Dalkeith High School

Maths

National 4

Relationships

Revision Booklet

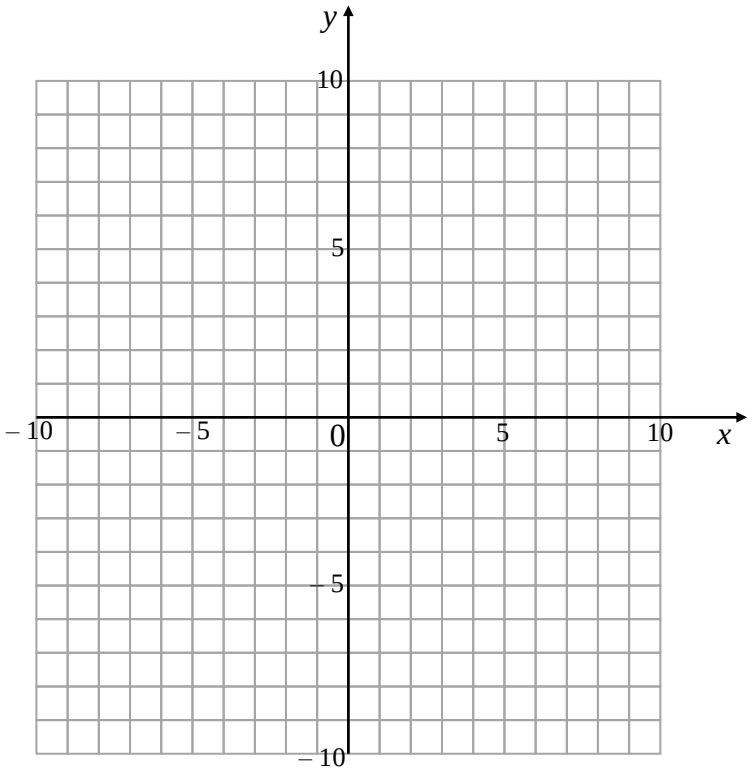
Contents

Practice Unit Assessment (1) Relationships

1. **(a)** Copy and complete the table below for $y = 2x + 1$.

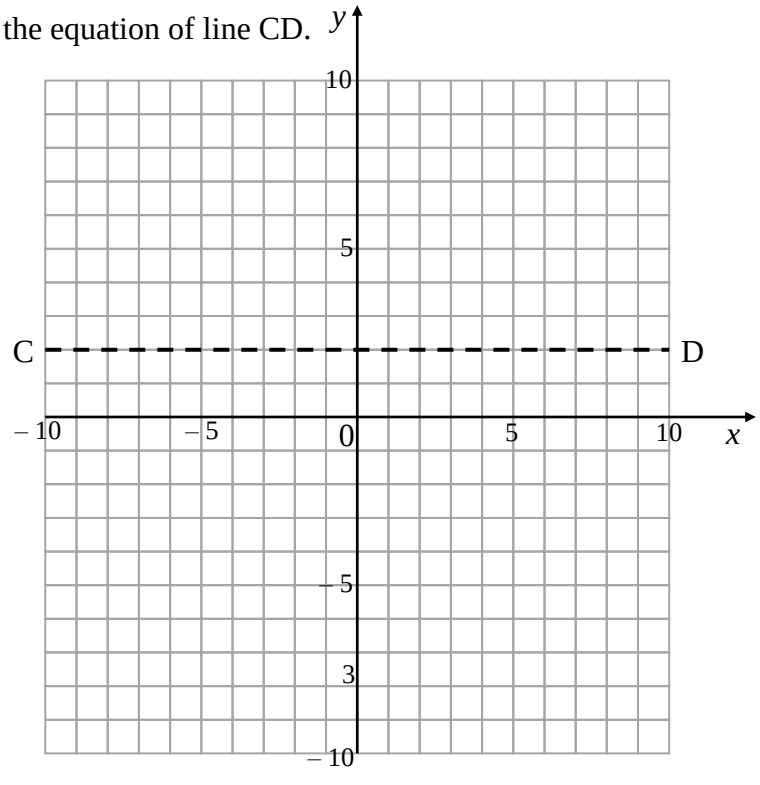
x	1	2	3
y			

(b) Draw the line $y = 2x + 1$, you will also need to draw a grid (see below)



2. Line CD is shown on the grid below.

Write down the equation of line CD.



3. Solve the following equation:

$$3y + 7 = -14$$

4. To find the distance of a journey we use the formula $D = ST$

Change the subject of the formula to T.

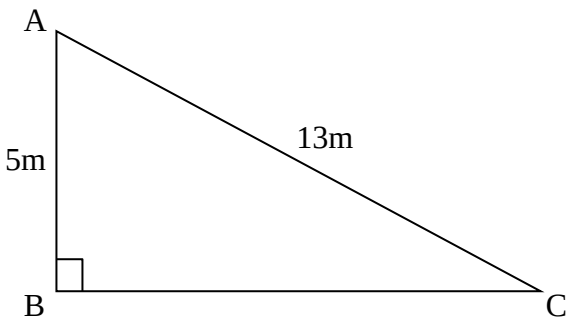
5. Change the subject of the formula

$a = 7b + 2$ to b.

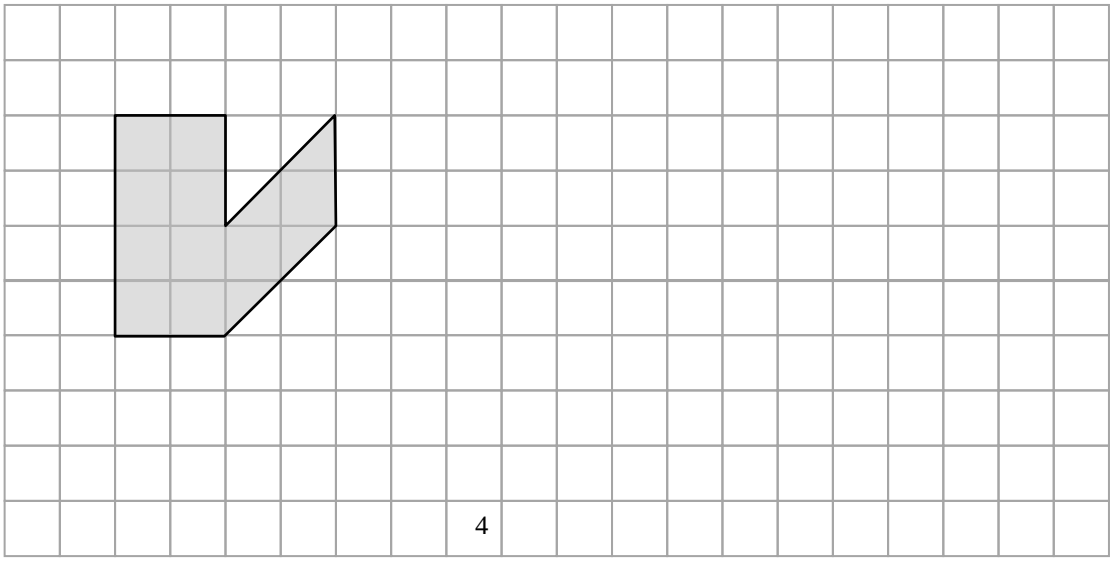
6. Triangle ABC is a right-angled triangle as shown in the diagram below.

AB is 5 metres long and AC is 13 metres long.

