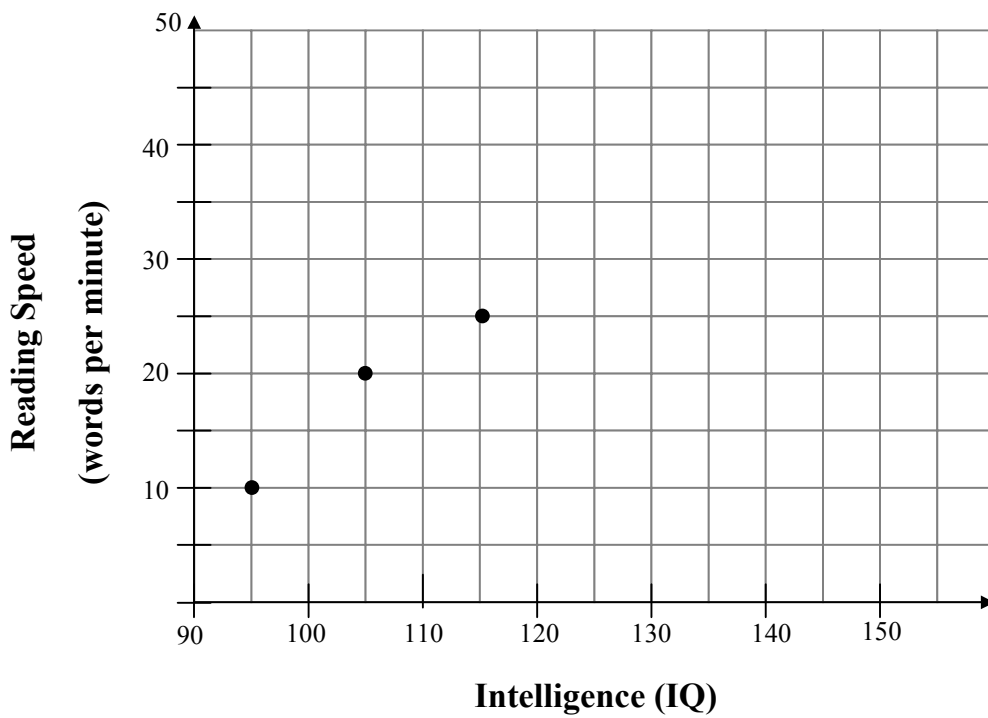
2.



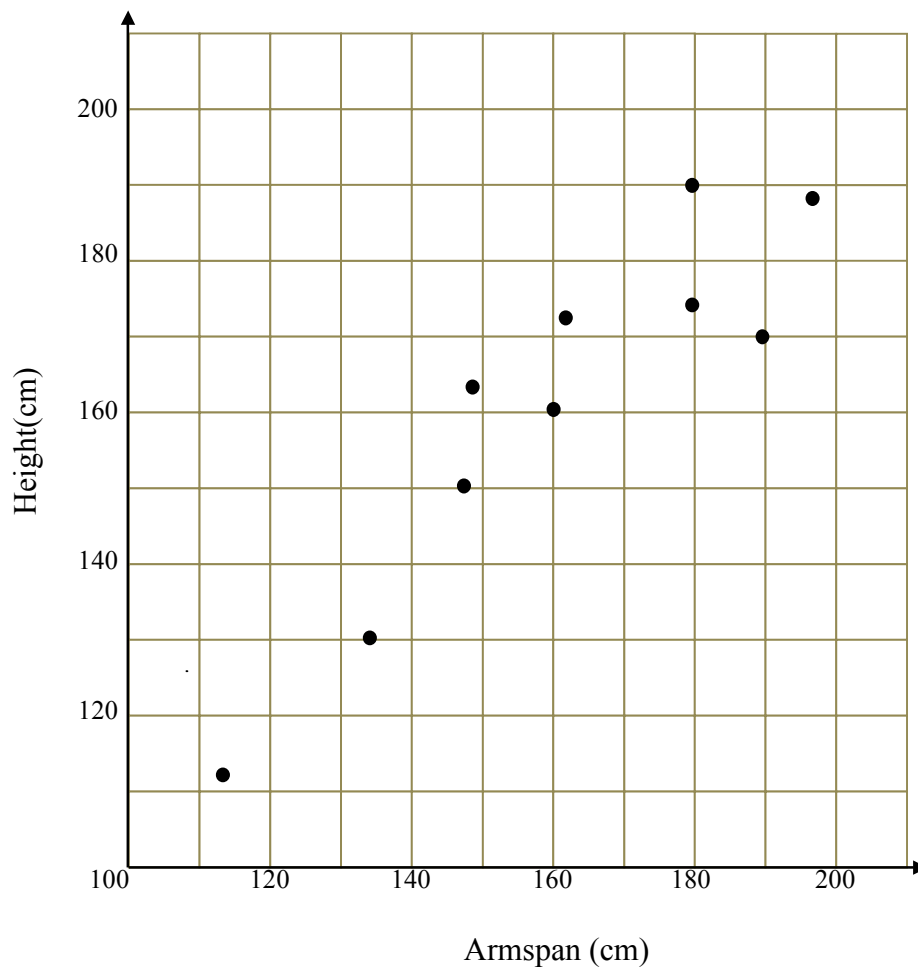
3.



4.



5.



ANSWERS

Applying Algebraic Skills to Linear Equations

Drawing the graph of a linear equation

1. (a)

x	0	1	2	3	4	5
y	0	2	4	6	8	10

(b) Graph drawn - see later

2. (a)

x	0	1	2	3	4	5
y	0	3	6	9	12	15

(b) Graph drawn - see later

3. (a)

x	0	2	4	6	8	10
y	0	1	2	3	4	5

(b) Graph drawn - see later

4. (a)

x	0	3	6	9	12
y	0	1	2	3	4

(b) Graph drawn - see later

5. A straight line has as its equation $y = x$.

(a) **Copy** and complete the table for this line.

x	1	2	3	4	5	6
y	1	2	3	4	5	6

(b) Graph drawn - see later

6. (a)

x	0	1	2	3	4	5
y	2	3	4	5	6	7

(b) Graph drawn - see later

7. (a)

x	0	1	2	3	4	5
y	1	3	5	7	9	11

(b) Graph drawn - see later

8. (a)

x	0	2	4	6	8	10
y	4	5	6	7	8	9

(b) Graph drawn - see later

9. (a)

x	0	4	8	12
y	5	6	7	8

(b) Graph drawn - see later

10. (a)

