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EDEXCEL INTERNATIONAL GCSE MATHS: QUESTIONS BY TOPIC

Pythagoras & Trigonometry (G5)

International GCSE Mathematics A (4MA1) · Foundation tier

39 questions · 157 marks · Mark schemes included

Past papers June 2018 - June 2025 · 4 sub-topics

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HOW TO USE THIS BOOKLET

Questions are grouped by sub-topic and run from the lowest to the highest mark tariff, then oldest paper first.

Click any row below to jump straight to that sub-topic or question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme; < QUESTION brings you back.

A gold bar in the left margin marks exactly where the question sits on the original page.

Diagrams, graphs, grids and tables are printed exactly as they appear in the original papers.

Each question is filed under its main topic; longer questions may also test skills from other topics.

QUESTION	SOURCE	MARKS	PAGE
G5a PYTHAGORAS' THEOREM		19 Qs · 79 marks	3
1. Q23	IGCSE Paper 2FR June 2018	3	4
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4. Q14	IGCSE Paper 1F November 2021	3	7
5. Q18	IGCSE Paper 1FR January 2019	4	8
6. Q20	IGCSE Paper 1FR June 2019	4	9
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G5b RIGHT-ANGLED TRIGONOMETRY & EXACT VALUES		18 Qs · 68 marks	24
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QUESTION	SOURCE	MARKS	PAGE
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G5c SINE RULE, COSINE RULE & AREA OF A TRIANGLE		2 Qs · 10 marks	44
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G5d 3D PYTHAGORAS & TRIGONOMETRY			

No questions on this sub-topic in the available past papers.



QUESTIONS

39 questions · 157 marks · 3 sub-topics

SUB-TOPIC G5a

PYTHAGORAS' THEOREM

Sub-topic G5a · 19 questions · 79 marks · lowest tariff first



- 23** From point A , Stanley walks 200 m due east to point B .
From B , he then walks 160 m due south to point C .

Work out the length of AC .

Give your answer correct to 3 significant figures.

.....metres

(Total for Question 23 is 3 marks)



22 Here is a right-angled triangle.

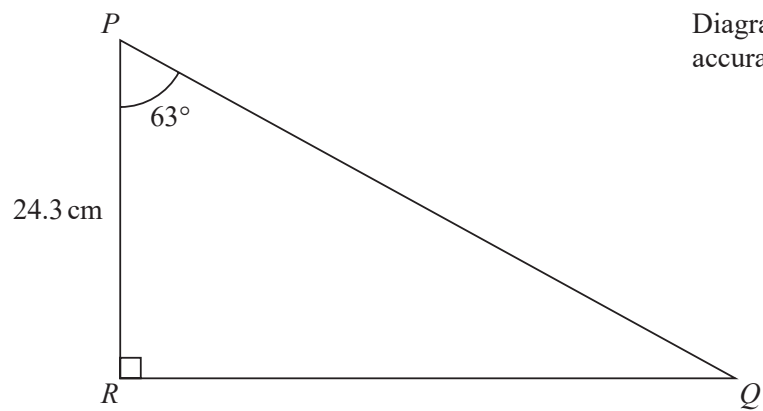


Diagram **NOT**
accurately drawn

Calculate the length of PQ .

Give your answer correct to 3 significant figures.

..... cm

(Total for Question 22 is 3 marks)

TOTAL FOR PAPER IS 100 MARKS



- 19 The diagram shows a rectangle and a diagonal of the rectangle.

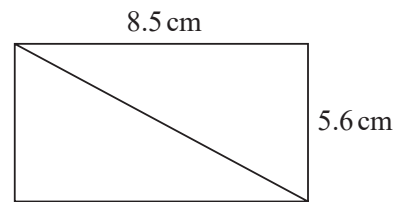


Diagram **NOT**
accurately drawn

Work out the length of the diagonal of the rectangle.
Give your answer correct to 1 decimal place.

..... cm

(Total for Question 19 is 3 marks)

- 20 A plane takes 3 hours 36 minutes to fly from the Cayman Islands to New York.
The plane flies a distance of 2470 km.

Work out the average speed of the plane in km/h.
Give your answer correct to the nearest whole number.

..... km/h

(Total for Question 20 is 3 marks)



13 (a) Simplify $e^8 \div e^2$

.....
(1)

(b) Expand and simplify $(x - 3)(x + 1)$

.....
(2)

(Total for Question 13 is 3 marks)

14 Here is a right-angled triangle.

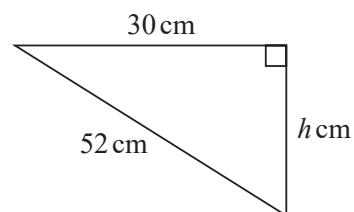


Diagram **NOT**
accurately drawn

Calculate the value of h .

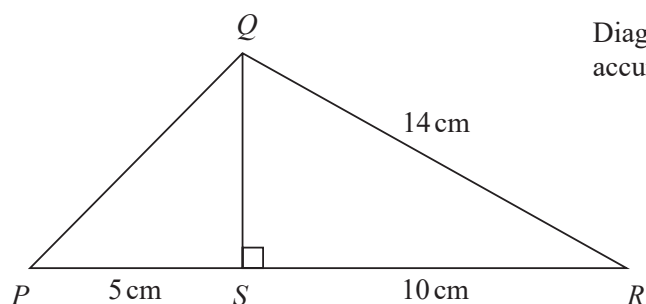
Give your answer correct to 3 significant figures.

$h =$

(Total for Question 14 is 3 marks)



18

Diagram **NOT**
accurately drawnIn triangle PQR , S is the point on PR such that angle $RSQ = 90^\circ$ $RQ = 14\text{ cm}$ $RS = 10\text{ cm}$ $SP = 5\text{ cm}$ Work out the length of PQ .

cm

(Total for Question 18 is 4 marks)



20 The diagram shows isosceles triangle ABC .

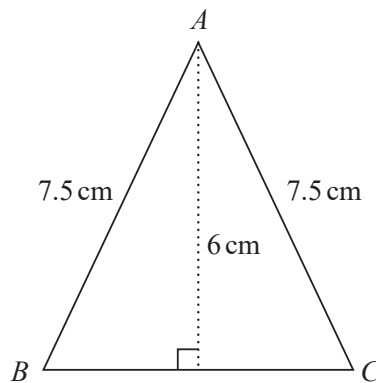


Diagram **NOT**
accurately drawn

$$AB = AC = 7.5 \text{ cm.}$$

The height of the triangle is 6 cm.

Calculate the area of the triangle.

.....cm²

(Total for Question 20 is 4 marks)



23 The diagram shows an isosceles triangle.

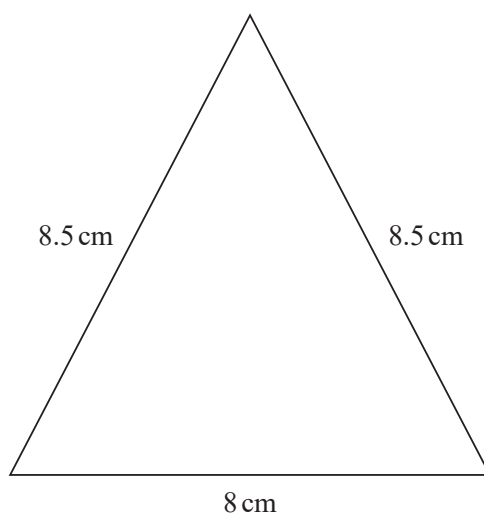


Diagram **NOT**
accurately drawn

Work out the area of the triangle.

.....cm²

(Total for Question 23 is 4 marks)



20 Markus makes a steel framework.

The framework is in the shape of the right-angled triangle ABC shown in the diagram.

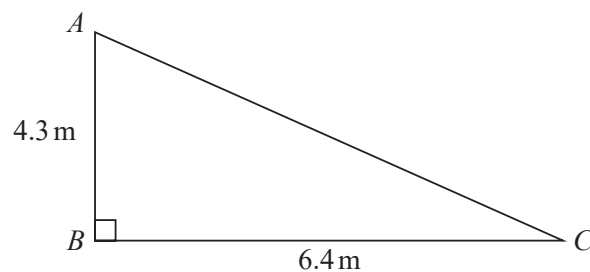


Diagram **NOT**
accurately drawn

The steel that Markus uses costs \$22 per metre.

The steel can **only** be bought in a length that is a whole number of metres.

Work out the total cost of the steel that Markus buys in order to make the framework.

\$.....

(Total for Question 20 is 4 marks)



10 The diagram shows a right-angled triangle.

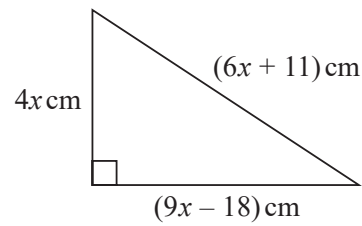


Diagram **NOT**
accurately drawn

The perimeter of the triangle is 126 cm.

Work out the area of the triangle.

..... cm^2

(Total for Question 10 is 4 marks)



24 The diagram shows isosceles triangle ABC

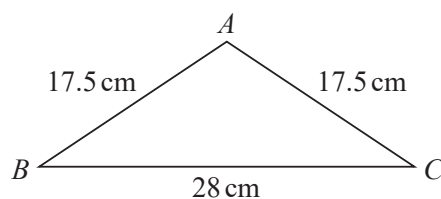


Diagram **NOT**
accurately drawn

$$AB = AC = 17.5 \text{ cm}$$

$$BC = 28 \text{ cm}$$

Calculate the area of triangle ABC

..... cm^2

(Total for Question 24 is 4 marks)



- 17 The shaded shape is made using three identical right-angled triangles and a square.