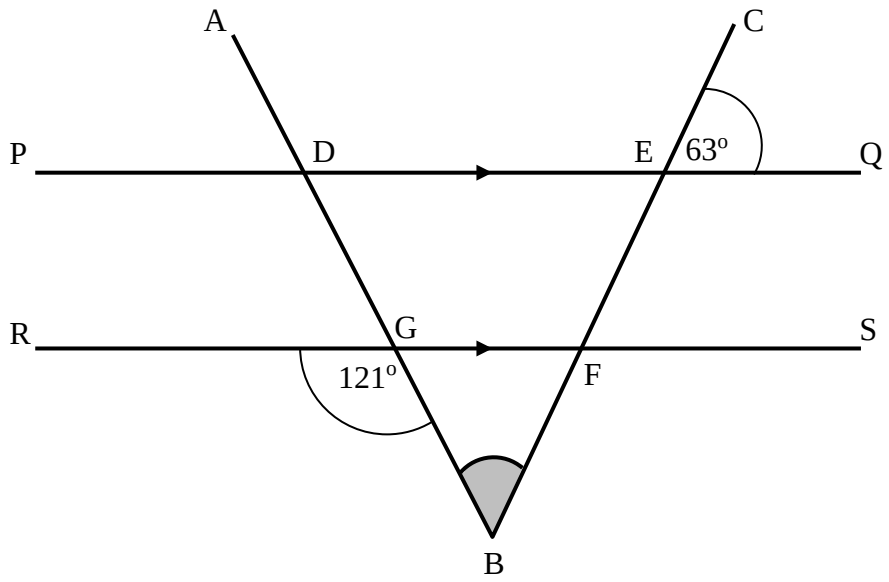
Calculate the length of BC (in metres).



7. Copy the diagram below and construct an enlargement of the given shape using a scale factor of $\frac{5}{2}$.



8. In the diagram below, lines PQ and RS are parallel.
Lines BA and BC intersect PQ and RS at the points D, E, F and G as shown.
Angle CEQ is 63° and angle RGB is 121°.

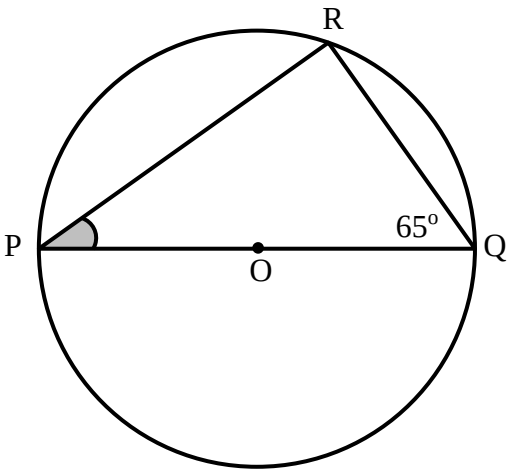


Calculate the size of angle ABC.

9. PQ is the diameter of a circle, centre O.

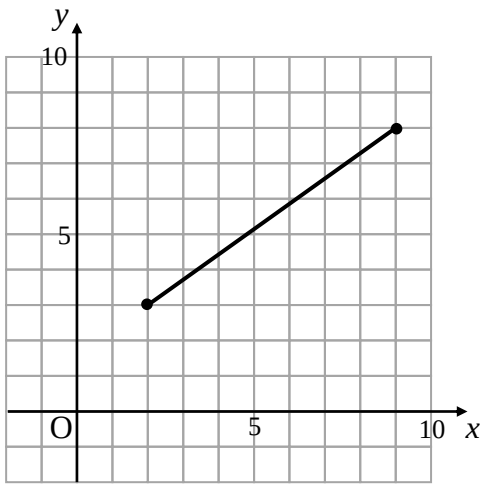
R is a point on the circumference of the circle.
Angle PQR is 65°.

Calculate the size of the shaded angle QPR.

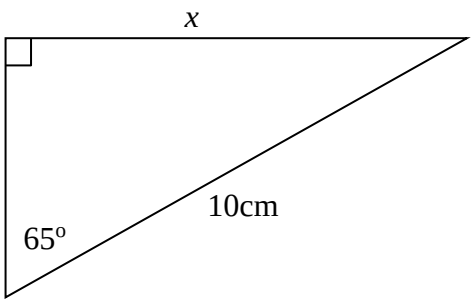


10. The end points of the line shown in the diagram have coordinates (2, 3) and (9, 8).

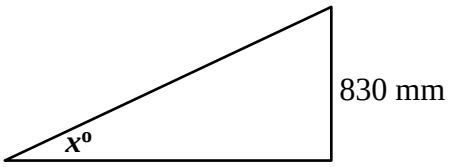
Calculate the length of the line.



11. Calculate the length of side *x* in the right-angled triangle below.



12. The diagram shows a ramp which has been manufactured for a shop entrance.



7200mm

(a) Calculate the size of angle *x*.

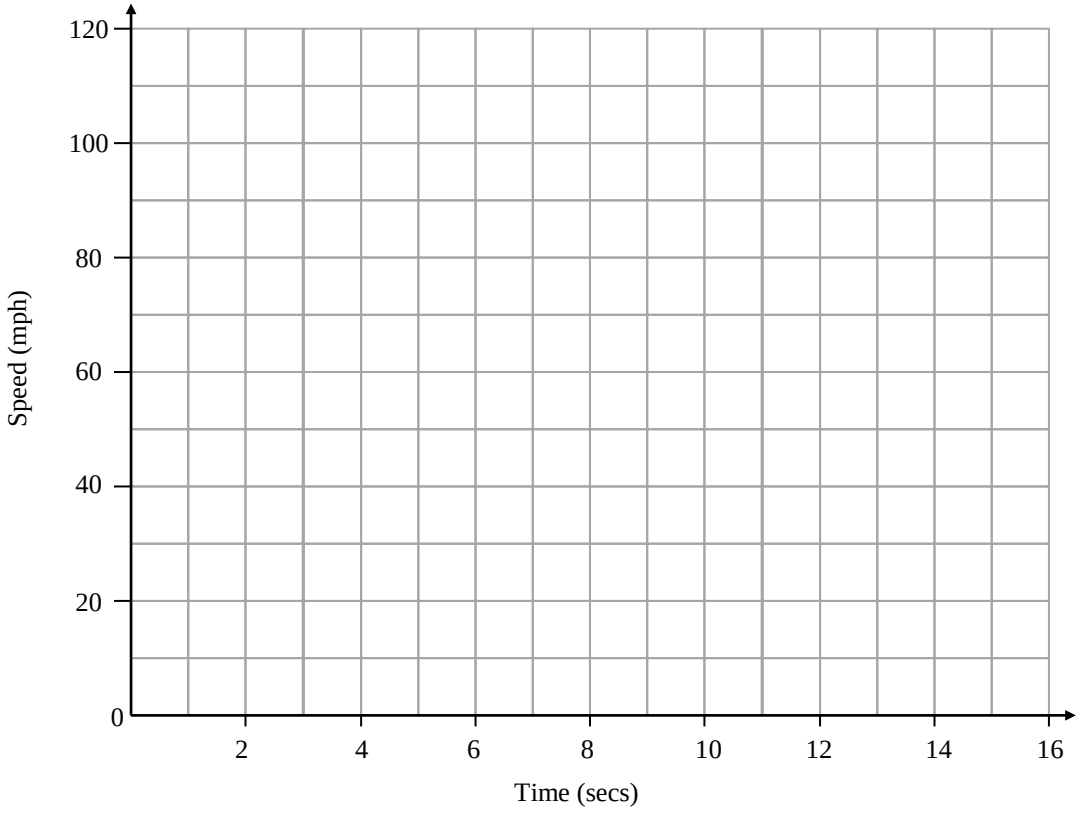
(b) For the ramp to be safe for wheelchair users the angle *x* should be between 5° and 7°.