x	1	2	3	4	5
y	1	4	7	10	13

(b) Graph drawn - see later

11. (a), (b) and (c) Graph drawn - see later

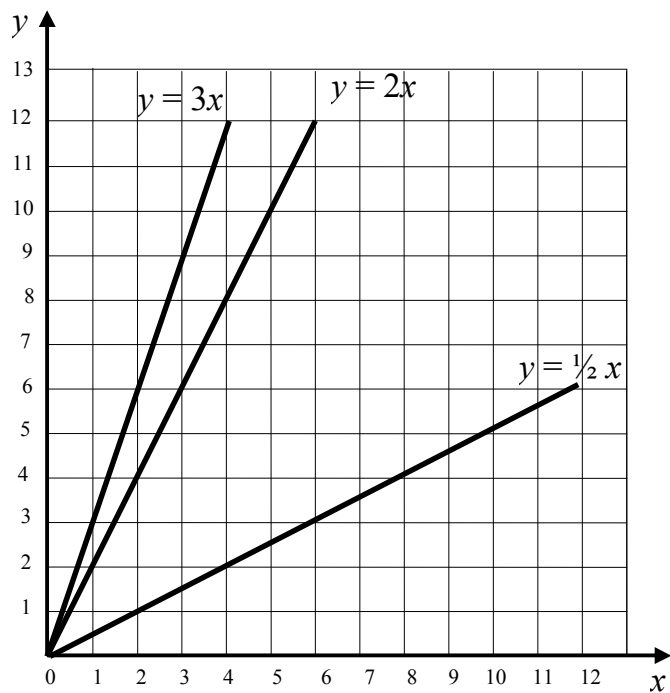
12. all parts Graphs drawn - see later

13. (a), (b) and (c) Graph drawn - see later

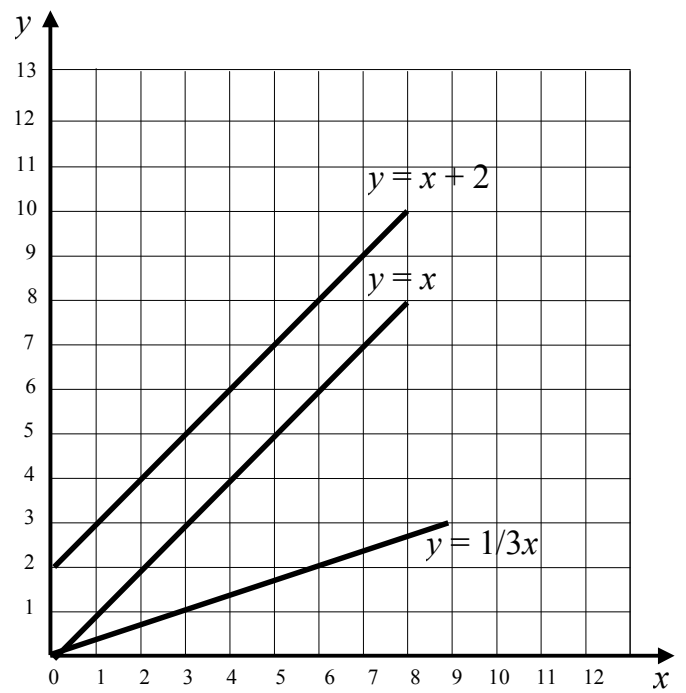
14. all parts Graphs drawn - see later

Drawing the graph of a linear equation

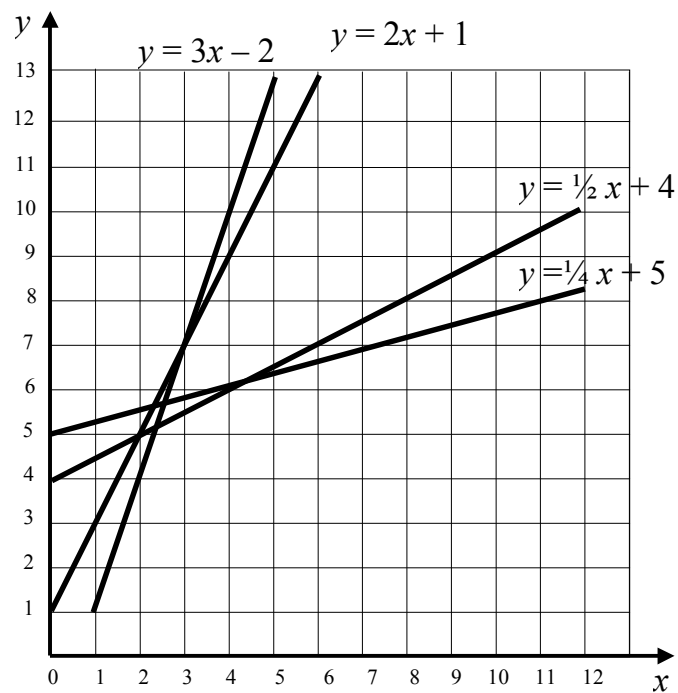
Questions 1, 2 and 3



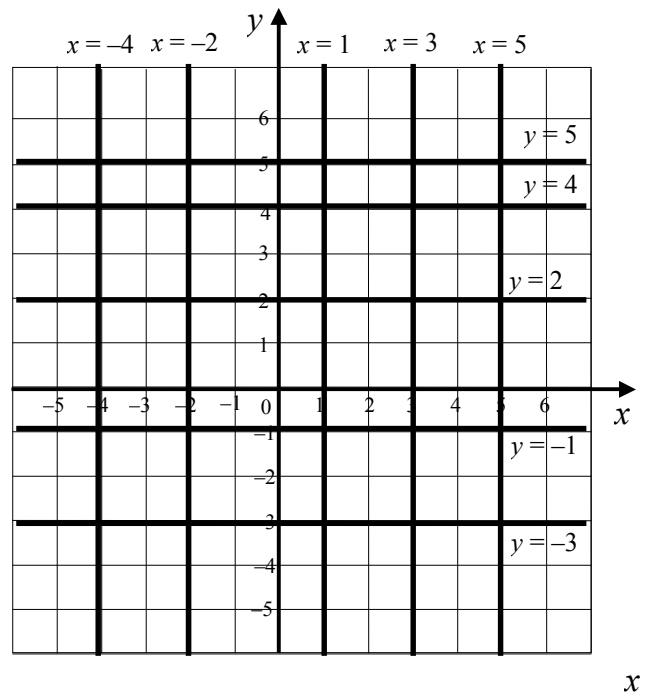
Questions 4, 5 and 6



Questions 7, 8, 9 and 10



Questions 11, 12, 13 and 14



Drawing the graph of a linear equation (More practice)

1. (a)

x	-2	-1	0	1	2	3
y	-5	-3	-1	1	3	5

(b) $(-2, -5), (-1, -3), (0, -1), (1, 1), (2, 3), (3, 5)$

(c) and (d) Graph drawn – see later

2. (a)