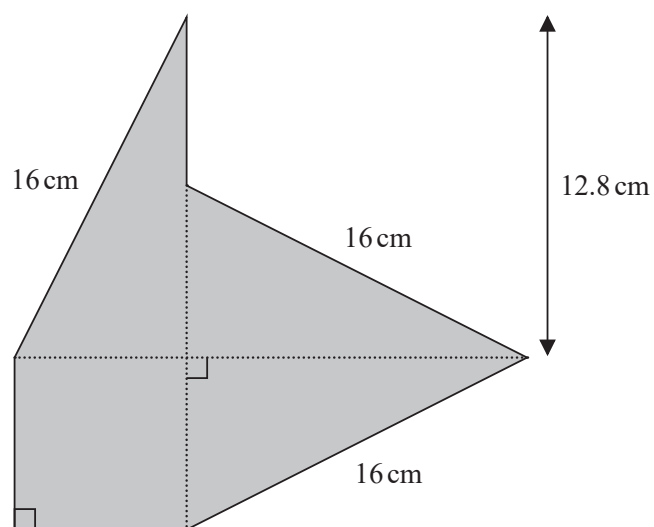


Diagram **NOT**
accurately drawn

Work out the perimeter of the shaded shape.

..... cm

(Total for Question 17 is 4 marks)

- 20 The diagram shows a shaded shape $AEBCD$ made by removing triangle AEB from rectangle $ABCD$

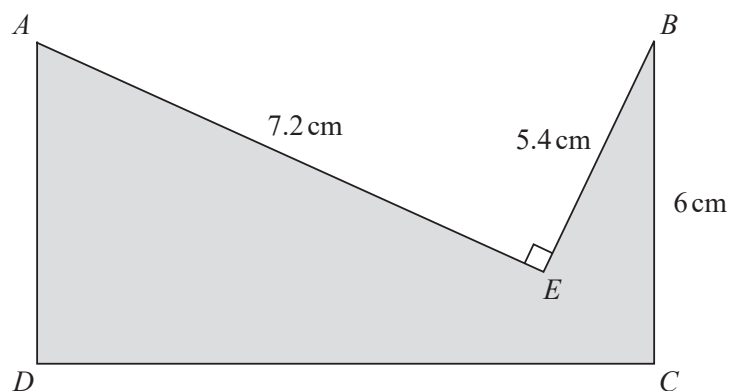


Diagram **NOT**
accurately drawn

$$AE = 7.2 \text{ cm} \quad BE = 5.4 \text{ cm} \quad BC = 6 \text{ cm} \quad \text{angle } AEB = 90^\circ$$

Work out the perimeter of the shaded shape.

..... cm

(Total for Question 20 is 4 marks)



15 The diagram shows a shape $ABCDE$ made from a right-angled triangle ABE and a square $BCDE$

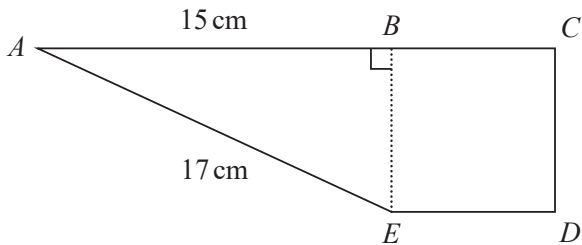


Diagram **NOT** accurately drawn

ABC is a straight line.
 $AB = 15\text{ cm}$ $AE = 17\text{ cm}$
The perimeter of triangle ABE is 40 cm
Work out the area of the shape $ABCDE$

..... cm^2

(Total for Question 15 is 4 marks)

26 The diagram shows a roof support.

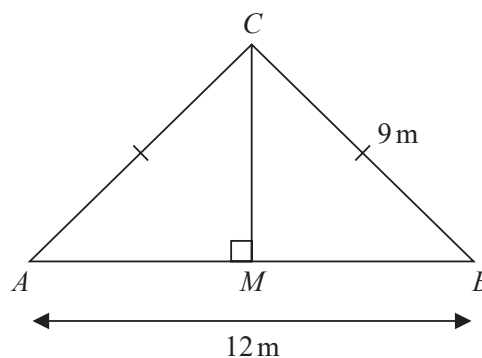


Diagram **NOT**
accurately drawn

The roof support is made from four lengths of wood, AB , AC , BC and MC

$$AC = BC = 9 \text{ m} \quad AB = 12 \text{ m}$$

$$\text{angle } AMC = 90^\circ$$

Lewis is going to buy lengths of wood to make the roof support.

The wood costs 21.50 euros per metre.

Each length of wood he buys has to be a whole number of metres.

Work out the total cost of the wood Lewis needs to buy.

Show your working clearly.

..... euros

(Total for Question 26 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS



25 The diagram shows an isosceles triangle, with base length 24 cm.

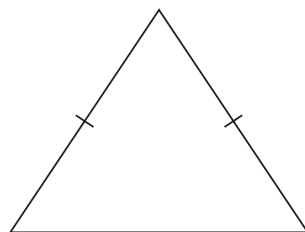


Diagram **NOT**
accurately drawn

24 cm

The perimeter of the triangle is 54 cm.

Work out the area of the triangle.

..... cm²

(Total for Question 25 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS



27 ABD and ABC are right-angled triangles.

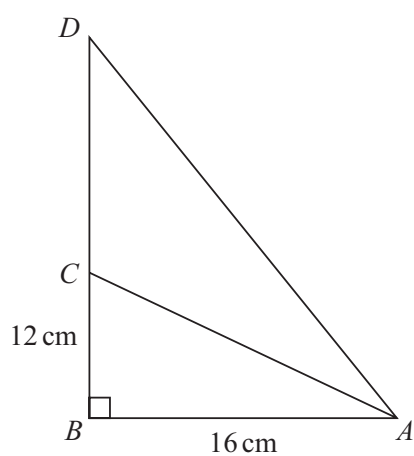


Diagram **NOT**
accurately drawn

$$AB = 16\text{ cm} \quad BC = 12\text{ cm} \quad AD = 1.5 \times AC$$

Find the length of CD

Give your answer correct to 3 significant figures.

..... cm

(Total for Question 27 is 5 marks)



27 The diagram shows two triangles, ADE and CDB

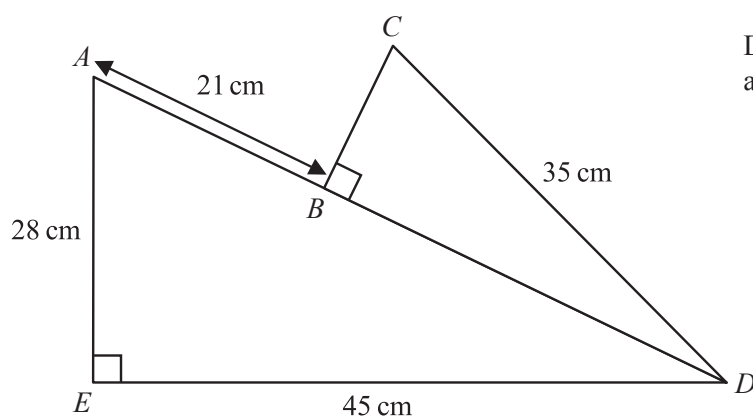


Diagram **NOT**
accurately drawn

ABD is a straight line.

$AE = 28 \text{ cm}$ $ED = 45 \text{ cm}$ $AB = 21 \text{ cm}$ $CD = 35 \text{ cm}$

angle $AED = \text{angle } CBD = 90^\circ$

Work out the area of triangle CDB

Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 27 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS



27 The diagram shows a quadrilateral $ABCD$

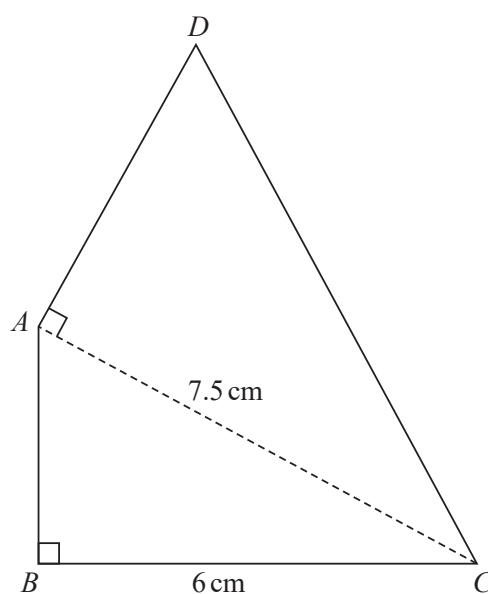


Diagram **NOT**
accurately drawn

In the diagram, ABC and DAC are right-angled triangles.

$$BC = 6 \text{ cm} \quad AC = 7.5 \text{ cm}$$

The area of quadrilateral $ABCD$ is 31.5 cm^2

Work out the length of AD

Question 27 continued.

..... cm

(Total for Question 27 is 6 marks)

TOTAL FOR PAPER IS 100 MARKS



23 The diagram shows a trapezium, $ABCD$

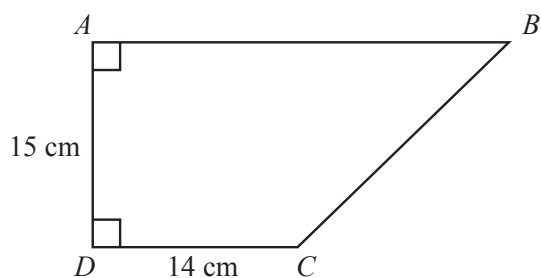


Diagram **NOT**
accurately drawn

DAB and ADC are right angles.

$$AD = 15 \text{ cm} \quad DC = 14 \text{ cm}$$

The area of the trapezium is 360 cm^2

Work out the perimeter of the trapezium.

..... cm

(Total for Question 23 is 6 marks)

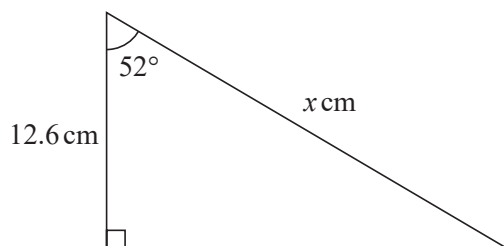
SUB-TOPIC G5b

RIGHT-ANGLED TRIGONOMETRY & EXACT VALUES

Sub-topic G5b · 18 questions · 68 marks · lowest tariff first



21

Diagram **NOT**
accurately drawn

Work out the value of x .
Give your answer correct to 3 significant figures.