Is this ramp suitable for wheelchair users? (Justify your answer)

13. The following table shows the speed of a car accelerating from rest.

Time (secs)	0	2	6	8	12	16
Speed (mph)	0	10	50	60	80	110

(a) Draw a scattergraph of the information on a copy of this grid..



(b) Draw the best fitting line on the graph.

(c) Use your graph to estimate the speed after 4 seconds.

(d) A car travelling at a speed of 70 mph was estimated to have been accelerating for 10 seconds. Is this a reasonable estimate?

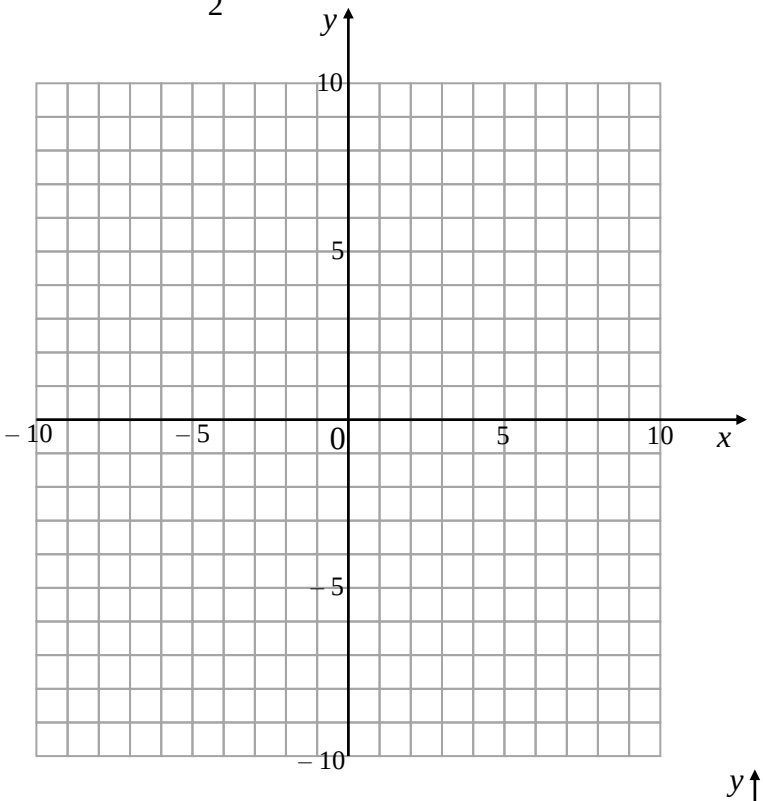
End of Question Paper

Practice Unit Assessment (2) Relationships

1. **(a)** Complete the table below for $y = \frac{1}{2}x + 2$

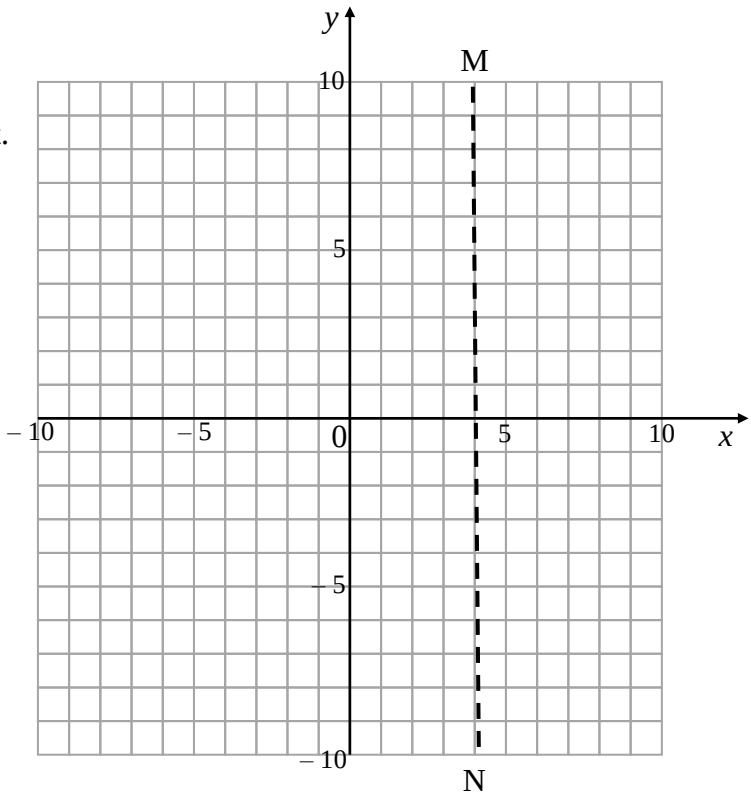
x	2	4	6
y			

(b) Draw the line $y = \frac{1}{2}x + 2$, you will also need to draw a grid (see below)



2. Line MN is shown on the grid to the right.

Write down the equation of line MN.



3. Solve the following equation:

$$4y - 3 = 13$$

4. A formula used in Physics to find wavelength is $v = f\lambda$.

Change the subject of the formula to *f*.

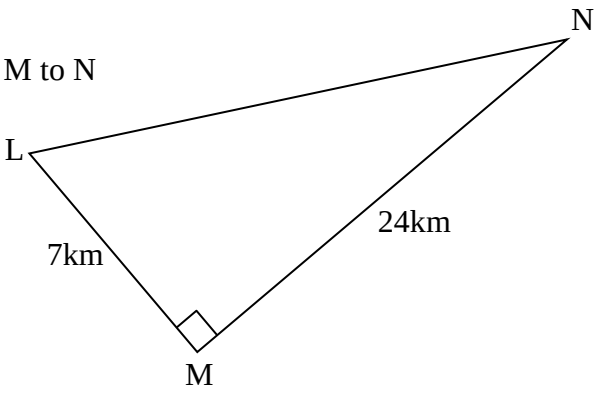
5. Change the subject of the formula

$y = 2x - 3$ to *x*.

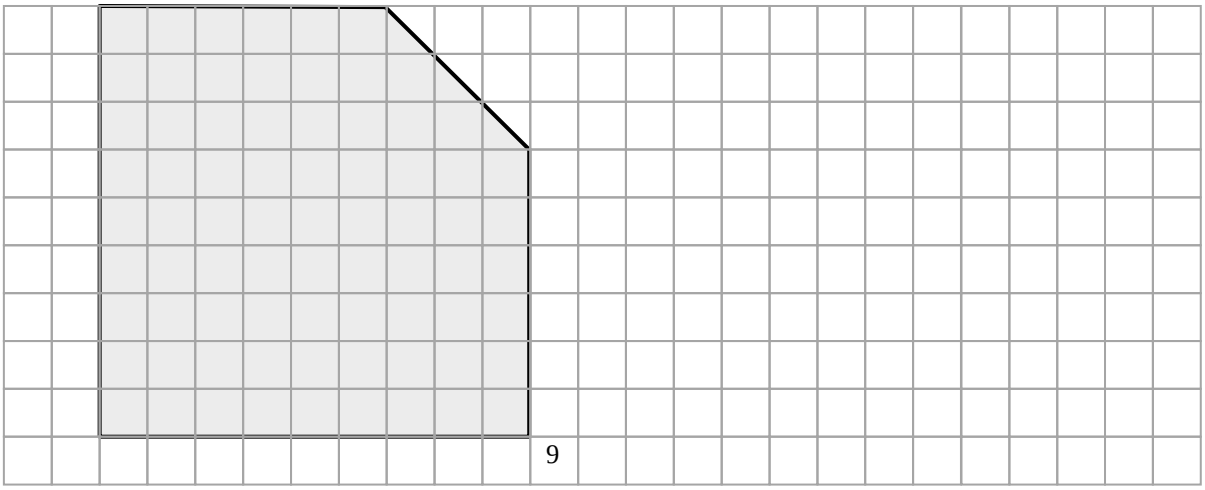
6. Triangle LMN represents a road network. It is a right-angled triangle.