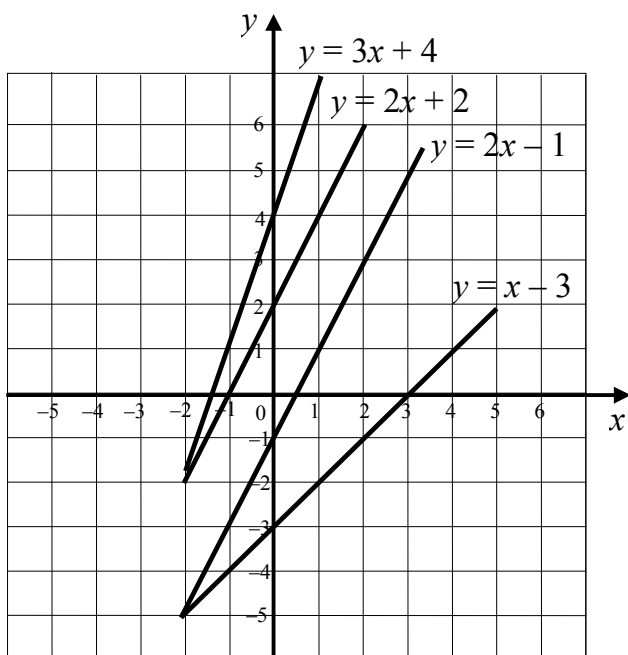
x	-2	-1	0	1	2	3
y	-2	1	4	7	10	13

(b) $(-2, -2), (-1, 1), (0, 4), (1, 7), (2, 10), (3, 13)$

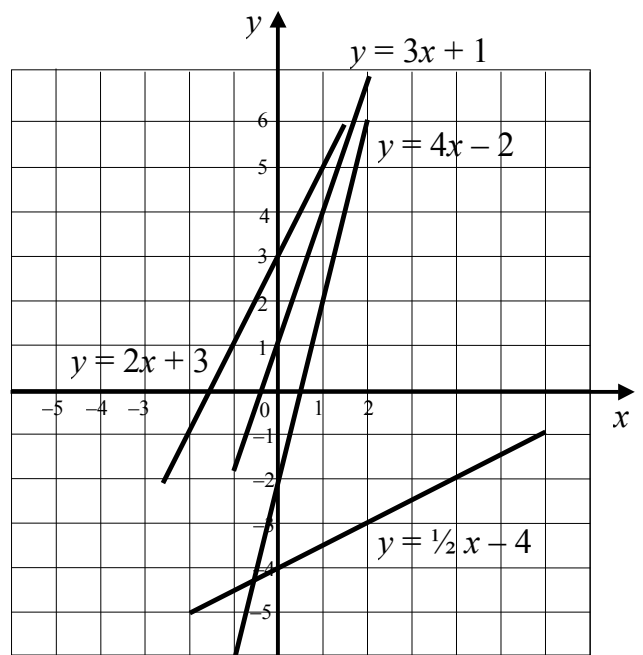
(c) and (d) Graph drawn – see later

3. All parts: Graph drawn – see later

Questions 1, 2, 3 (a) and (b)



Question 3 (c), (d), (e) and (f)



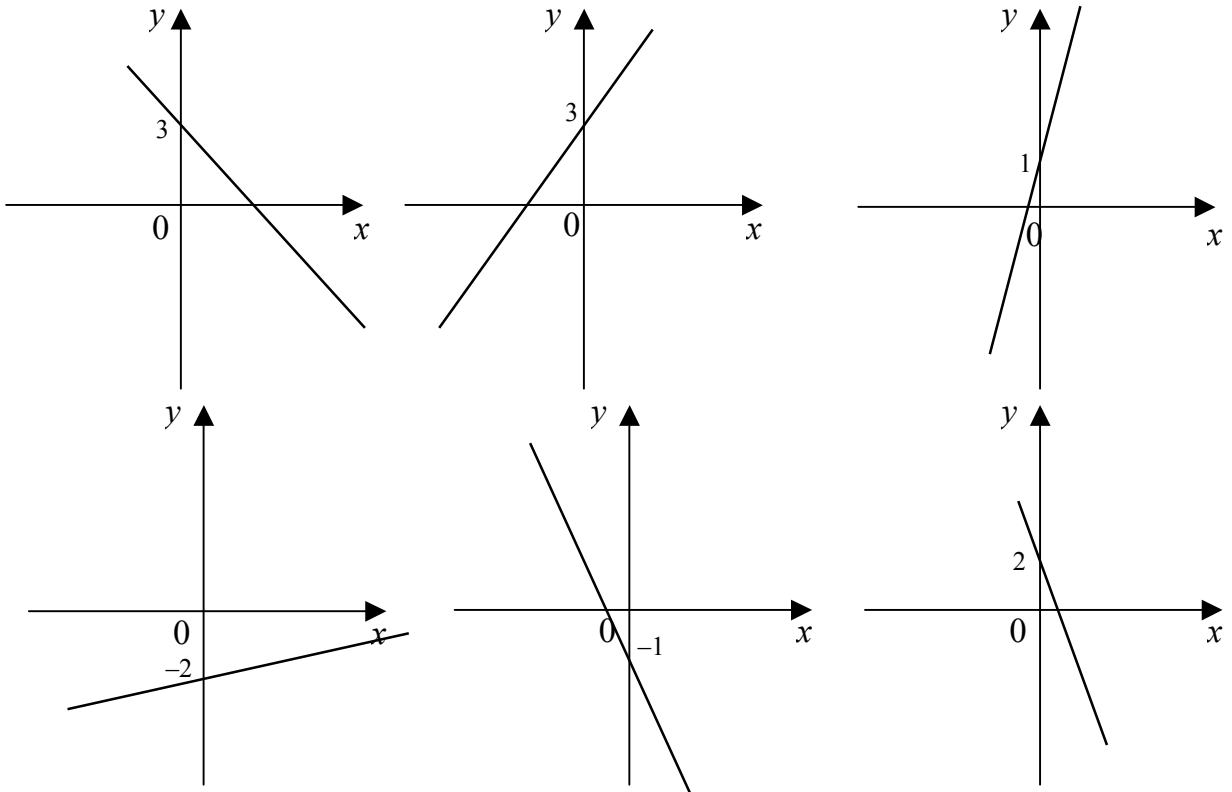
Recognising the graph of a linear equations

1. (a) $m = 1; (0, 3)$ (b) $m = 2; (0, 2)$ (c) $m = 3; (0, 1)$
 (d) $m = 4; (0, 2)$ (e) $m = 2; (0, 3)$ (f) $m = \frac{1}{2}; (0, 4)$
2. (a) $m = 3; (0, 1)$ (b) $m = \frac{1}{2}; (0, -5)$ (c) $m = -2; (0, 3)$
 (d) $m = -\frac{1}{4}; (0, -2)$ (e) $m = 8; (0, -\frac{1}{2})$ (f) $m = -1; (0, 4)$

3. (1) and (b); (2) and (d); (3) and (f); (4) and (c); (5) and (a); 6 and (e)

4. (a) $y = 4x + 5$ (b) $y = 3x + 1$ (c) $y = 2x - 1$ (d) $y = \frac{1}{4}x + 2$
 (e) $y = \frac{1}{2}x - 2$ (f) $y = -2x - 4$ (g) $y = -3x + 3$ (h) $y = -\frac{3}{4}x - 2$
5. (a) $y = 4$ (b) $x = 6$ (c) $y = 1$ (d) $y = -5$
 (e) $x = -5$ (f) $x = 3$ (g) $y = -2$ (h) $x = -3$

6.



7. (a) $y = 2x + 2$ (b) $y = \frac{1}{2}x - 1$ (c) $y = 4x - 2$ (d) $y = 3x + 3$
 (e) $y = -\frac{1}{3}x - 2$ (f) $y = -2x + 3$ (g) $y = -3x - 3$ (h) $y = \frac{1}{4}x - 2.5$

Drawing and recognising the graph of a linear equations.