 $x = \dots\dots\dots$

(Total for Question 21 is 3 marks)



22 The diagram shows a right-angled triangle.

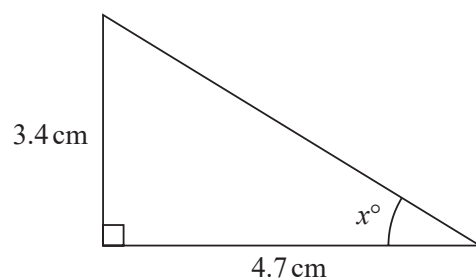


Diagram **NOT**
accurately drawn

Calculate the value of x .

Give your answer correct to one decimal place.

$x =$

(Total for Question 22 is 3 marks)



21 Here is a right-angled triangle.

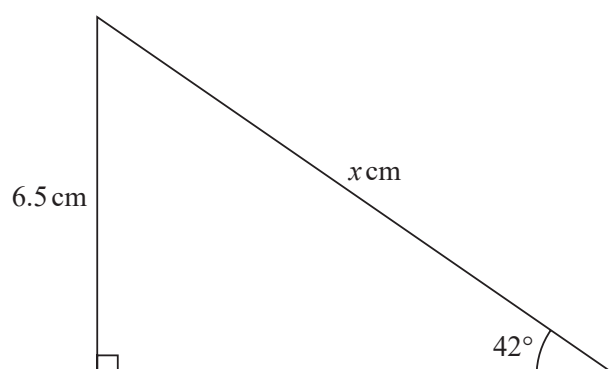


Diagram **NOT**
accurately drawn

Work out the value of x .
Give your answer correct to one decimal place.

$x =$

(Total for Question 21 is 3 marks)



- 17 Danil, Gabriel and Hadley share some money in the ratios 3 : 5 : 9

The difference between the amount of money that Gabriel receives and the amount of money that Hadley receives is 196 euros.

Work out the amount of money that Danil receives.

..... euros

(Total for Question 17 is 3 marks)

- 18 The diagram shows triangle ABC

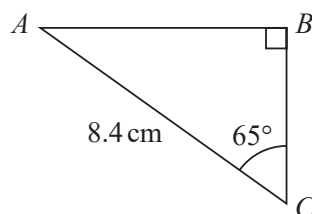


Diagram **NOT**
accurately drawn

Work out the length of the side AB

Give your answer correct to 3 significant figures.

..... cm

(Total for Question 18 is 3 marks)



22 The diagram shows triangle PQR .

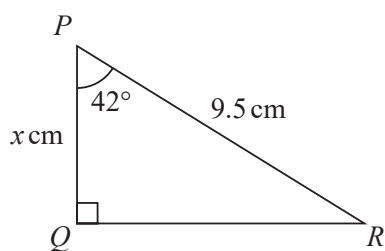


Diagram **NOT**
accurately drawn

Work out the value of x
Give your answer correct to one decimal place.

$x =$

(Total for Question 22 is 3 marks)

23 Change a speed of 81 kilometres per hour to a speed in metres per second.

..... metres per second

(Total for Question 23 is 3 marks)



21 The diagram shows triangle ABC

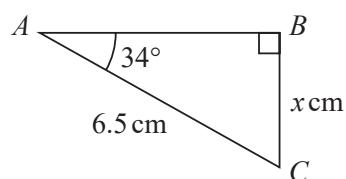


Diagram **NOT**
accurately drawn

Work out the value of x
Give your answer correct to one decimal place.

$x =$

(Total for Question 21 is 3 marks)

22 Change a speed of w metres per second to a speed in kilometres per hour.
Give your answer in terms of w in its simplest form.

..... kilometres per hour

(Total for Question 22 is 3 marks)



19 The diagram shows triangle PQR

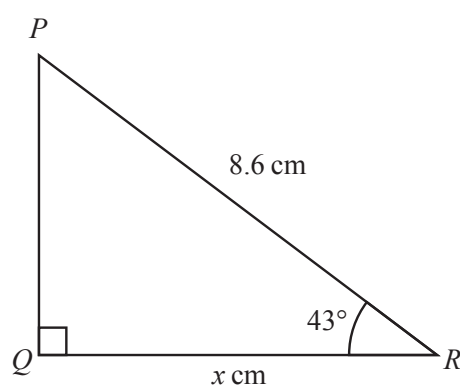


Diagram **NOT**
accurately drawn

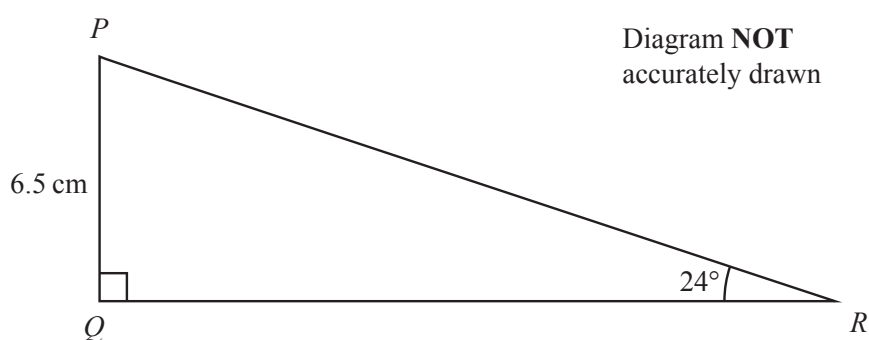
Work out the value of x
Give your answer correct to one decimal place.

$x =$

(Total for Question 19 is 3 marks)



24 The diagram shows triangle PQR



Work out the length of QR
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 24 is 3 marks)



25 $ABCD$ is a trapezium.

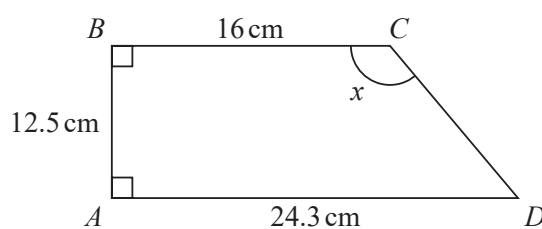


Diagram **NOT**
accurately drawn

Work out the size of angle x .
Give your answer correct to 1 decimal place.

(Total for Question 25 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS



22 The diagram shows a trapezium.

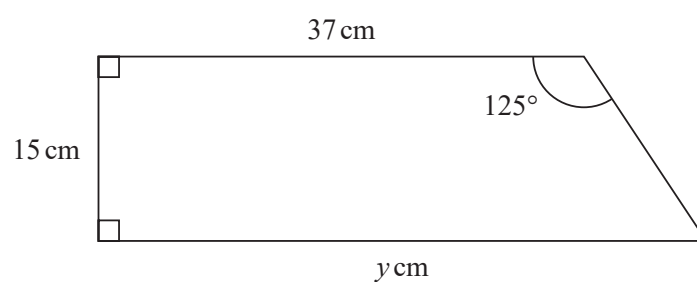


Diagram **NOT**
accurately drawn

Work out the value of y .
Give your answer correct to 1 decimal place.

$y =$

(Total for Question 22 is 4 marks)



26 Here is isosceles triangle ABC .

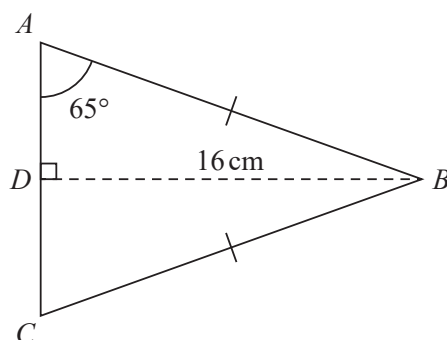


Diagram **NOT**
accurately drawn

D is the midpoint of AC and $DB = 16$ cm.

Angle $DAB = 65^\circ$

Work out the perimeter of triangle ABC .

Give your answer correct to one decimal place.

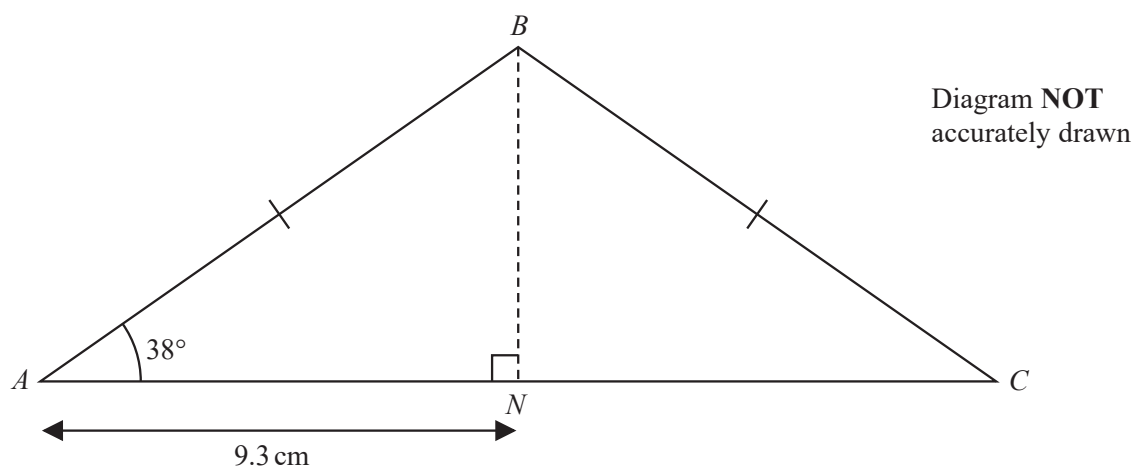
..... cm

(Total for Question 26 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS



26 ABC is an isosceles triangle with $BA = BC$.



N is the point on AC such that $AN = 9.3$ cm and BN is perpendicular to AC .

Work out the perimeter of triangle ABC .

Give your answer correct to 3 significant figures.