The distance from L to M is 7 kilometres and from M to N is 24 kilometres.

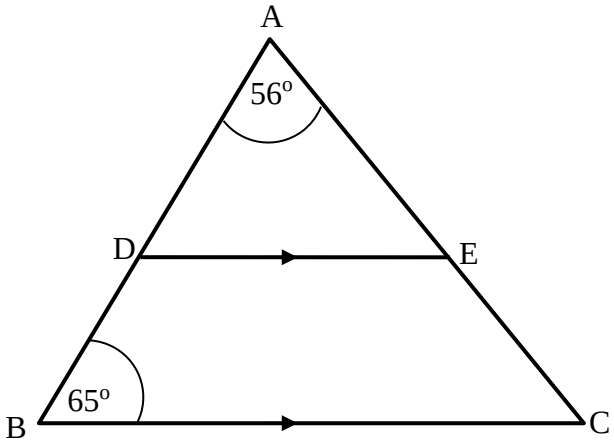
Calculate the distance from L to N (in kilometres).



7. Copy the diagram below and construct an enlargement of the given shape using a scale factor of $\frac{2}{3}$.



8. In the diagram below, lines DE and BC are parallel.
Point D lies on the line AB and the point E on the line AC.
Angle ABC is 65° and angle DAE is 56°.

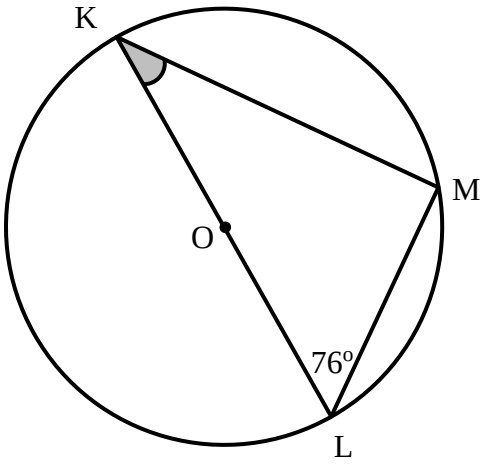


Calculate the size of angle AED.

9. KL is the diameter of a circle, centre O.

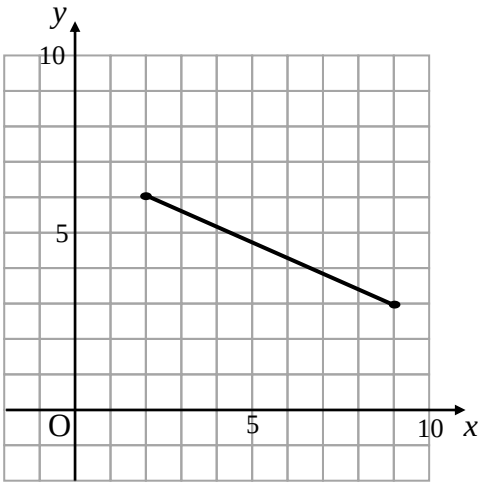
M is a point on the circumference of the circle.
Angle KLM is 76°.

Calculate the size of the shaded angle MKL.

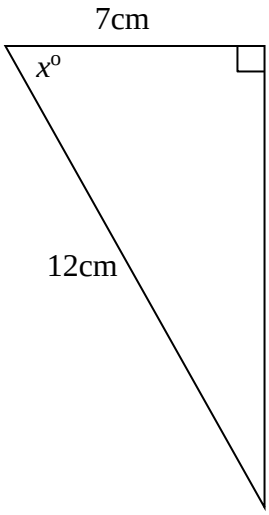


10. The end points of the line shown in the diagram have coordinates (2, 6) and (9, 3).

Calculate the length of the line.

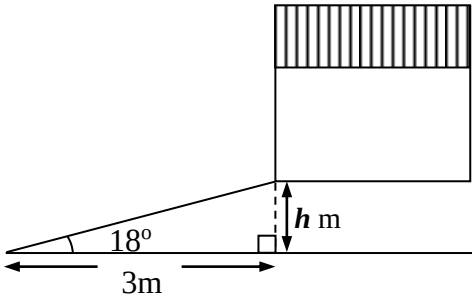


11. Calculate the size of the angle marked x^o in the right-angled triangle below.



12. A driveway leading up to a garage is 3 metres long and at an angle of 18^o to the horizontal.

(a) Calculate the height, ***h*** metres, which the ramp rises.

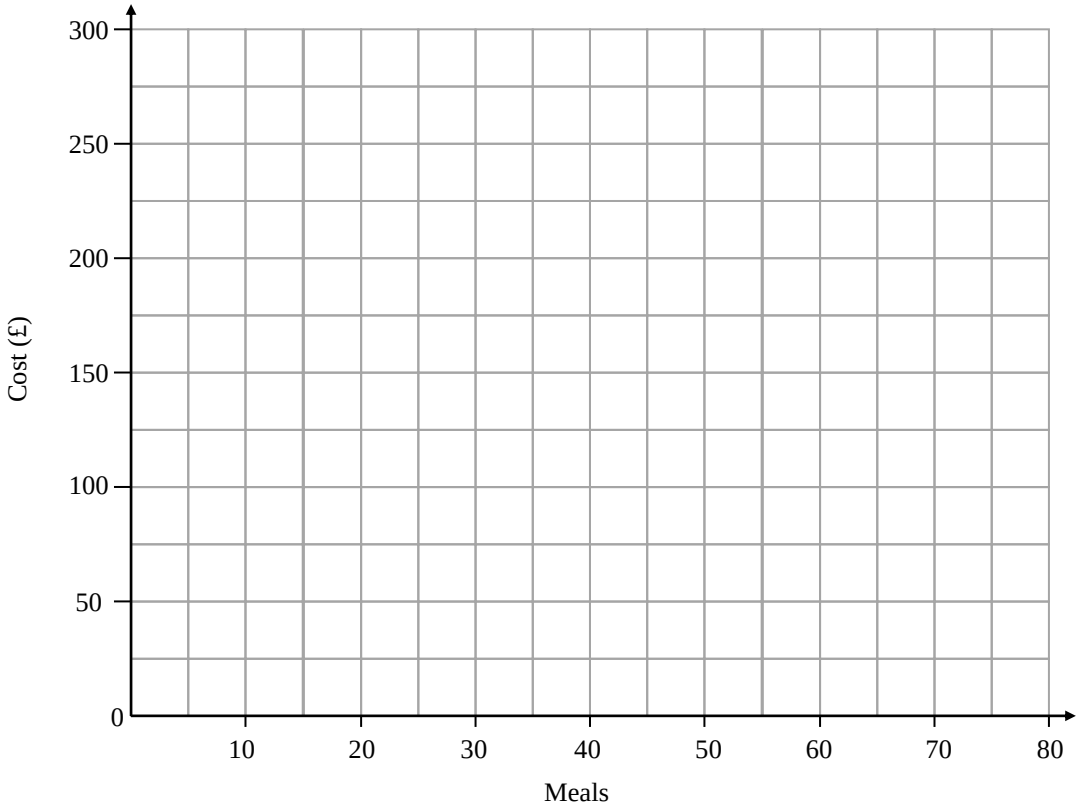


(b) For the driveway to pass regulations it rise by no more than 1 metre. Would this driveway pass regulations? (Justify your answer)

13. A restaurant manager finds that the cost of running his restaurant depends on the number of meals served.

(a) Draw a scattergraph of the information on a copy of this grid.