EXAM QUESTIONS

- (a) $-7, 5, 11$ (b) Line drawn passing through $(-2, -7), (2, 5), (4, 1)$
(c) Horizontal line passing through $(0, 8)$ (d) $(3, 8)$
- (a) $5, 1, -2$ (b) Line drawn passing through $(-6, 5), (2, 1), (8, -2)$
(c) Vertical line passing through $(3, 0)$ (d) $(3, \frac{1}{2})$
- (a) $11, -1, -10$ (b) Line drawn passing through $(-4, 11), (0, -1), (3, -10)$
(c) Horizontal line passing through $(0, 2)$ (d) $(-1, 2)$
- (a) $-4, -2, 0$ (b) Line drawn passing through $(-2, -4), (2, -2), (6, 0)$
(c) $(0, -3)$
- (a) $-5, 1, 1$
(b) Graph drawn passing through $(-3, -5), (-1, -1), (0, 1), (1, 3), (3, 7)$
- (a) $5, 4, 2, 1$
(b) Line drawn passing through $(-1, 5), (0, 4), (2, 2), (3, 1)$
(c) $(4, 0)$

Solving linear equations

- (a) $x = 2$ (b) $x = 4$ (c) $x = 3$ (d) $x = 5$
(e) $a = 2$ (f) $y = 5$ (g) $p = 4$ (h) $c = 1$
(i) $b = 2$ (j) $q = 0$ (k) $d = 5$ (l) $x = 5$
(m) $c = 2$ (n) $p = 7$ (o) $a = 13$ (p) $y = 9$
- (a) $x = 3$ (b) $x = 4$ (c) $x = 2$ (d) $x = 9$
(e) $a = 4$ (f) $y = 4$ (g) $p = 3$ (h) $c = 5$
(i) $b = 4$ (j) $q = 9$ (k) $d = 10$ (l) $x = 8$
(m) $c = 7$ (n) $p = 5$ (o) $a = 7$ (p) $y = 7$
- (a) $x = 7$ (b) $x = 6$ (c) $x = 11$ (d) $x = 9$
(b) $a = 6$ (f) $y = 11$ (g) $p = 18$ (h) $c = 9$
(j) $b = 16$ (j) $q = 16$ (k) $d = 15$ (l) $x = 7$
(m) $c = 10$ (n) $p = 20$ (o) $a = 17$ (p) $y = 19$

4. (a) $a = 18$ (b) $m = 11$ (c) $q = 8$ (d) $y = 16$
 (e) $x = 13$ (f) $c = 9$ (g) $d = 12$ (h) $a = 25$
 (i) $p = 9$ (j) $q = 8 \cdot 5$ (k) $x = 5 \cdot 5$ (l) $q = 5 \cdot 5$
 (m) $c = 3 \cdot 5$ (n) $x = 18$ (o) $a = 4 \cdot 2$ (p) $y = 10 \cdot 5$
5. (a) $x = 1$ (b) $x = 1$ (c) $x = 3$ (d) $x = 1$
 (e) $a = 6$ (f) $y = 3$ (b) $p = 7$ (h) $c = 4$
 (i) $b = 7$ (j) $q = 0$ (k) $d = 15$ (l) $x = 7$
 (m) $c = 4$ (n) $p = 7$ (o) $a = 2$ (p) $y = 5$
6. (a) $x = 3$ (b) $x = 4$ (c) $x = 6$ (d) $x = 4$
 (e) $a = 2$ (f) $y = 5$ (g) $p = 6$ (h) $c = 8$
 (i) $b = 8$ (j) $q = 8$ (k) $d = 12$ (l) $x = 9$
 (m) $c = 6$ (n) $p = 7$ (o) $a = 15$ (p) $y = 18$
7. (a) $x = 12$ (b) $x = 20$ (c) $x = 21$ (d) $x = 24$
 (e) $x = 10$ (f) $x = 9$ (g) $x = 28$ (h) $x = 16$
 (i) $x = 4$ (j) $x = 48$ (k) $x = 50$ (l) $x = 27$
8. (a) $x = 1$ (b) $y = 2$ (c) $a = 6$ (d) $x = 5$
 (e) $x = 3$ (f) $c = 2$ (g) $d = 5$ (h) $m = 6$
 (i) $y = 11$ (j) $d = 9$ (k) $s = 11$ (l) $x = 20$
 (m) $w = 7$ (n) $c = 12$ (o) $a = 21$
9. (a) $y = 3$ (b) $y = 2$ (c) $c = 2$ (d) $x = 3$
 (e) $b = 2$ (f) $n = 3$ (g) $x = 6$ (h) $c = 5$
 (i) $y = 3$ (j) $a = 6$ (k) $x = 4$ (l) $n = 0 \cdot 5$
 (m) $b = 8$ (n) $x = 11$ (o) $x = 15$ (p) $y = 3$
 (q) $a = 12$ (r) $x = 4$ (s) $y = 7$ (t) $b = 16$
 (u) $x = 9$ (v) $x = 7$ (w) $x = 4$ (x) $a = 2$
10. (a) $y = 6$ (b) $a = 6$ (c) $c = 4$ (d) $x = 1$
 (e) $b = 4$ (f) $n = 6$ (g) $x = 4$ (h) $c = 24$
 (i) $y = 10$ (j) $a = 7$ (k) $x = 5$ (l) $n = 2 \cdot 5$
 (m) $b = 2 \cdot 5$ (n) $x = 16$ (o) $x = 15$ (p) $y = 2$
 (q) $a = 2$ (r) $x = 4$ (s) $x = 7$ (t) $b = 6$
 (u) $x = 2$ (v) $x = 7$ (w) $x = 12$ (x) $a = 40$

11. (a) $a = 3$ (b) $x = 9$ (c) $m = 3$ (d) $d = 2$
 (e) $h = 1$ (f) $y = 2 \cdot 5$ (g) $a = 6$ (h) $x = 2$
 (i) $a = 24$ (j) $d = 6$ (k) $x = 5$ (l) $u = 7$
 (m) $w = 16$ (n) $x = 6$
12. (a) $x = 3$ (b) $m = 3$ (c) $y = 7$ (d) $t = 7$
 (e) $a = 5$ (f) $x = 4$ (g) $y = 4$ (h) $p = 4$
 (i) $r = 5$ (j) $x = 2$ (k) $a = 2$ (l) $d = 2$
 (m) $c = 3$ (n) $x = 3$ (o) $x = 1$ (p) $x = 2$
 (q) $v = 2$ (r) $x = 3$
13. (a) $x = 1$ (b) $x = 3$ (c) $y = 2$ (d) $v = 3$
 (e) $h = -1 \cdot 5$ (f) $a = 2$ (g) $x = 3$ (h) $m = 3$
 (i) $e = 4$ (j) $x = 2$ (k) $y = 2$ (l) $a = 1$
 (m) $x = 1$ (n) $k = 2$ (o) $c = 4$

Solving linear equations

EXAM QUESTIONS

1. $x = 4$ 2. $a = 4$ 3. $x = 5$ 4. $x = 4$ 5. $x = 5$
 6. $x = -6$ 7. $w = 10$ 8. $x = 4$ 9. $y = 3$ 10. $x = 6$