..... cm

(Total for Question 26 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS



25 R and T are points on a circle, centre O

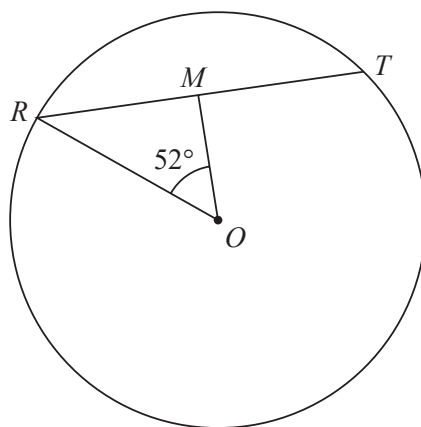


Diagram **NOT**
accurately drawn

$$RT = 12 \text{ cm}$$

M is the midpoint of RT

$$\text{Angle } ROM = 52^\circ$$

Work out the area of the circle.

Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 25 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS



28 The diagram shows right-angled triangle ABD

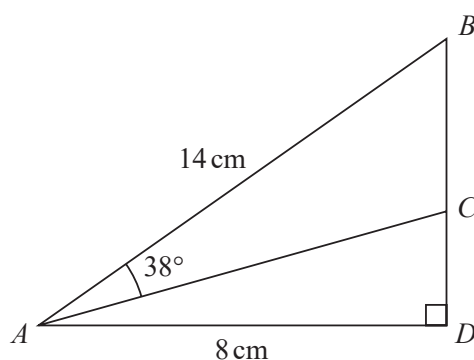


Diagram **NOT**
accurately drawn

$$AB = 14 \text{ cm} \quad AD = 8 \text{ cm}$$

C is the point on BD such that angle $BAC = 38^\circ$

Work out the length of CD

Give your answer correct to 3 significant figures.

..... cm

(Total for Question 28 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS



19

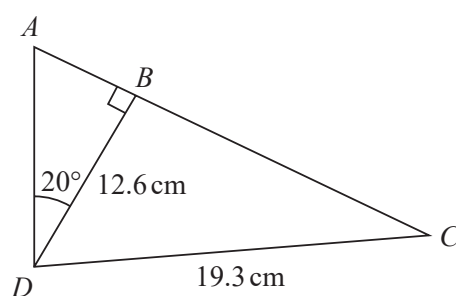


Diagram **NOT**
accurately drawn

ABC is a straight line.

Work out the length of AC .

Give your answer correct to 1 decimal place.

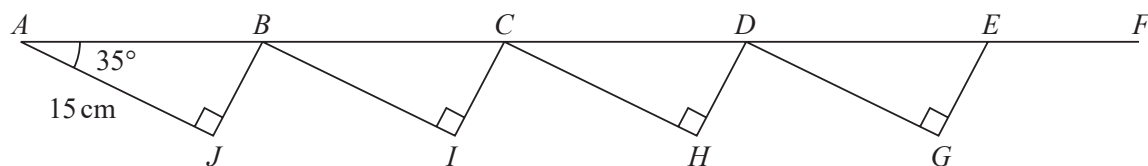
cm

(Total for Question 19 is 5 marks)



- 26 The diagram shows four congruent right-angled triangles ABJ , BCI , CDH and DEG .
The diagram also shows the straight line $ABCDEF$.

Diagram **NOT**
accurately drawn



$AJ = 15 \text{ cm}$
Angle $BAJ = 35^\circ$

$AF = 80 \text{ cm}$

Work out the length of EF .
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 26 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS



27 The diagram shows triangle ABP inside the regular hexagon $ABCDEF$

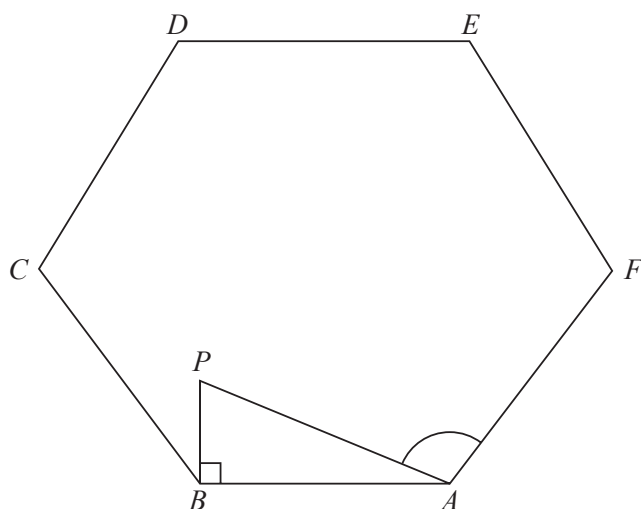


Diagram **NOT**
accurately drawn

$$AB = 5 \text{ cm}$$

$$BP = 2 \text{ cm}$$

$$\text{Angle } ABP = 90^\circ$$

Work out the size of angle PAF

Give your answer correct to 3 significant figures.

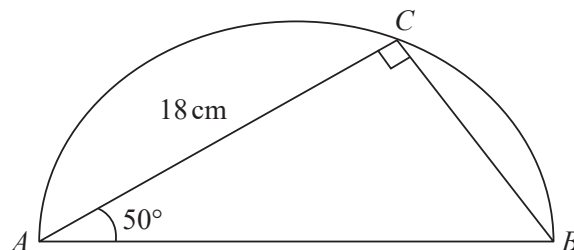
(Total for Question 27 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS



23 The diagram shows a triangle ABC inside a semicircle.

Diagram **NOT**
accurately drawn



A , B and C are points on the semicircle.

AB is the diameter of the semicircle.

Angle $ACB = 90^\circ$

Angle $BAC = 50^\circ$

$AC = 18$ cm

Work out the perimeter of the semicircle.

Give your answer correct to 2 significant figures.

..... cm

(Total for Question 23 is 5 marks)

24 (a) Write 6.25×10^{-4} as an ordinary number.

.....
(1)

(b) Work out $(2.4 \times 10^{12}) \div (9.6 \times 10^4)$
Give your answer in standard form.

.....
(2)

(Total for Question 24 is 3 marks)



SUB-TOPIC G5c

SINE RULE, COSINE RULE & AREA OF A TRIANGLE

Sub-topic G5c · 2 questions · 10 marks · lowest tariff first



27

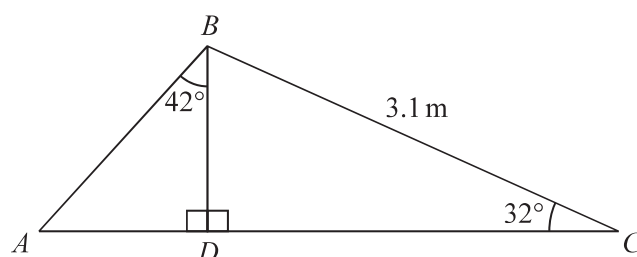


Diagram **NOT**
accurately drawn

Calculate the length of AB .
Show your working clearly.
Give your answer correct to 3 significant figures.

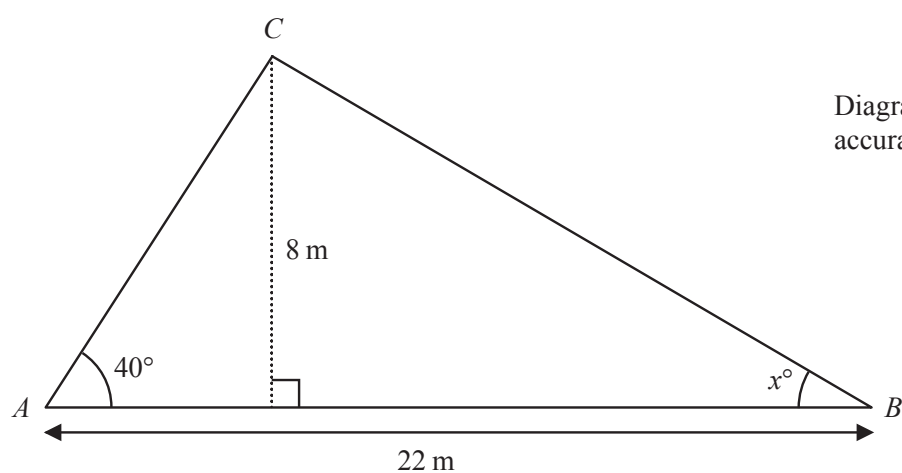
..... m

(Total for Question 27 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS



24 Here is triangle ABC



Work out the value of x
Give your answer correct to one decimal place.
Show your working clearly.

$x =$

(Total for Question 24 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS



MARK SCHEMES

official mark schemes, in the same order as the questions



Question	Working	Answer	Mark	Notes
23	$160^2 + 200^2 (=65600)$ $\sqrt{160^2 + 200^2}$	256	3	M1 M1 A1 accept 256 – 256.2
Total 3 marks				
24	Interior angle of pentagon ($180 \times 3 \div 5 (= 108)$) oe Interior angle of octagon ($180 \times 6 \div 8 (= 135)$) oe (CBF $\Rightarrow$) $360 - ("108" + "135") (= 117)$	31.5	4	M1 or exterior angle of pentagon = $\frac{360}{5} (= 72)$ or exterior angle of octagon = M1 $\frac{360}{8} (= 45)$ M1 (CBF $\Rightarrow$) "72" + "45" (= 117) A1
Total 4 marks				

22		$\cos 63 = \frac{24.3}{(PQ)}$ or $\sin 27 = \frac{24.3}{(PQ)}$ or $\frac{(PQ)}{\sin 90} = \frac{24.3}{\sin 27}$ or $\frac{\sin 90}{(PQ)} = \frac{\sin 27}{24.3}$ oe		3	M1 for a correct trigonometric ratio	M2 for $(RQ =) 24.3 \times \tan 63 (= 47.6914..)$ oe and $(PQ =) \sqrt{47.6914^2 + 24.3^2}$ oe
		$(PQ =) \frac{24.3}{\cos 63}$ or $(PQ =) \frac{24.3}{\sin 27}$ or $(PQ) = \frac{24.3}{\sin 27} \times \sin 90$			M1 for a correct rearrangement for PQ	
			53.5		A1 Accept 53.5 - 53.53	
						Total 3 marks