Number of meals	10	20	30	40	50	60
Cost in £	125	175	175	225	225	275



(b) Draw the best fitting line on the graph.

(c) Use your graph to estimate the cost of running the restaurant when 55 meals are served.

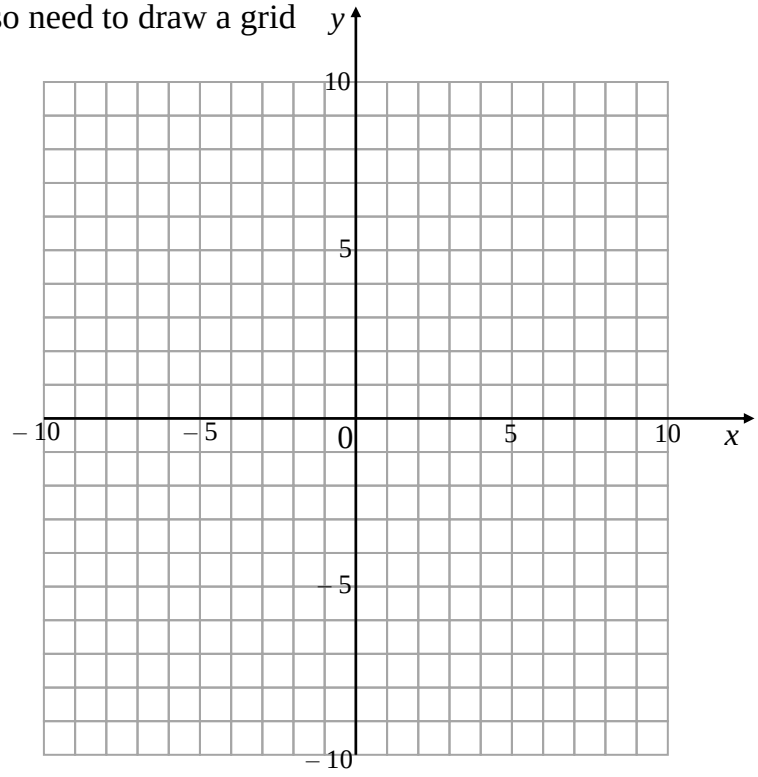
(d) The restaurant owner estimates the cost of running the restaurant when 75 meals were served would be £300. Is this a reasonable estimate?

Practice Unit Assessment (3) for National 4 Relationships

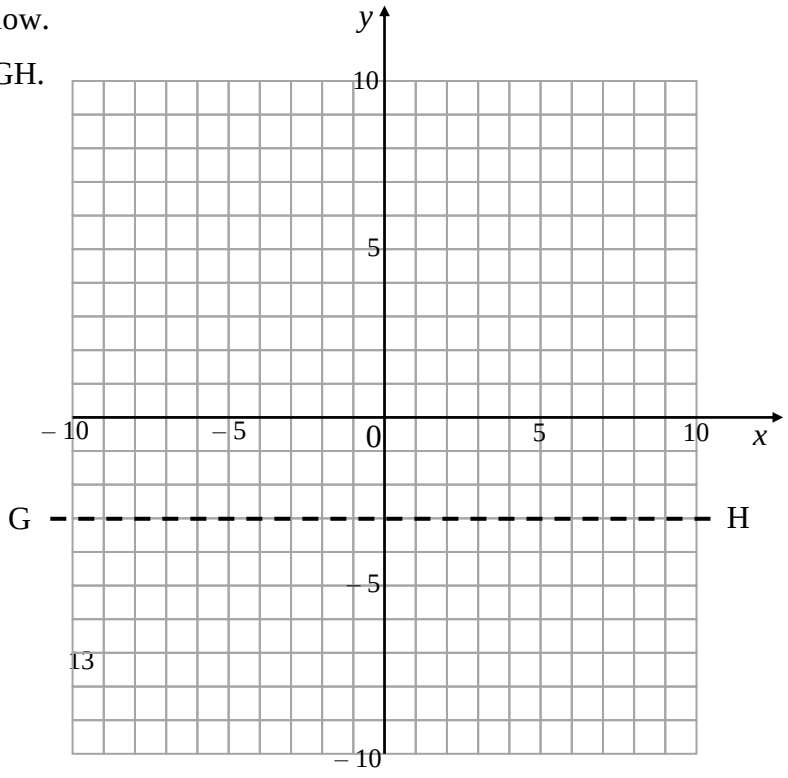
1. **(a)** Complete the table below for $y = 3x - 2$