Solving Inequations

1. (a) $x > 1$ (b) $x > 3$ (c) $x > 4$ (d) $x > 4$ (e) $a > 3$ (f) $y > 3$
 (g) $p > 9$ (h) $c > 1$ (i) $b > 6$ (j) $q > 0$ (k) $d > 3$ (l) $x > 4$
 (m) $c > 5$ (n) $p > 9$ (o) $a > 12$ (p) $y > 12$
2. (a) $x < 2$ (b) $x < 7$ (c) $x < 10$ (d) $x < 4$ (e) $a < 3$ (f) $y < 6$
 (g) $p < 8$ (h) $c < 4$ (i) $b < 5$ (j) $q < 17$ (k) $d < 0$ (l) $x < 5$
 (m) $c < 6$ (n) $p < 14$ (o) $a < 11$ (p) $y < 1$
3. (a) $x > 3$ (b) $x > 4$ (c) $x > 2$ (d) $x > 9$ (e) $a > 4$ (f) $y > 4$
 (g) $p > 3$ (h) $c > 5$ (i) $b < 4$ (j) $q < 9$ (k) $d < 10$ (l) $x < 8$
 (m) $c < 7$ (n) $p < 5$ (o) $a < 7$ (p) $y < 7$
4. (a) $x < 7$ (b) $x > 6$ (c) $x > 11$ (d) $x < 9$ (e) $a < 6$ (f) $y > 11$
 (g) $p < 18$ (h) $c > 9$ (i) $b > 16$ (j) $q < 16$ (k) $d > 15$ (l) $x > 7$
 (m) $c > 10$ (n) $p < 20$ (o) $a < 17$ (p) $y < 19$

5. (a) $x < 2$ (b) $x > 2$ (c) $x > 3$ (d) $x > 2$ (e) $a < 3$ (f) $y < 2$
 (g) $p > 8$ (h) $c < 5$ (i) $b > 6$ (j) $q < 0$ (k) $d < 10$ (l) $x > 4$
 (m) $c < 3$ (n) $p < 7$ (o) $a > 2$ (p) $y < 3$
6. (a) $x > 3$ (b) $x > 4$ (c) $x < 6$ (d) $x > 3$ (e) $a < 2$ (f) $y < 5$
 (g) $p > 6$ (h) $c > 8$ (i) $b > 8$ (j) $q < 8$ (k) $d < 12$ (l) $x > 9$
 (m) $c < 6$ (n) $p < 7$ (o) $a < 15$ (p) $y < 18$

Solving inequations

EXAM QUESTIONS

1. $y < 3$ 2. $x > -12$ 3. $x > -8$ 4. $x > -32$ 5. $y < 26$
 6. $d > -87$. $t < 5$ 8. $x > 5$ 9. $y > 6$ 10. $p > 28$

Changing the Subject of a Formula

1. (a) $x = y - 3$ (b) $x = y + 5$ (c) $x = y - a$ (d) $x = y + b$
 (e) $x = \frac{y}{3}$ (f) $x = \frac{y}{10}$ (g) $x = \frac{y}{k}$ (h) $x = \frac{y}{a}$
 (i) $x = y - 3p$ (j) $x = y + 5t$ (k) $x = \frac{y-1}{2}$ (l) $x = \frac{y+7}{3}$
 (m) $x = \frac{y-4a}{7}$ (n) $x = \frac{y-3b}{4}$ (o) $x = \frac{y-8}{10}$
2. (a) $a = 4 - b$ (b) $a = 12 - d$ (c) $a = 5x - y$ (d) $a = \frac{2-m}{2}$
 (e) $a = \frac{7-q}{5}$ (f) $a = \frac{20-c}{3}$ (g) $a = \frac{s-r}{2}$ (h) $a = \frac{d-t}{4}$
 (i) $a = \frac{4b-z}{5}$ (j) $a = \frac{2h-k}{7}$ (k) $a = \frac{6q-p}{11}$ (l) $a = \frac{2x-g}{9}$
3. (a) $x = \frac{y-b}{a}$ (b) $x = \frac{y-c}{m}$ (c) $x = \frac{t+r}{s}$ (d) $x = \frac{p-2r}{q}$
 (e) $x = \frac{m+3n}{f}$ (f) $x = \frac{a-b}{c}$ (g) $x = \frac{h-k}{m}$ (h) $x = \frac{d-3b}{c}$
 (i) $x = \frac{kc-g}{h}$
4. (a) $l = \frac{P}{4}$ (b) $I = \frac{V}{R}$ (c) $T = \frac{S}{D}$ (d) $b = \frac{A}{l}$
 (e) $d = \frac{C}{\pi}$ (f) $U = \frac{G}{T}$ (g) $t = \frac{v-u}{a}$ (h) $l = \frac{P-2b}{2}$
 (i) $y = \frac{H-5m}{x}$
5. (a) $c = 2b$ (b) $c = 5x$ (c) $c = 4y$ (d) $c = 6m$
 (e) $c = 9k$ (f) $c = 10d$ (g) $c = 2(a-2)$ (h) $c = 3(h+5)$
 (i) $c = 4(p-q)$ (j) $c = 10(y+x)$ (k) $c = 8(t-2s)$ (l) $c = 5(r+3q)$

6. (a) $x = \frac{3}{y}$ (b) $x = \frac{c}{d}$ (c) $x = \frac{y}{m}$ (d) $x = \frac{a+2}{s}$
 (e) $x = \frac{z-1}{w}$ (f) $x = \frac{b+c}{a}$ (g) $x = 9a - 8$ (h) $x = 2k + 5$
 (i) $x = 3 - 4p$ (j) $x = \frac{2}{y-1}$ (k) $x = \frac{6}{z+7}$ (l) $x = \frac{m}{h-k}$

Applying Geometric Skills to Sides and Angles of a Shape

Using Pythagoras' Theorem

1. (a) 10 (b) 17 (c) 25 (d) 10.3 (e) 14.7 (f) 8.1
 (g) 6.6 (h) 2.8 (i) 124 (j) 2.0 (k) 17.4 (l) 16.6
 (m) 68.5 (n) 22.7 (o) 4.0
2. (a) 6.2 (b) 12.7 (c) 23 (d) 8 (e) 10.3 (f) 6.8
 (g) 4.8 (h) 2.4 (i) 62 (j) 2.1 (k) 12.1 (l) 13.3
 (m) 42.5 (n) 16.4 (o) 1.5
3. 2.4 m 4. 2.5 m 5. 3.8 m
6. 13.1 m 7. 83.2 cm 8. (a) 11.7cm (b) 12.7cm
9. (a) 20cm (b) 15cm
10. (a) 15cm (b) 16cm
11. 19.2km 12. 427.2km 13. 9.6km
14. 7.9km 15. 15.6mm 16. 16.6cm
17. 4.6m 18. 4.4m
19. 16.9m 20. 1.92m

Pythagoras' Theorem (more practice)

1. 6.7m
2. P = 46.4cm; P = 46.4m
3. 4.8m or 4.9m depending on rounding; 6.3m or 6.4m depending on rounding
4. 10.6m
5. 9.9m; 8.4 or 8.5m depending on rounding.