Question	Working	Answer	Mark	Notes
17	$4x$ or $x - 7$		4	M1 Correct expression for B or C
	$x + 4x + x - 7 = 137$ oe			M1 Correct equation
	$x = 144 \div 6 (=24)$ or $6x = 144$			M1 Gathering up the x's and numbers Dep on previous M1
		17		A1
Total 4 marks				
18 (a)		$3e^2 - 5e$	1	B1
(b)		$5(7 + f)$	1	B1
(c)		$64p^3q^6$	2	B2 B1 for 2 correct parts of the product
Total 4 marks				
19	$8.5^2 + 5.6^2 (=103.61)$		3	M1
	$\sqrt{8.5^2 + 5.6^2}$			M1
		10.2		A1 awrt 10.2
Total 3 marks				
20	3 hours 36 mins = 216 mins or 3.6 hours		3	M1
	$2470 \div 3.6$ or $2470 \div 216 \times 60$ oe			M1 Allow $2470 \div 3.36 (=735$ or better)
		686		A1
Total 3 marks				
21	(adding) $10x = -5$ or $21x + 35y = 42$ $21x - 15y = -33$ then $50y = 75$		3	M1 Correct method to eliminate x or y: coefficients of x or y the same and correct operator to eliminate selected variable or correct substitution for x or y into 2 nd equation
		$x = -0.5$ oe $y = 1.5$ oe		A1 A1 Both A marks dep on M1
Total 3 marks				



Q	Working	Answer	Mark	Notes
13 (a)		e^6	1	B1 cao
(b)	$x^2 - 3x + x - 3$		2	M1 for any 3 correct terms or for 4 out of 4 correct terms ignoring signs or for $x^2 - 2x \dots$ or for $\dots - 2x - 3$
	Correct answer scores full marks (unless from obvious incorrect working)	$x^2 - 2x - 3$		A1
				Total 3 marks

14	$30^2 + h^2 = 52^2$ oe or $900 + h^2 = 2704$ $(h^2 =) 52^2 - 30^2 (=1804)$ or $(h^2 =) 2704 - 900 (=1804)$		3	M1 for applying Pythagoras theorem correctly
	$(h =) \sqrt{52^2 - 30^2} (= \sqrt{1804}) (= 42.47352\dots)$ or $(h =) \sqrt{2704 - 900} (= \sqrt{1804}) (= 42.47352\dots)$			M1 for square rooting
	Correct answer scores full marks (unless from obvious incorrect working)	42.5		A1 awrt 42.5 or allow $2\sqrt{451}$
				Total 3 marks

Question	Working	Answer	Mark	Notes
17	$\frac{3}{4} \times 60 (= 45)$ or $\frac{1}{4} \times 60 (= 15)$ OR $\frac{3}{4} \times \frac{3}{5} \left(= \frac{9}{20} \right)$	$\frac{13}{20}$	4	M1
	$\frac{3}{5} \times "45" (= 27)$ or $\frac{4}{5} \times "15" (= 12)$ OR $\frac{1}{4} \times \frac{4}{5} \left(= \frac{4}{20} \right)$			M1
	$\frac{"27" + "12"}{60}$ OR $"\frac{9}{20}" + "\frac{4}{20}"$			M1 For a complete method
				A1 oe
18	$14^2 - 10^2 (= 96)$	11	4	M1
	$"96" + 5^2 (= 121)$			M1
	$\sqrt{"121"}$			M1
				A1
19	$(a =) 40 - 14 (= 26)$	$\frac{26}{34}$	3	M1 Method to find a
	e.g. $\frac{"26" + b}{2} = 30$ or $30 + (30 - "26")$			M1 Method to find b
				A1



20	$7.5^2 - 6^2 (= 20.25)$		4	M1 OR for a correct trig statement involving one of the angles e.g. $\cos BAM = \frac{6}{7.5}$ or $\sin ABC = \frac{6}{7.5}$ where M is the midpoint of BC
	$\sqrt{7.5^2 - 6^2} (= 4.5)$			M1 OR for a method to find one of the angles in the triangle e.g. $BAM = \cos^{-1}\left(\frac{6}{7.5}\right) (= 36.8\dots)$ or $ABC = \sin^{-1}\left(\frac{6}{7.5}\right) (= 53.1\dots)$
	"4.5" $\times$ 6 oe			M1 for a complete method to find the area of triangle ABC e.g. $2 \times \frac{1}{2} \times 7.5 \times 6 \times \sin("36.8")$ oe or $2 \times \frac{1}{2} \times 7.5 \times \sqrt{7.5^2 - 6^2} \times \sin("53.1")$ oe
		27		A1 cao
				Total 4 marks

21	$10 \times 79.2 (= 792)$ or $3 \times 68 (= 204)$		3	M1
	$(10 \times 79.2 - 3 \times 68) \div 7$			M1
		84		A1
				Total 3 marks



23	$8.5^2 - (8 \div 2)^2 (= 56.25)$ or $\cos x = \frac{4}{8.5}$		4	M1 or eg $\cos A = \frac{8^2 + 8.5^2 - 8.5^2}{2 \times 8 \times 8.5}$
	$\sqrt{56.25}$ (= 7.5) or $x = \cos^{-1}\left(\frac{4}{8.5}\right)$ (= 61.927...)			M1 or eg $(A =) \cos^{-1}\left(\frac{8^2 + 8.5^2 - 8.5^2}{2 \times 8 \times 8.5}\right)$ (61.927...) (other angle = 56.144...)
	$8 \times "7.5" \div 2$ oe or $0.5 \times 8 \times 8.5 \times \sin "61.927..."$			M1 or eg $0.5 \times 8.5 \times 8 \times \sin 61.927... \text{oe}$
		30		A1
				Total 4 marks



20	$4.3^2 + 6.4^2$ or 59.45		4	M1 for squaring and adding
	$\sqrt{4.3^2 + 6.4^2}$ or $\sqrt{59.45}$ or 7.71(038...) or 7.7			M1 dep 1st M1 for square rooting
	e.g ('7.71' + 4.3 + 6.4) × 22 or '18.4' × 22 or ('8' + 4.3 + 6.4) × 22 or '18.7' × 22 or '19' × 22 or '20' × 22			M1 dep 2nd M1 for a non-rounded perimeter × 22 or 18 × 22 or 19 × 22 accept 20 × 22
		\$418		A1 answer must come from 19
Total 4 marks				

21	$15 \times 24 (= 360)$ or $25 \times 18 (= 450)$		3	M1 may be implied by 810 seen
	$\frac{'360' + '450'}{40} (= \frac{810}{40})$			M1 dep on M1
		20.25 oe		A1 for 20.25 accept 20.3 (allow 20 from correct working)
Total 3 marks				



10		$4x + 6x + 11 + 9x - 18 = 126$ oe eg $19x - 7 = 126$ or eg $(126 + 18 - 11) \div 19$		4	M1 A correct equation or a correct calculation for x
		$x = 7$			A1
		$0.5 \times (9 \times "7" - 18) \times (4 \times "7")$ $(0.5 \times 45 \times 28)$			M1 Dep on M1
			630		A1 cao
					Total 4 marks
11		$ABD = 180 - 143 (= 37)$ or $AEJ = 76$ or $CED = 76$ or $ECD = 180 - 143 (= 37)$		3	M1 may be marked on diagram
		$180 - 76 - "37"$			M1 A correct calculation for EDC
			67		A1
				Total 3 marks	
12		$438 \times 0.12 (= 52.56)$ or $44.39 \div 0.92 (= 48.25)$		4	M1
		$438 \times 0.12 (= 52.56)$ and $44.39 \div 0.92 (= 48.25)$ or $438 \times 0.12 (= 52.56)$ and $"52.56" \times 0.92 (= 48.355)$ or $44.39 \div 0.92 (= 48.25)$ and $"48.25" \div 0.12 (= 402.083...)$			M1
		$"52.56" - "48.25"$ or $"48.355" - 44.39 = 3.965$ and $"3.965" \div 0.92$ or $438 - "402.083..." (= 35.916...)$ and $"35.916" \times 0.12$			M1 Dep on M2
			4.31		A1
					Total 4 marks



23	$12.6 \times 10^{(-24+145)}$ or 12.6×10^{121} or 1.26×10^n		2	M1
		1.26×10^{122}		A1 allow 1.3×10^{122}
Total 2 marks				

24	$17.5^2 - 14^2 (= 110.25)$		4	M1 or for use of cosine rule to find one of the angles eg $28^2 = 17.5^2 + 17.5^2 - 2 \times 17.5 \times 17.5 \times \cos A$ or eg $\cos B = \frac{14}{17.5}$
	$\sqrt{17.5^2 - 14^2} (= 10.5)$			M1 or for rearranging the cosine rule to eg $\cos A = \frac{17.5^2 + 17.5^2 - 28^2}{2 \times 17.5 \times 17.5}$ ($A = 106.26\dots$) or eg $B = \cos^{-1}(\frac{14}{17.5})$ ($= 36.86\dots$)
	$0.5 \times 28 \times "10.5"$ oe			M1 or for $0.5 \times 17.5 \times 17.5 \times \sin 106.26\dots$ oe eg $0.5 \times 17.5 \times 28 \times \sin 36.86\dots$ [clear use of Heron's formula: M1 for $S = 0.5(17.5 + 17.5 + 28)(=31.5)$ M2 for $\sqrt{31.5("31.5"-17.5)^2("31.5"-28)}$ oe]
		147		A1 accept awrt 147
Total 4 marks				



16	0.65×300 oe			M1
		195		A1 (SCB1 for 105)
				Total 2 marks
17	$12.8^2 + x^2 = 16^2$ oe or $163.84 + x^2 = 256$ or $(x^2 =) 16^2 - 12.8^2 (= 92.16)$ or $(x^2 =) 256 - 163.84 (= 92.16)$		4	M1 for applying Pythagoras theorem correctly Allow $\cos^{-1}\left(\frac{12.8}{16}\right) (= 36.9\dots)$ and $\frac{x}{\sin(36.9\dots)} = \frac{16}{(\sin 90)}$
	$(x =) \sqrt{16^2 - 12.8^2} (= \sqrt{92.16}) (= 9.6)$ or $(x =) \sqrt{256 - 163.84} (= \sqrt{92.16}) (= 9.6)$			M1 for square rooting Allow $x = \frac{16}{(\sin 90)} \times \sin(36.9\dots)$
	$(12.8 - "9.6") + "9.6" + "9.6" + 16 + 16 + 16$ oe			M1 (dep on M1) for a complete method to find the perimeter
		70.4		A1 oe e.g. $\frac{352}{5}$
				Total 4 marks