x	1	2	3
y			

(b) Draw the line , you will also need to draw a grid



2. Line GH is shown on the grid below.
Write down the equation of line GH.



3. Solve the following equation:

$$8k + 3 = -21$$

4. The formula for find the circumference of a circle is $C = \pi D$.

Change the subject of the formula to *D.*

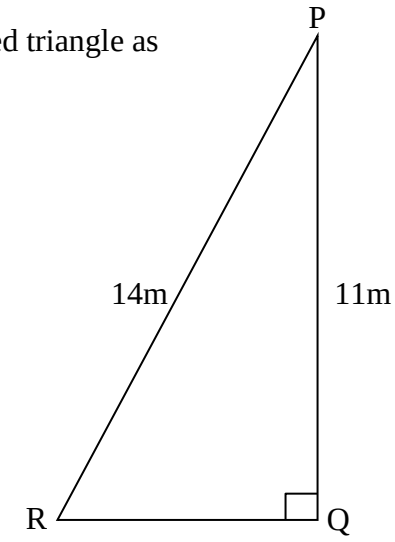
5. Change the subject of the formula

$$v = u + 6t \quad \text{to } t.$$

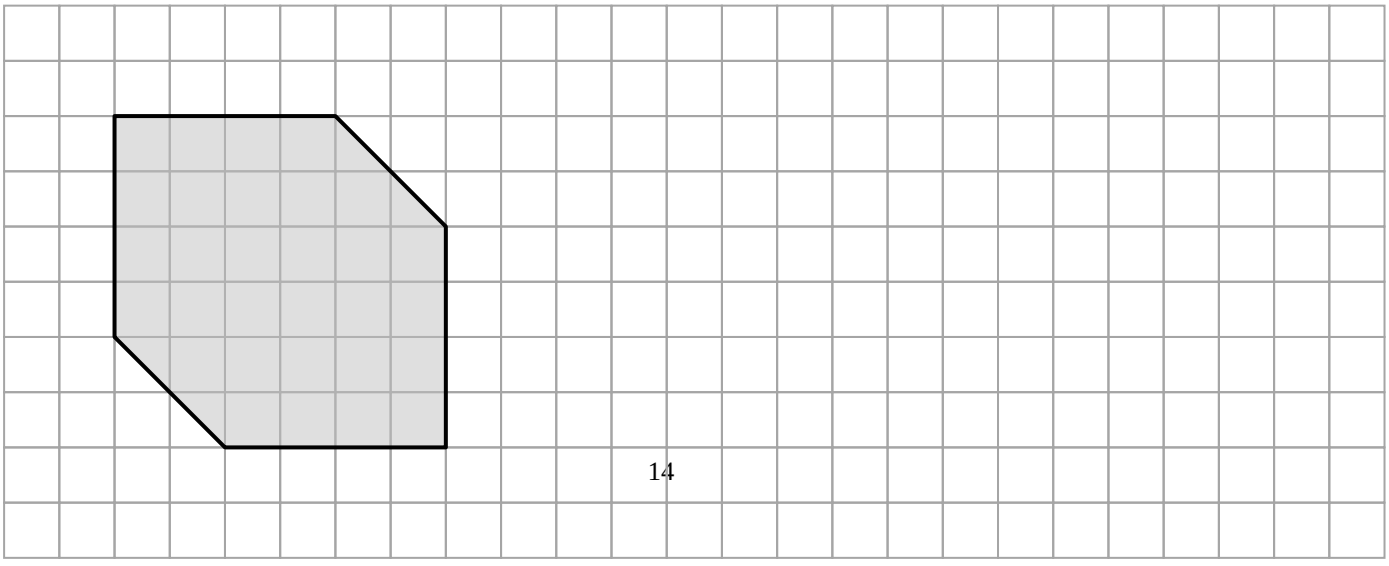
6. A piece of lawn in my garden is in the shape of a right – angled triangle as shown by triangle PQR in the diagram.

The distance PR is 14 metres and PQ is 11 metres.

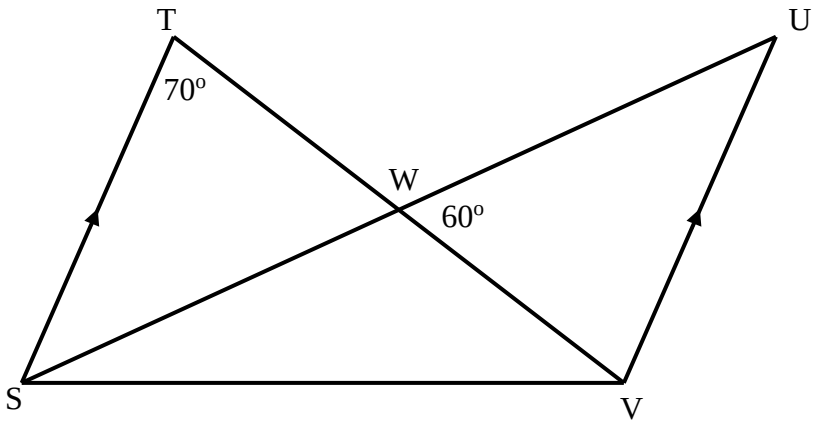
Calculate the length RQ (in metres).



7. Copy the diagram below and construct an enlargement of the given shape using a scale factor of $\frac{3}{2}$.



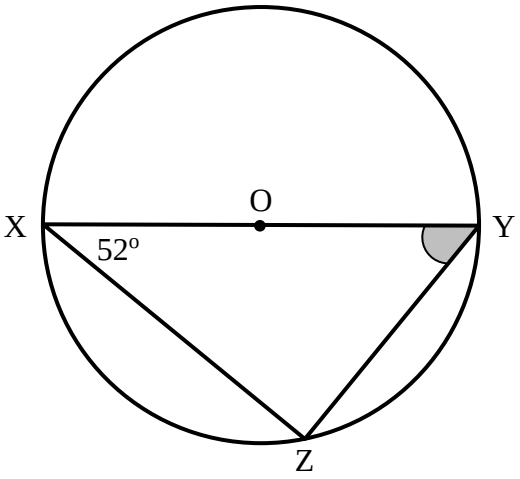
8. In the diagram below, lines ST and VU are parallel.
W is the point of intersection of TV and SU.
Angle STV is 70° and angle UWV is 60º.



Calculate the size of angle SUV.

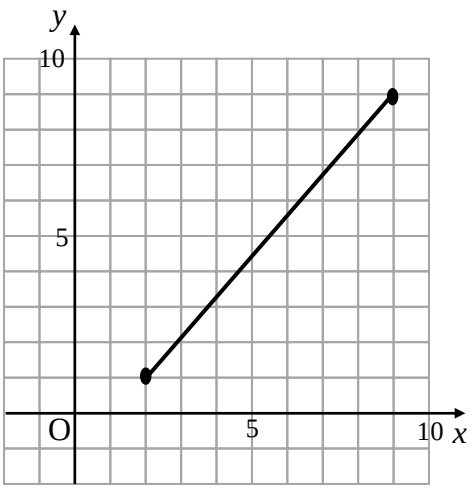
9. XY is the diameter of a circle, centre O.

Z is a point on the circumference of the circle.
Angle ZXY is 52°.
Calculate the size of the shaded angle ZYX.

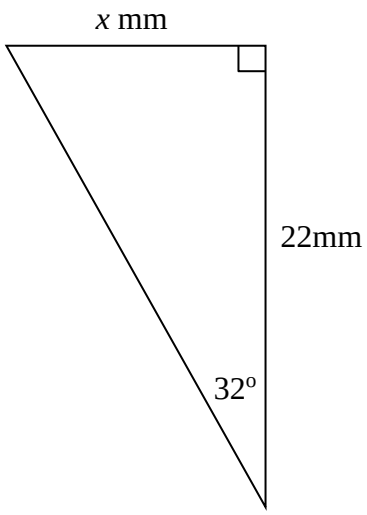


10. The end points of the line shown in the diagram have coordinates (2, 1) and (9, 9).

Calculate the length of the line.

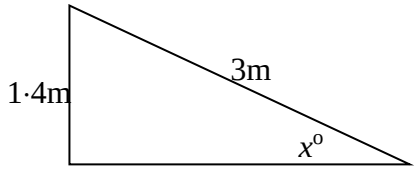


11. Calculate the length of side x in the right-angled triangle below.



12. A child's chute is 3 metres long and one end of it is 1·4 metres from the ground.

(a) Use the diagram below to help you calculate the angle, x^o, which the chute makes with the ground.