Calculating the Distance between 2 Points

- (a) 3·6 (b) 4·5 (c) 6·3
(d) 7·1 (e) 7·6
- (a) 3·6 (b) 5·4 (c) 5·4 (d) 8·6
(e) 5·8 (f) 9·4 (g) 9·9 (h) 13
- (a) 7·6 (b) 7·2 (c) 11·2 (d) 10·8 (e) 12·2 (f) 10·8
- (a) $PQ = 3·6$, $QR = 7·6$, $RP = 6·4$
(b) $PQ = 11·2$, $QR = 8·5$, $RP = 9·4$
- (a) $AB = 4$, $AC = 4·5$, $BC = 4·5$ (b) Isosceles
- (a) $KL = 3·2$, $KN = 3·2$, $NM = 3·2$, $LM = 3·2$ (b) Square or Rhombus
- $EF = 8·5$, $EG = 6·1$, $FG = 7·6$; Scalene
- $VW = 7·6$, $VY = 5·7$, $WX = 5·7$, $YX = 7·6$; Rectangle or Parallelogram

Using Pythagoras' Theorem

EXAM QUESTIONS

- 24cm
- 80m
- 540cm^2
- 37cm
- 15cm
- 38·6m
- 41·2cm
- 11·2m
- 25cm
- £64.35
- 9·2m
- 33cm
- £952
- (a) 8mm; 4mm (b) 6·9mm
- 21·5m
- 68·8cm
- $1994·2\text{cm}^2$
- 42·8cm
- 13·4m
- 36km

Using a Fractional Scale Factor to Enlarge or Reduce a Shape

Questions 1 – 6: Check diagrams

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

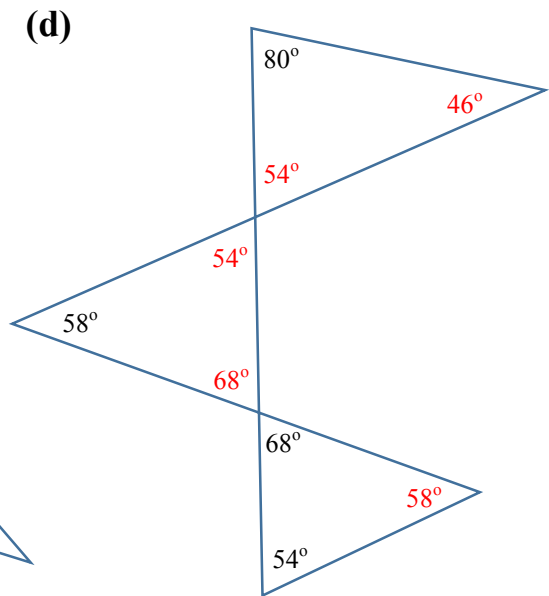
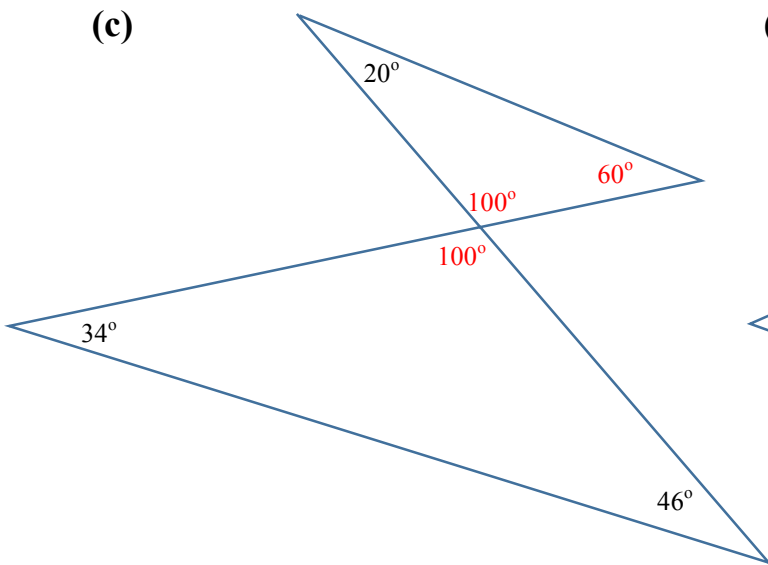
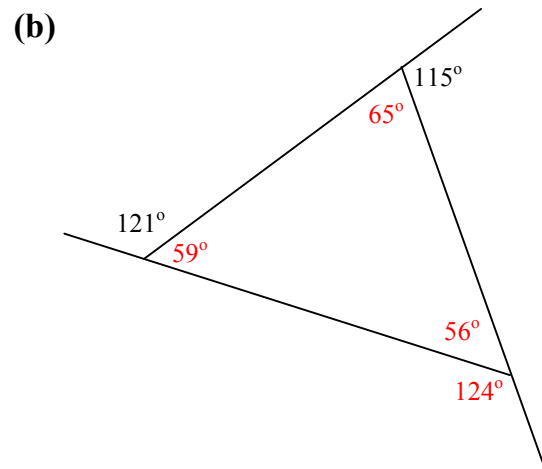
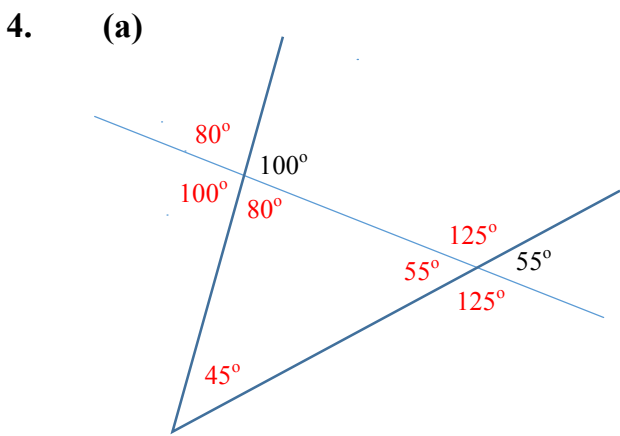
Applying Geometric Skills to Sides and Angles of a Shape