20	$7.2^2 + 5.4^2 (= 81)$		4	M1 for correct first step using Pythagoras	M1 for reaching one step from the length of AB if using trig eg $(EAB =) \tan^{-1} \left(\frac{5.4}{7.2} \right) (= 36.8\dots)$ and $\sin("36.8\dots") = \frac{5.4}{AB}$
	$\sqrt{7.2^2 + 5.4^2} (= 9)$			M1 for complete Pythagoras method to find length of AB/DC check the diagram for sight of 9, DC marked as 9 implies M2	M1 for complete method to find the length of AB/DC eg $\frac{5.4}{\sin("36.8\dots")} (= 9)$
	$7.2 + 5.4 + 6 + "9" + 6$ oe			M1 for a complete method to find the perimeter	
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	33.6		A1 oe	
				Total 4 marks	



14	(a)	$\frac{86}{490}(\times 100)$ oe or $0.175(510\dots)(\times 100)$		2	M1	
		<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	17.6		A1 awrt 17.6	
	(b)	$\frac{12}{100} \times 375 (= 45)$ oe or $0.12 \times 375 (= 45)$ oe or $\frac{10}{100} \times 375 + \frac{1}{100} \times 375 + \frac{1}{100} \times 375$ oe (= 45) or $37.5 + 3.75 + 3.75 (= 45)$ oe		3	M1 Must see a calculation. Do not accept, for eg, 12% of 375 unless 45 seen	M2 $\frac{88}{100} \times 375$ oe
		$375 - "45"$ or $375 - "37.5" - "3.75" - "3.75"$ oe or $375 - "37.5" - "7.5"$ oe			M1	
		<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	330		A1	
					Total 5 marks	

15		$40 - (17 + 15) (= 8)$ or $\sqrt{17^2 - 15^2} (= \sqrt{289 - 225} = \sqrt{64} = 8)$		4	M1 may be seen on diagram	
		$"8" \times "8" (= 64)$			M1 for area of square (can be seen on diagram)	M2 for use of formula for area of trapezium
		$\frac{15 \times "8"}{2} (= 60)$ oe or			M1 for area of triangle (can be seen on diagram)	$\frac{1}{2} \times (15 + "8" + "8") \times "8"$
		<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	124		A1	
					Total 4 marks	



25	(a)		1	1	B1
	(b)		6	1	B1
	(c)		$125a^{12}c^6$	2	B2 for $125a^{12}c^6$ B1 for a product in the form ka^pc^q where 2 from k , p or q are correct eg $5a^{12}c^6$ or $125a^{12}3c^6$ Accept multiplication signs between terms (Allow $125a^{12}$ or $125c^6$ or $a^{12}c^6$ as long as not added to any other terms)
Total 4 marks					

26	$(CM)^2 + (12 \div 2)^2 = 9^2$ oe or $9^2 - (12 \div 2)^2 (= 81 - 36 = 45)$		4	M1 $AM = MB$ $CAM = CBM$	M2 for $(\cos^{-1}(CAM) = \frac{12 \div 2}{9} = 48.1(896...))$
	$\sqrt{9^2 - (12 \div 2)^2}$ oe $(= \sqrt{81 - 36} = \sqrt{45} = 3\sqrt{5} = 6.7(08...))$			M1	and $(CM =)(12 \div 2) \times \tan 48.1... (= 6.7...)$ or $(CM =) 9 \times \sin 48.1... (= 6.7...)$
	$(“7” + 9 + 9 + 12) \times 21.5(0)$ oe			M1	
	Working required	795.5(0)		A1 dep on M2 SC B3 for awrt 789 for using 6.7...	
Total 4 marks					



Question	Working	Answer	Mark	Notes	
25	$(54 - 24) \div 2 (=15)$ [may be marked on diagram]		5	M1	
	$"15" - (24 \div 2) (=81)$			M1	ft their "15" (if > 12)
	[height =] $\sqrt{"15" - (24 \div 2) (=9)}$			M1	ft their "15" (if > 12)
	$(24 \times "9") \div 2$ oe			M1	figures must be from correct working
	Correct answer scores full marks (unless from obvious incorrect working)	108		A1	allow 107.9 – 108.1
ALTERNATIVES BELOW					
25	$(54 - 24) \div 2 (=15)$ [may be marked on diagram]		5	M1	
	or $x = \cos^{-1}\left(\frac{"12"}{"15"}\right) (=36.86\dots)$ or $y = \sin^{-1}\left(\frac{24 \div 2}{"15"}\right) (=53.13\dots)$ or $A = \cos^{-1}\left(\frac{15^2 + 15^2 - 24^2}{2 \times 15 \times 15}\right) (=106.2\dots)$ or $B = \cos^{-1}\left(\frac{15^2 + 24^2 - 15^2}{2 \times 15 \times 24}\right) (=36.8\dots)$			M1	ft their "15" (if > 12)
	or "12"tan"36.86..." (=9) (allow 8.9... for these) "12" ÷ tan"53.13..." (=9) or "15" × sin "36.86..." (=9) or "15" × cos "53.13..." (=9)			M1	ft their "15" (if > 12)
	$(24 \times "9") \div 2$ oe			M1	
	Correct answer scores full marks (unless from obvious incorrect working)	108		A1	allow 107.9 – 108.1
Total 5 marks					

Q	Working	Answer	Mark	Notes
27	$(AC^2 =) 12^2 + 16^2 (= 144 + 256 = 400)$ or $(BAC =) \tan^{-1}\left(\frac{12}{16}\right) (= 36.8(698...))$ or 36.9 or $(BCA =) \tan^{-1}\left(\frac{16}{12}\right) (= 53.1(301...))$		5	M1 for a correct method using triangle ABC
	$(AC =) \sqrt{12^2 + 16^2} (= \sqrt{144 + 256} = \sqrt{400} = 20)$ or $(AC =) \frac{16}{\cos 36.8''} (= 20)$ or $(AC =) \frac{12}{\sin 36.8''} (= 20)$ or $(AC =) \frac{16}{\sin 53.1''} (= 20)$ or $(AC =) \frac{12}{\cos 53.1''} (= 20)$			M1 for a correct method to find AC
	$(BD^2 =) (1.5 \times 20'')^2 - 16^2 (= 644)$ or $(BD^2 =) 30^2 - 16^2 (= 900 - 256 = 644)$ or $(BAD =) \cos^{-1}\left(\frac{16}{30''}\right) (= 57.7(690...))$ or 57.8 or $(BDA =) \sin^{-1}\left(\frac{16}{30''}\right) (= 32.2(309...))$ or $(BCA =) \sin^{-1}\left(\frac{16}{20''}\right) (= 53.1(301...))$ and $\frac{(CD)}{\sin(180 - 126.9 - 32.2)} = \frac{30''}{\sin(180 - 53.1)}$ oe			M1 for a correct method using triangle to find BD^2 or angle BAD or angle BDA or for a correct equation for side CD
	$(BD =) \sqrt{(1.5 \times 20'')^2 - 16^2} (= 25.3(771)...) $ or $(BD =) \sqrt{30^2 - 16^2} (= \sqrt{900 - 256} = \sqrt{644} = 2\sqrt{161} = 25.3(771...))$ or $(BD =) 16 \times \tan 57.7'' (= 25.3(771...))$ or $(BD =) 30'' \times \sin 57.7'' (= 25.3(771...))$ or $(BD =) \sqrt{16^2 + 30''^2 - 2 \times 16 \times 30'' \times \cos 57.7''} (= 25.3(771...))$ or $(BD =) 30 \times \cos 32.2'' (= 25.3(771...))$ or $(BD =) \frac{16}{\tan 32.2''} (= 25.3(771...))$ or $(BD =) \frac{16}{\sin 32.2''} \times \sin 57.7'' (= 25.3(771...))$ or $(CD =) \frac{30''}{\sin 126.9''} \times \sin 20.9''$ oe			M1 for a correct method to find BD or CD
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	13.4		A1 awrt 13.4
				Total 5 marks



27	$(AD^2 =) 28^2 + 45^2 (= 784 + 2025 = 2809)$ or $(EDA =) \tan^{-1}\left(\frac{28}{45}\right) (= 31.8(9\dots))$ or $(EAD =) \tan^{-1}\left(\frac{45}{28}\right) (= 58.1(09\dots))$		5	M1 for a correct method to find AD^2 or angle EDA or angle EAD
	eg $(AD =) \sqrt{28^2 + 45^2} (= \sqrt{784 + 2025} = \sqrt{2809} = 53)$ oe or $(AD =) \frac{28}{\sin 31.8(9\dots)} (= 53\dots)$ or $(AD =) \frac{45}{\cos 31.8(9\dots)} (= 53\dots)$ oe or $(AD =) \frac{45}{\sin 58.1\dots} (= 53\dots)$ or $(AD =) \frac{28}{\cos 58.1\dots} (= 53\dots)$ oe			M1 for a correct method to find AD
	eg $(BC =) \sqrt{35^2 - ("53" - 21)^2} (= \sqrt{1225 - 1024} = \sqrt{201} = 14.1(7\dots))$ or $(BDC =) \cos^{-1}\left(\frac{"53" - 21}{35}\right) (= 23.8(9\dots))$ or $(BCD =) \sin^{-1}\left(\frac{"53" - 21}{35}\right) (= 66.1\dots)$			M1 for correct method to find BC or angle BDC or angle BCD
	eg $\frac{1}{2} \times "14.1(7\dots)" \times ("53" - 21) (= 16\sqrt{201})$ or $\frac{1}{2} \times 35 \times ("53" - 21) \times \sin("23.8(9\dots)")$ or $\frac{1}{2} \times 35 \times "14.1(7\dots)" \times \sin("66.1\dots")$			M1 for a correct method to find the area of triangle CDB
	Correct answer scores full marks (unless from obvious incorrect working)	227		A1 awrt 227 accept $16\sqrt{201}$
				Total 5 marks