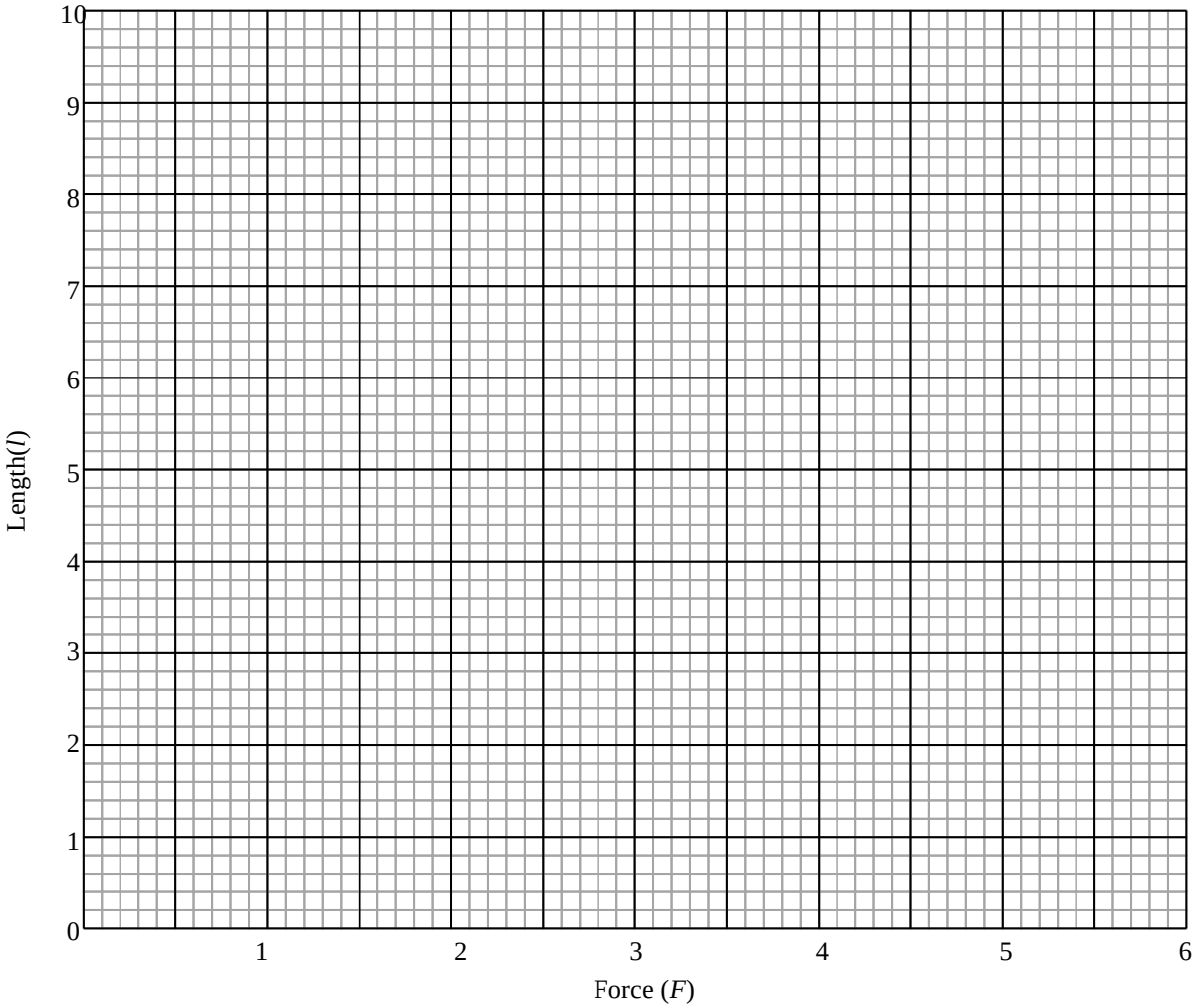
(b) To be safe the angle that the chute makes with the ground should be between 27^o and 28^o.

Is this chute safe? (Justify your answer)

13. The results below show the length of a spring when a force is applied.

Force (F)	1	2	3	4	5	6
Length (l)	3·0	3·8	5·4	6·0	6·8	8·2

(a) Draw a scattergraph of the information on a copy of this grid.



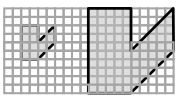
(b) Draw the best fitting line on the graph.

(c) Use your graph to estimate the length of the spring when a force of 3·5 is applied.

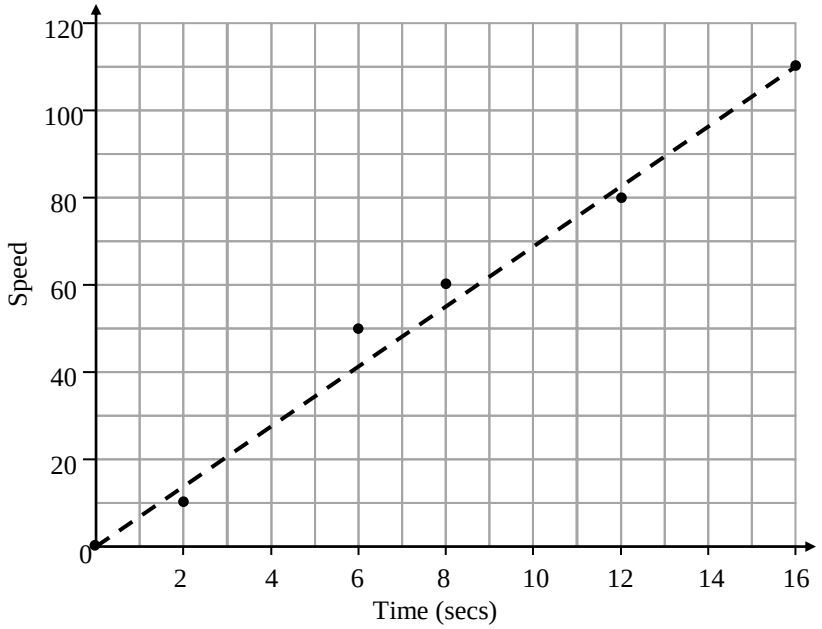
(d) It is estimated that the length of the spring should be 6·6 when a force of 4·5 is applied to it. Is this a reasonable estimate?

Practice Unit Assessment (1) Relationships — Marking Scheme

Points of reasoning are marked # in the table.

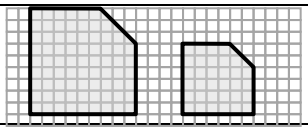
Question	Main points of expected responses	
1	•1 complete table of values •2 points plotted •3 line drawn	•1 y = 3, 5 and 7 •2 (1, 3), (2, 5), (3, 7) •3 straight line graph of $y = 2x + 1$
2	•1 line CD identified	•1 $y = 2$
3	•1 solve for $3y$ •2 solve for y	•1 $3y = -21$ •2 $y = -7$
4	•1 divide D by S	•1 $T = D/S$
5	•1 subtract 2 from a •2 divide by 7	•1 $7b = a - 2$ •2 $b = \frac{a-2}{7}$
6	•1 know to use Pythagoras •2 correct use of Pythagoras •3 correct answer	•1 $BC^2 = 13^2 - 5^2 = 144$ •2 $BC = \sqrt{(144)}$ •3 BC = 12 m
7	•1 3 lines correct •2 further 3 lines correct	•1 •2 
8	#2.1 valid strategy •1 third angle calculated	#2.1 63^o and 59^o within one of the triangles •1 58^o
9	•1 angle in semi-circle •2 angles in a triangle	•1 angle in semi-circle = 90^o •2 angle QPR = $180 - 90 - 65 = 25^o$
10	# 2.1 use valid strategy •1 correct answer	#2.1 finds horizontal and vertical distances (7 and 5) and applies Pythagoras' Theorem •1 $8 \cdot 6$
11	•1 use sine ratio correctly •2 rearrange formula and show evidence of numerical value of ratio substituted	•1 $\sin 65° = \frac{x}{10}$ •2 $x = 10 \times \sin 65°$ [stated or implied] •3 x = 9·06 cm (rounding not required)

	•3 determines side of triangle	
12 (a)	•1 use tangent ratio correctly •2 calculate angle	•1 $\tan x° = \frac{830}{7200}$ •2 $x^o = 6{\cdot}6°$
(b)	#2.2 valid conclusion	#2.2 It can be considered safe as the angle is between 5 and 7 degrees.
13 (a)	•1 4 points correct on graph	•1 see below
	•2 2 further points correct	•2 see below
(b)	•3 valid line of best fit drawn	•3 valid line of best fit drawn
(c)	•4 speed estimated	•4 approximately 30 mph
(d)	#2.2 valid reading from graph	#2.2 this estimate is fine.