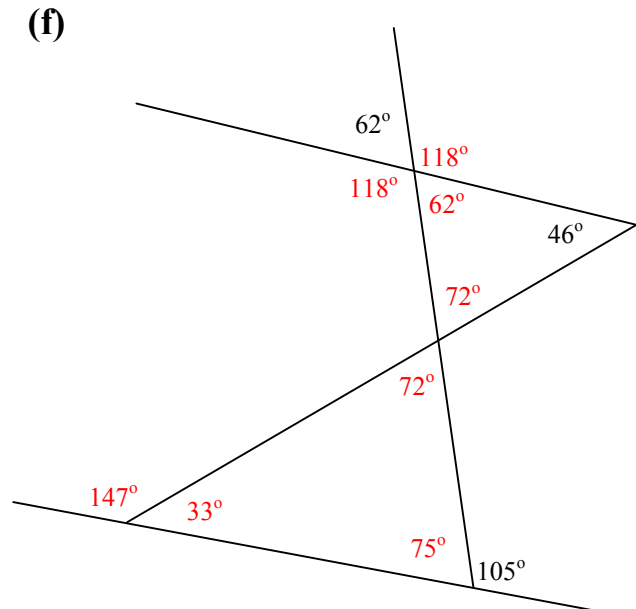
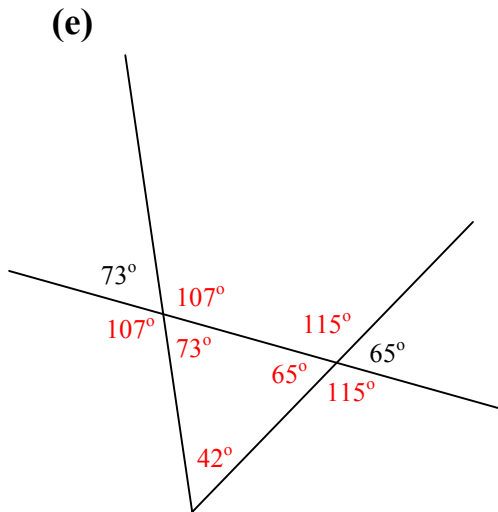
Using Parallel Lines, Symmetry and Circle Properties to Calculate Angles

REMINDERS

1. $a = 115^\circ$ $b = 60^\circ$ $c = 145^\circ$ $d = 85^\circ$ $e = 100^\circ$
 $f = 75^\circ$ $g = 112^\circ$ $h = 38^\circ$ $i = 142^\circ$ $j = 85^\circ$
 $k = 95^\circ$ $l = 85^\circ$ $m = 32^\circ$ $n = 32^\circ$ $p = 148^\circ$

2. $a = 40^\circ$ $b = 108^\circ$ $c = 80^\circ$ $d = 90^\circ$
3. (a) $75^\circ/30^\circ$ (b) 48° (c) both 80°
 (d) all 60° (e) $45^\circ/90^\circ$





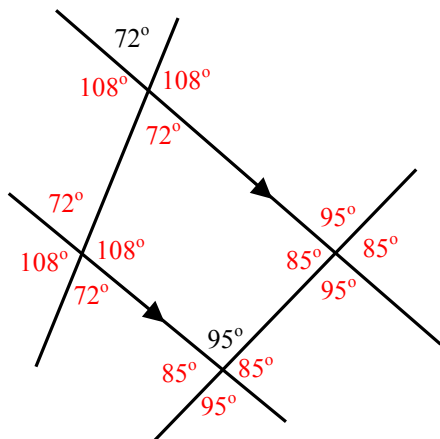
Applying Geometric Skills to Sides and Angles of a Shape

Using Parallel Lines, Symmetry and Circle Properties to Calculate Angles

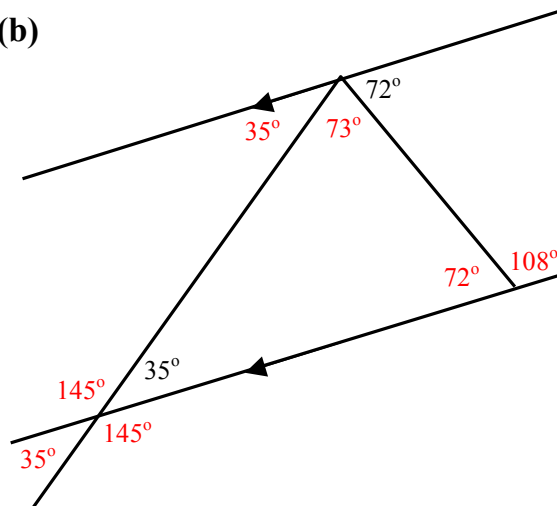
PART 1

1. (a) $a = 108^\circ$ $b = 72^\circ$
 (b) $c = 32^\circ$ $d = 148^\circ$ $e = 32^\circ$
 (c) $f = 67^\circ$ $g = 113^\circ$
 (d) $h = 53^\circ$ $i = 66^\circ$ $j = 61^\circ$ $k = 53^\circ$
 (e) $l = 56^\circ$ $m = 56^\circ$ $n = 67^\circ$
 (f) $p = 25^\circ$ $q = 25^\circ$ $r = 130^\circ$
2. (a) $a = 41^\circ$ $b = 65^\circ$ $c = 74^\circ$
 (b) $d = 105^\circ$ $e = 75^\circ$
 (c) $f = 150^\circ$ $g = 30^\circ$ $h = 50^\circ$ $i = 100^\circ$
3. (a) $a = 55^\circ$ $b = 63^\circ$ $c = 62^\circ$
 (b) $d = 65^\circ$ $e = 65^\circ$ $f = 115^\circ$ $g = 83^\circ$ $h = 97^\circ$
4. (a) $a = 19^\circ$ $b = 122^\circ$ $c = 102^\circ$
 (b) $d = 57^\circ$ $e = 58^\circ$ $f = 65^\circ$

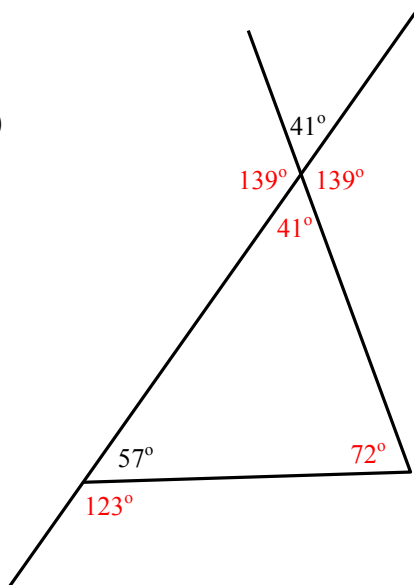
5. (a)



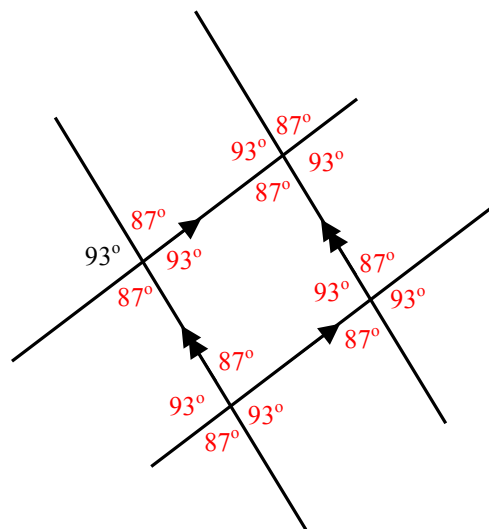
(b)



(c)



(d)