27	$(AB^2 =) 7.5^2 - 6^2 (= 20.25)$ or eg $(BAC =) \sin^{-1}\left(\frac{6}{7.5}\right) (= 53.1\dots)$		6	M1	for a correct first step to find AB or a complete method to find angle BAC or a correct first step to find angle BCA
	or $\cos(BCA) = \frac{6}{7.5} (= 0.8)$			M1	for a complete method to find AB or angle BCA
	$(AB =) \sqrt{7.5^2 - 6^2} (= 4.5)$ or $(AB =) \frac{6}{\tan 53.1} (= 4.5\dots)$			M1	ft [their labelled AB] or [their labelled BCA] eg for $\frac{1}{2} \times 6 \times$ [their labelled AB] or $\frac{1}{2} \times 6 \times 7.5 \times \sin$ [their labelled BCA]
	or $(AB =) 7.5 \cos 53.1 (= 4.5\dots)$ or $(BCA =) \cos^{-1}\left(\frac{6}{7.5}\right) (= 36.8\dots)$			M1	ft (dep on previous M1) allow $31.5 -$ [their area]
	(Area $ABC =) \frac{1}{2} \times 6 \times 4.5 (= 13.5)$ or (Area $ABC =) \frac{1}{2} \times 6 \times 7.5 \times \sin(36.8) (= 13.47\dots$ or $13.5)$			M1	for a complete method to find AD , dependent on correct working
	(Area $DAC =) 31.5 - 13.5 (= 18)$ or $13.5 + 0.5 \times 7.5 \times AD = 31.5$ oe $(AD =) (18 \div 7.5) \div 0.5$ oe			A1	accept $4.78 - 4.81$
		4.8		Total 6 marks	



23	$\frac{14 + AB}{2} \times 15 = 360$ oe or $360 - 14 \times 15 (=150)$ oe		6	M1 for setting up an equation using the area of the trapezium or method to find the area of the triangle
	$AB = 34$ or $MB = 20$ (where M is point on AB such that MC is perpendicular to AB)			A1 could be seen on diagram
	$(CB^2 =) 15^2 + 20^2 (= 625)$ or $(CB^2 =) 15^2 + MB^2$			M1 allow use of their MB
	$(CB =) \sqrt{15^2 + 20^2} (= 25)$ or $(CB =) \sqrt{15^2 + MB^2}$			M1 allow use of their MB
	$14 + 15 + "34" + "25"$ oe or $14 + 15 + 14 + MB + CB$ oe			M1ft (dep on previous two M marks) for a method to find the perimeter of the trapezium, allow use of their MB and CB
	Correct answer scores full marks (unless from obvious incorrect working)	88		A1 cao
				Total 6 marks



Question	Working	Answer	Mark	Notes
21	$\cos 52 = \frac{12.6}{x}$ or $\sin 38 = \frac{12.6}{x}$		3	M1 Or use of tan to find horizontal side $12.6 \times \tan 52$ or $\frac{12.6}{\tan 38}$ (=16.12...) and a correct first stage to find x eg $x^2 = 12.6^2 + "16.12..."^2$ or $\sin 52 = \frac{"16.12..."}{x}$ oe Allow correct first stage of sine rule
	$(x =) \frac{12.6}{\cos 52}$ or $\frac{12.6}{\sin 38}$ (= $\frac{12.6}{0.61566...}$) or			M1 Accept decimal correct to at least 3SF Or $(x =) \sqrt{12.6^2 + "16.12..."^2}$ or $(x =) \frac{"16.12..."}{\sin 52}$ Allow rearranged $(x =)$ sine rule
		20.5		A1 20.4 – 20.5
Total 3 marks				



21	a		g^{10}	1	B1
	b		$9c^2d^8$	2	B2 B1 for 2 out of 3 terms correct as part of a product
	c	eg $4x + 3y = 17$ – $4x + 8y = 20$ or eg $4(5 - 2y) + 3y = 17$	eg $8x + 6y = 34$ – $3x + 6y = 15$ or eg $4x + 3 \times \frac{1}{2}(5 - x) = 17$	3	M1 Correct method to eliminate x or y: coefficients of x or y the same and correct operation to eliminate selected variable (condone any one arithmetic error in multiplication) or writing x or y in terms of the other variable and correctly substituting
		eg $4x + 3 \times 0.6 = 17$ or $x + 2 \times 0.6 = 5$	eg $4 \times 3.8 + 3y = 17$ or $3.8 + 2y = 5$		M1 (dep) correct method to find second variable – could start process again or use substitution
			$x = 3.8$ $y = 0.6$		A1 oe for both solutions dep on first M1
					Total 6 marks
22		$\tan x = \frac{3.4}{4.7}$ oe eg $\cos x = \frac{4.7}{\sqrt{3.4^2 + 4.7^2}}$			M1 or $\sin x = \frac{3.4 \sin 90}{\sqrt{3.4^2 + 4.7^2}}$ oe
		$(x =) \tan^{-1}\left(\frac{3.4}{4.7}\right)$ oe eg $(x =) \cos^{-1}\left(\frac{4.7}{\sqrt{3.4^2 + 4.7^2}}\right)$			M1 or $(x =) \sin^{-1}\left(\frac{3.4 \sin 90}{\sqrt{3.4^2 + 4.7^2}}\right)$ oe
			35.9	3	A1 accept 35.7 - 36.1
					Total 3 marks



Question	Working	Answer	Mark	Notes
21	$\sin 42 = \frac{6.5}{x}$ or $\frac{x}{\sin 90} = \frac{6.5}{\sin 42}$ or $\cos 48 = \frac{6.5}{x}$ [where $48 = 180 - 90 - 42$]		3	M1 or use of tan to find the horizontal side and then a correct first step in Pythagoras' theorem ie [base =] $\frac{6.5}{\tan 42}$ (= 7.21...) and $[x^2 =] 6.5^2 + "7.21..."$
	$[x =] \frac{6.5}{\sin 42}$ or $\frac{6.5 \sin 90}{\sin 42}$ or $[x =] \frac{6.5}{\cos 48}$ [where $48 = 180 - 90 - 42$]			M1 or complete method using Pythagoras $[x =] \sqrt{6.5^2 + "7.21..."}$ (If students give this statement with nothing before it they gain M2)
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	9.7		A1 accept 9.7 – 9.72
Total 3 marks				



16	(a)		a^{11}	1	B1
	(b)		w^{12}	1	B1
	(c)		$64x^{10}y^6$	2	B2 if not B2 then award B1 for 2 correct parts as part of a product eg $kx^{10}y^6$ where $k \neq 64$ or $64x^ky^6$ where $k \neq 10$ or $64x^{10}y^k$ where $k \neq 6$
	(d)	$c + 8v = t^3$		2	M1
			$t = \sqrt[3]{c+8v}$		A1 oe SCB1 for an answer of $t = \frac{c+8v}{3}$ oe
Total 6 marks					
17		$196 \div (9 - 5) (= 49)$ oe		3	M1
		$3 \times "49"$			M1
			147		A1 SCB1 for an answer from 34.5 – 34.6 or an answer of 42
Total 3 marks					
18		eg $\sin 65 = \frac{AB}{8.4}$ or $\frac{AB}{\sin 65} = \frac{8.4}{\sin 90}$		3	M1 for setting up a trig equation in AB
		eg $(AB =) 8.4\sin 65$ or $(AB =) \frac{8.4\sin 65}{\sin 90}$			M1 for a complete method
			7.61		A1 accept 7.61 – 7.613
Total 3 marks					



22	$\cos 42 = \frac{x}{9.5}$ or $\tan 42 = \frac{9.5 \sin 42}{x}$ or $\sin(90 - 42) = \frac{x}{9.5}$ or $\frac{x}{\sin 48} = \frac{9.5}{\sin 90}$ or $9.5^2 - (9.5 \sin 42)^2$		3	M1 a correct trig statement for x or correct Pythagoras for x^2
	$(x =) 9.5 \cos 42$ or $(x =) \frac{9.5 \sin 42}{\tan 42}$ or $(x =) 9.5 \sin(90 - 42)$ or $(x =) \frac{9.5 \sin 48}{\sin 90}$ or $(x =) \sqrt{9.5^2 - (9.5 \sin 42)^2}$			M1 a fully correct calculation to find x
		7.1		A1 awrt 7.1
Total 3 marks				



21	$\sin 34 = \frac{x}{6.5}$ or $\frac{x}{\sin 34} = \frac{6.5}{\sin 90}$ $6.5^2 - (6.5 \times \cos 34)^2$ or $\cos 56 = \frac{x}{6.5}$ oe		3	M1 a correct trig statement for x
	$(x =) 6.5 \times \sin 34$ or $x = \frac{6.5 \times \sin 34}{\sin 90}$ or $(x =) \sqrt{6.5^2 - (6.5 \times \cos 34)^2}$ or $(x =) 6.5 \times \cos 56$ oe			M1 a fully correct method to find x
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	3.6		A1 awrt 3.6
				Total 3 marks



19	$\cos 43 = \frac{x}{8.6}$ or $\tan 43 = \frac{8.6 \sin 43}{x}$ or $\sin(90 - 43) = \frac{x}{8.6}$ or $\frac{x}{\sin(90 - 43)} = \frac{8.6}{\sin 90}$ or $(x^2 =)8.6^2 - (8.6 \sin 43)^2$ or $(x^2 =)8.6^2 - 5.8(65\dots)^2$		3	M1 a correct trig statement for x or QR or a correct Pythagoras statement for x^2
	$(x =)8.6 \cos 43$ or $(x =)\frac{8.6 \sin 43}{\tan 43} \left(= \frac{5.8(65\dots)}{\tan 43} \right)$ or $(x =)8.6 \sin(90 - 43)$ or $(x =)\frac{8.6 \sin 47}{\sin 90}$ or $(x =)\sqrt{8.6^2 - 5.8(65\dots)^2}$			M1 a fully correct calculation to find x (some students go straight to this and gain M2)
	Correct answer scores full marks (unless from obvious incorrect working)	6.3		A1 awrt 6.3 seen even if then rounded incorrectly
				Total 3 marks