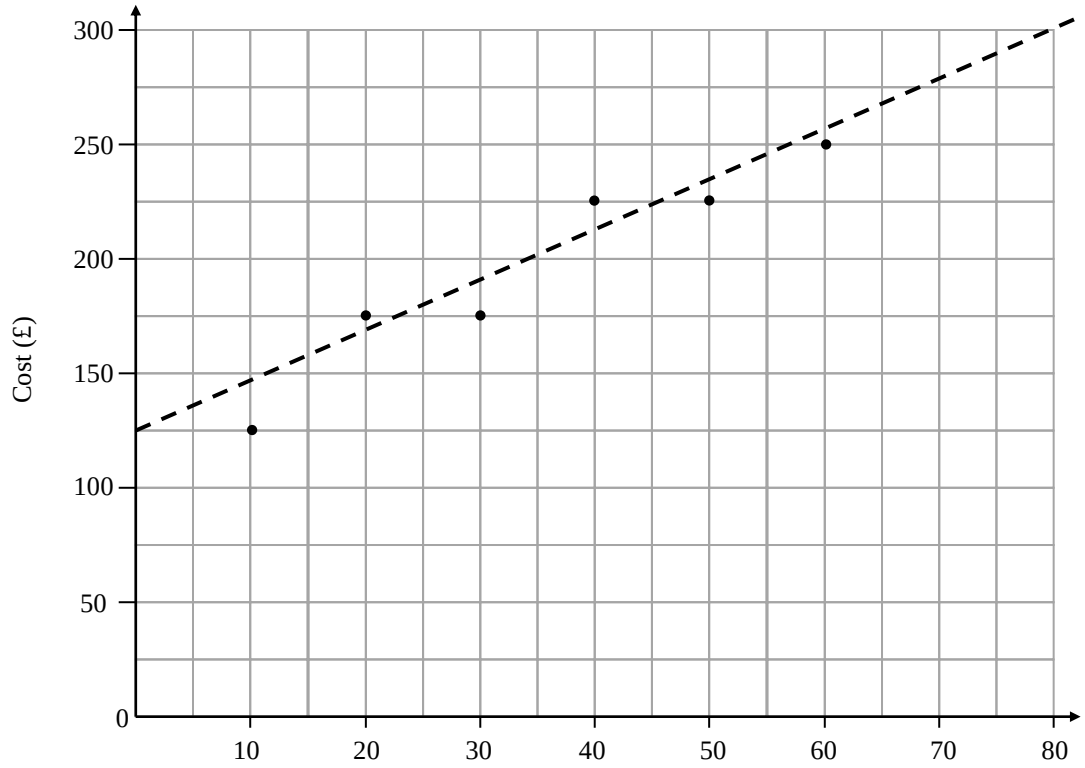


Practice Unit Assessment (2) Relationships Marking Scheme

Points of reasoning are marked # in the table.

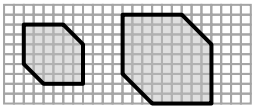
Question	Main points of expected responses	
1	•[1] complete table of values •[2] points plotted •[3] line drawn	•[1] y = 3, 4 and 5 •[2] (2, 3), (4, 4), (6, 5) •[3] straight line graph of $y = \frac{1}{2}x + 2$
2	•[1] line MN identified	•[1] $x = 4$
3	•[1] solve for $4y$ •[2] solve for y	•[1] $4y = 16$ •[2] $y = 4$
4	•[1] divide v by λ	•[1] $f = v/\lambda$
5	•[1] add 3 to y •[2] divide by 2	•[1] $2x = y + 3$ •[2] $x = \frac{y+3}{2}$
6	•[1] know to use Pythagoras •[2] correct use of Pythagoras •[3] correct answer	•[1] $LN^2 = 24^2 + 7^2 = 625$ •[2] $LN = \sqrt{(625)}$ •[3] LN = 25 km
7	•[1] 3 lines correct •[2] other lines correct	•[1] •[2] 
8	#2.1 valid strategy •[1] third angle calculated	#2.1 65° and 56° within one of the triangles •[1] 59°
9	•[1] angle in semi-circle •[2] angles in a triangle	•[1] angle in semi-circle = 90° •[2] angle KML = 180 – 90 – 76 = 14°
10	# 2.1 use valid strategy •[1] correct answer	#2.1 finds horizontal and vertical distances (7 and 3) and applies Pythagoras' Theorem •[1] 7·6
11	•[1] use cosine ratio correctly •[2] rearrange formula and show evidence of taking inverse	•[1] $\cos x° = \frac{7}{12}$ •[2] $\cos^{-1}(7 \div 12)$ [stated or implied]

	•3 determines size of angle	•3 $x = 54^o$ (rounding not required)
12 (a)	•1 use tangent ratio correctly	•1 $\tan 18° = \frac{h}{3}$
	•2 calculate h	•2 $h = 0{\cdot}97$ metres
(b)	#2.2 valid conclusion	#2.2 It will pass since $0{\cdot}97 < 1$
13 (a)	•1 4 points correct on graph	•1 see below
	•2 2 further points correct	•2 see below
(b)	•3 valid line of best fit drawn	•3 valid line of best fit drawn
(c)	•4 cost estimated	•4 approximately £245
(d)	#2.2 valid reading from graph	#2.2 this estimate is about right.



Practice Unit Assessment (3) Relationships — Marking Scheme

Points of reasoning are marked # in the table.

Question	Main points of expected responses	
1	•1 complete table of values •2 points plotted •3 line drawn	•1 $y = 1$, 4 and 7 •2 (1, 1), (2, 4), (3, 7) •3 straight line graph of $y = 3x - 2$
2	•1 line GH identified	•1 $y = -3$
3	•1 solve for $8k$ •2 solve for k	•1 $8k = -24$ •2 $k = -3$
4	•1 divide C by π	•1 $D = C/\pi$
5	•1 subtract u from v •2 divide by 6	•1 $6t = v - u$ •2 $t = \frac{v-u}{6}$
6	•1 know to use Pythagoras •2 correct use of Pythagoras •3 correct answer	•1 $RQ^2 = 14^2 - 11^2 = 75$ •2 $RQ = \sqrt{(75)}$ •3 RQ = 8·7 m
7	•1 3 lines correct •2 other lines correct	•1 •2 
8	#2.1 valid strategy •1 third angle calculated	#2.1 70º within triangle WVU •1 50º
9	•1 angle in semi-circle •2 angles in a triangle	•1 angle in semi-circle = 90º •2 angle KML = 180 – 90 – 52 = 38º
10	# 2.1 use valid strategy •1 correct answer	#2.1 finds horizontal and vertical distances (7 and 8) and applies Pythagoras' Theorem •1 10·6
11	•1 use tangent ratio correctly •2 rearrange formula and show evidence of numerical value of ratio substituted	•1 $\tan 32° = \frac{x}{22}$ •2 $x = \tan 32° \times 22$ [stated or implied] •3 x = 13·7 mm (rounding not required)

	•3 determines side of triangle	
12 (a)	•1 use sine ratio correctly	•1 $\sin x° = \frac{1 \cdot 4}{3}$
	•2 calculate angle	•2 $x = 27 \cdot 8^o$
(b)	#2.2 valid conclusion	#2.2 safe since $27 \cdot 8^o$ is between 27^o and 28^o
13 (a)	•1 4 points correct on graph	•1 see below
	•2 2 further points correct	•2 see below
(b)	•3 valid line of best fit drawn	•3 valid line of best fit drawn
(c)	•4 length estimated	•4 approximately 5·4
(d)	#2.2 valid reading from graph	#2.2 this estimate is good.