6. (a) 34° (b) 20° (c) 40° (d) 36° (e) 30° (f) 25°
 (g) 20° (h) 110°

Applying Geometric Skills to Sides and Angles of a Shape

Using Parallel Lines, Symmetry and Circle Properties to Calculate Angles

PART 2

- | | | | | | | |
|----|----------------|----------------|-----------------|----------------|----------------|----------------|
| 1. | $a = 57^\circ$ | $b = 90^\circ$ | $c = 18^\circ$ | $d = 45^\circ$ | $e = 90^\circ$ | $f = 26^\circ$ |
| 2. | $a = 90^\circ$ | $b = 45^\circ$ | $c = 90^\circ$ | $d = 55^\circ$ | $e = 90^\circ$ | $f = 43^\circ$ |
| | $g = 90^\circ$ | $h = 18^\circ$ | $i = 90^\circ$ | $j = 63^\circ$ | $k = 90^\circ$ | $l = 78^\circ$ |
| 3. | $a = 90^\circ$ | $b = 20^\circ$ | $c = 110^\circ$ | $d = 90^\circ$ | $e = 60^\circ$ | $f = 30^\circ$ |
| | $g = 25^\circ$ | $h = 25^\circ$ | $i = 90^\circ$ | $j = 65^\circ$ | $k = 90^\circ$ | $l = 90^\circ$ |
| | $m = 45^\circ$ | $n = 55^\circ$ | | | | |

Applying Trigonometric Skills to Right-angled Triangles

Calculating a side in a right-angled triangle

1. (a) 1.9cm (b) 6m (c) 17m
(d) 3.9cm (e) 4.6m (f) 13.7cm
(g) 5m (h) 9.2cm (i) 4.9cm
(j) 5.4m (k) 3.1m (l) 1.3cm
(m) 17.7cm (e) 5.8m (o) 17.7mm
2. (a) 3cm (b) 5.7m (c) 14.5m
(d) 6cm (e) 2.4m (f) 24.3cm
(g) 1.5m (h) 5.7cm (i) 4.9cm
(j) 4.6m (k) 6.3m (l) 2.4cm
(m) 23.3cm (n) 4.6m (o) 5.5mm
3. (a) 3.7cm (b) 3.1m (c) 10.7m
(d) 5.7cm (e) 1.6m (f) 60.7cm
(g) 2.2m (h) 2cm (i) 4.8cm
(j) 2.8m (k) 7.4m (l) 6.9cm
(m) 42.4cm (n) 7.2m (o) 0.8mm
4. (a) 3.9cm (b) 13m (c) 5.2m
(d) 9.9cm (e) 5m (f) 64.9cm
(g) 1.6m (h) 5cm (i) 5.6cm
(j) 9.6m (k) 9.3m (l) 7.1cm
(m) 26.5cm (n) 33.7m (o) 83.7mm

Applying Trigonometric Skills to Right-angled Triangles

Calculating an angle in a right-angled triangle

1. (a) 33.9° (b) 72.6° (c) 52.7°
(d) 52° (e) 51° (f) 21.8°
(g) 59.4° (h) 61.4° (j) 45°
(j) 19.7° (k) 34° (l) 21.6°
(m) 38.8° (n) 67.2° (o) 16.2°

- | | | | | | | |
|----|-----|--------------|-----|--------------|-----|--------------|
| 2. | (a) | 42.1° | (b) | 56.2° | (c) | 49.7° |
| | (d) | 39.5° | (e) | 41.8° | (f) | 23.6° |
| | (g) | 45.2° | (h) | 43.4° | (i) | 46.2° |
| | (j) | 21° | (k) | 32.1° | (l) | 21.2° |
| | (m) | 26.7° | (n) | 46.1° | (o) | 27.5° |
| 3. | (a) | 47.9° | (b) | 65° | (c) | 56.5° |
| | (d) | 36.5° | (e) | 54.6° | (f) | 36.9° |
| | (g) | 55.6° | (h) | 68.7° | (i) | 43.8° |
| | (j) | 30.8° | (k) | 41.9° | (l) | 39.3° |
| | (m) | 36.7° | (n) | 68.2° | (o) | 44.1° |
| 4. | (a) | 47.5° | (b) | 64.2° | (c) | 58.1° |
| | (d) | 38.2° | (e) | 58.5° | (f) | 24.8° |
| | (g) | 68.4° | (h) | 40° | (i) | 45° |
| | (j) | 42° | (k) | 32.4° | (l) | 28.9° |
| | (m) | 27.1° | (n) | 62° | (o) | 33.4° |

Applying Trigonometric Skills to Right-angled Triangles

Problem Solving Questions

- | | | | | | | | | | | | | |
|-----|--------------|--------------|--------------|-----|--------------|----|-------------|--------------|---|-----|--------------|---|
| 1. | 9.9 m | 2. | 77.1 m | 3. | 3.7 m | 4. | 6.7° | | | | | |
| 5. | 57.6° | 6. | 35.7° | 7. | 275 cm | 8. | 15.9m | | | | | |
| 9. | (a) | 14.0° | N | (b) | 21.8° | Y | (c) | 18.9° | N | (d) | 17.9° | N |
| | (e) | 19.9° | N | (f) | 20.2° | Y | (g) | 19.6° | N | (h) | 20.9° | Y |
| 10. | (a) | 24.2° | Y | (b) | 19.3° | N | (c) | 21.3° | N | (d) | 29.4° | N |
| | (e) | 25.8° | Y | (f) | 30.7° | N | (g) | 29.2° | N | (h) | 21.3° | N |

Applying Trigonometric Skills to Right-angled Triangles

EXAM QUESTIONS

- | | | | |
|----|--|-----|--|
| 1. | No since $20.4^\circ < 21^\circ$ | 2. | 295cm or 2.95mA |
| 3. | Correct since $3^\circ < 3.05^\circ < 5^\circ$ | 4. | 16.2cm or 16.3cm depending on rounding |
| 5. | 28.7° | 6. | 2.85m |
| 7. | 33.6° | 8. | 41.5m |
| 9. | Yes, since $10^\circ < 11.5^\circ < 12^\circ$ | 10. | 8.57m |

- | | |
|---|--|
| 11. 53.1° | 12. 2.04m |
| 13. 4.9° | 14. 11.5cm |
| 15. OK since $24^\circ < 24.6^\circ < 26^\circ$ | 16. 42° |
| 17. 41.4° | 18. (a) 7.9m (b) 70cm or 71cm [rounding] |
| 19. 3.16m | 20. No since $40.7^\circ > 40^\circ$ |

Applying Statistical Skills to Representing Diagrams

Constructing a scattergraph.

- (a) no relation (b) positive (c) negative
- (a) positive correlation (more rain – more people buy umbrellas)
(b) no relation between hair colour and pocket money
(c) negative correlation (the faster you go, the less time it takes)
- (a) yes (b) yes, but not strong
(c) yes (d) no

Applying Statistical Skills to Representing Diagrams

Drawing and applying the line of best fit

- student's best fit lines
- student's best fit lines
- (a) graph drawn (b) approx $1 \square 6$
- (a) graph drawn (b) approx. 19
- (a) graph drawn (b) approx. 62°C
- (a) graph drawn (b) approx 0.3

Applying Statistical Skills to Representing Diagrams

EXAM QUESTIONS

- (a) line drawn (b) 3.5 – 4.5
- (a) line drawn (b) approx. 70
- (a) line drawn (b) approx. 9.8°C
- (a) graph completed (b) line drawn
- (a) line drawn (b) approx. 170cm