24	eg $\tan 24 = \frac{6.5}{QR}$ or $\frac{6.5}{\sin 24} = \frac{QR}{\sin(180-90-24)}$ or $\tan(180-90-24) = \frac{QR}{6.5}$ or $(PR =) \frac{6.5}{\sin 24} (=15.9\dots)$ and $6.5^2 + QR^2 = 15.9^2$		3	M1 for setting up a trig equation in QR or for a complete method to find PR and then setting up Pythagoras or trig equation for QR
	eg $(QR =) \frac{6.5}{\tan 24}$ or $(QR =) \frac{6.5}{\sin 24} \times \sin 66$ or $(QR =) 6.5 \tan 66$ [where $66 = 180 - 90 - 24$] or $(QR =) \sqrt{15.9^2 - 6.5^2}$			M1 for a complete method
	Correct answer scores full marks (unless from obvious incorrect working)	14.6		A1 accept 14.5 – 14.61
				Total 3 marks

Question	Working	Answer	Mark	Notes
25	$24.3 - 16 (= 8.3)$ $\tan y = \frac{12.5}{8.3}$ or $\tan z = \frac{8.3}{12.5}$ OR $\sqrt{8.3^2 + 12.5^2} (= 15.004\dots)$ and $\sin y = \frac{12.5}{15.0}$ or $\sin z = \frac{8.3}{15.0}$ or $\cos y = \frac{8.3}{15.0}$ or $\cos z = \frac{12.5}{15.0}$ $\tan^{-1}\left(\frac{12.5}{8.3}\right) (= 56.415\dots)$ or $\tan^{-1}\left(\frac{8.3}{12.5}\right) (= 33.584\dots)$ or $\sin^{-1}\left(\frac{12.5}{15.0}\right) (= 56.415\dots)$ or $\sin^{-1}\left(\frac{8.3}{15.0}\right) (= 33.584\dots)$ or $\cos^{-1}\left(\frac{8.3}{15.0}\right) (= 56.415\dots)$ or $\cos^{-1}\left(\frac{12.5}{15.0}\right) (= 33.584\dots)$	123.6	4	M1 Forming a right angled triangle with 24.3 – 16 on one side, 8.3 may be seen on diagram M1 for a correct trig statement involving angle <i>CDE</i> or <i>DCE</i> where <i>E</i> is on the line <i>AD</i> and <i>CE</i> is perpendicular to <i>AD</i> M1 complete method to find angle <i>CDE</i> or <i>DCE</i> A1 123.5 – 123.6
Total 4 marks				



Question	Working	Answer	Mark	Notes
20 (a)		12.35	1	B1 or 12.349
(b)		12.25	1	B1
21	$6000 \times 0.015 (= 90)$ or $6000 \times 1.015 (= 6090)$ $(6000 + '90') \times 0.015 (= 91.35)$ $('6090' + '91.35') \times 0.015 (= 92.72)$ $('6090' + '91.35' + '92.72') \times 0.015$ $(= 94.11..)$	368.18	3	M1 or for $\frac{4 \times 1.5}{100} \times 6000 (= 360)$ or 6360 M1 for complete method (4 years) for total value or sight of 6368..... M2 for 6000×1.015^4 A1 accept 368 – 368.20
22	$\tan '35' = \frac{x}{15}$ or $\tan '55' = \frac{15}{x}$ $x = 15 \times \tan '35' (= 10.5...)$ or $x = \frac{15}{\tan '55'}$ ($= 10.5...$) $10.5 + 37$	47.5	4	M1 Forming a right-angled triangle with angle 125 – 90 marked or 55 marked M1 M1 A1 Awrt 47.5

26	e.g. $\sin 65 = \frac{16}{AB}$ or $\cos 25 = \frac{16}{AB}$ or $\frac{AB}{\sin 90} = \frac{16}{\sin 65}$ or $\tan 65 = \frac{AD}{16}$ or $\tan 25 = \frac{AD}{16}$ or $\frac{AD}{\sin 25} = \frac{16}{\sin 65}$		4	M1 for a correct trig ratio for <i>AB</i> or <i>AD</i> accept $180 - 90 - 65$ for 25
	e.g. $(AB) = \frac{16}{\sin 65} (= 17.654\dots)$ or $(AB) = \frac{16}{\cos 25} (= 17.654\dots)$ or $(AB) = \frac{16 \sin 90}{\sin 65} (= 17.654\dots)$ and $(AD) = \frac{16}{\tan 65} (= 7.460\dots)$ or $(AD) = 16 \times \tan 25 (= 7.460\dots)$ or $(AD) = \frac{16 \sin 25}{\sin 65} (= 7.460\dots)$			M1 for finding <i>AB</i> and <i>AD</i> Allow use of Pythagoras $(AD) = \sqrt{17.654\dots^2 - 16^2} (= 7.460\dots)$ or $(AB) = \sqrt{7.460\dots^2 + 16^2} (= 17.654\dots)$
	$(17.654\dots \times 2) + (7.460\dots \times 2)$ oe			M1 for a complete method to find the perimeter
		50.2		A1 accept 49.6 – 50.6
Total 4 marks				

26	eg $\cos 38 = \frac{9.3}{(AB)}$ oe or $\sin'52' = \frac{9.3}{(AB)}$ oe or $\frac{(BC)}{\sin 38} = \frac{2 \times 9.3}{\sin'104'}$ oe or $\frac{\sin'52'}{9.3} = \frac{\sin 90}{(BC)}$ oe		4	M1 or $BN = \frac{9.3 \sin 38}{\sin'52'}$ or $9.3 \tan 38 (= 7.2659...)$ and $(AB^2) = 9.3^2 + '7.2659...'^2$
	eg $(AB =) \frac{9.3}{\cos 38} (= 11.80....)$ or $(AB =) \frac{9.3}{\sin'52'}$ (= 11.80....) or $(BC =) \frac{2 \times 9.3 \times \sin 38}{\sin'104'}$ (= 11.80....) oe			M1 or $(AB =) \sqrt{9.3^2 + '7.2659...'^2} (= 11.80...)$
	'11.8' + '11.8' + 9.3 + 9.3 or '11.8' $\times$ 2 + 9.3 $\times$ 2 oe			M1
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	42.2		A1 awrt 42.2
				Total 4 marks

25	$\sin 52 = \frac{12 \div 2}{r}$ oe or $\frac{r}{\sin 90} = \frac{6}{\sin 52}$ oe or $\cos(90 - 52) = \frac{12 \div 2}{r}$ oe or $(r^2 =)(12 \div 2)^2 + \left(\frac{12 \div 2}{\tan 52}\right)^2$ oe $[r^2 = 6^2 + 4.687...^2]$ or $\frac{r}{\sin 38} = \frac{12}{\sin 104}$ oe		4	M1 A correct trig statement for the radius use of tan must also include a correct Pythagoras statement.
	$r = \frac{6}{\sin 52}$ (=7.614) oe or $r = \frac{6}{\cos 38}$ oe or $(r =)\sqrt{(12 \div 2)^2 + \left(\frac{12 \div 2}{\tan 52}\right)^2}$ $[r = \sqrt{6^2 + 4.687...^2}]$ oe or $\frac{12 \sin 38}{\sin 104}$ oe			M1 A correct method to find the radius of the circle use of tan must also use Pythagoras to find an expression for r
	(Area =) $\pi \times ("7.61...")^2$			M1 the radius must come from a completely correct method
	Correct answer scores full marks (unless from obvious incorrect working)	182		A1 Accept 181 - 183
				Total 4 marks

28	$\cos BAD = \frac{8}{14}$ or $\sin ABD = \frac{8}{14}$ or $\sin ABD = \frac{8 \sin 90}{14}$ or $(BD =) \sqrt{14^2 - 8^2} (= \sqrt{132} = 2\sqrt{33} = 11.489...)$		4	M1
	$BAD = \cos^{-1}\left(\frac{8}{14}\right) (= 55.1(5...))$ or $\cos^{-1}\left(\frac{14^2 + 8^2 - "11.489"'^2}{2 \times 14 \times 8}\right)$ $BAD = \sin^{-1}\left(\frac{"11.489..." }{14}\right) (= 55.1(5...))$ or $BAD = \tan^{-1}\left(\frac{"11.489..." }{8}\right) (= 55.1(5...))$ or $BAD = 180 - 90 - \sin^{-1}\left(\frac{8}{14}\right) (= 180 - 90 - 34.8... = 55.1(5...))$ or $CAD = 180 - 38 - \sin^{-1}\left(\frac{8}{14}\right) - 90 (= 180 - 38 - 34.8 - 90 = 17.2)$			M1 (accept 55.1 or 55.2 without working)
	$\tan("55.15..." - 38) = \frac{CD}{8}$ oe eg $\tan 17.2 = \frac{CD}{8}$ oe or $\frac{CD}{\sin(55.1... - 38)} = \frac{8}{\sin(90 - (55.1... - 38))}$ oe			M1 A correct equation with <i>CD</i> being the only unknown value
	Correct answer scores full marks (unless from obvious incorrect working)	2.47		A1 2.44 – 2.48
				Total 4 marks



Question	Working	Answer	Mark	Notes
18 (a)		71 800 000	1	B1
(b)	Eg $1.88 \times 10^7 + 3.10 \times 10^8 + 2.64 \times 10^8 + 7.18 \times 10^7$ or 18 800 000 + 310 000 000 + 264 000 000 + 71 800 000 with at least 3 numbers correct			M1 for a complete method or for digits 6646
		6.646×10^8 oe	2	A1 for 6.646×10^8 oe eg 664 600 000
(c)		9.88×10^6	1	B1
19	$\tan 20^\circ = \frac{AB}{12.6}$ (AB =) $12.6 \tan 20^\circ$ or 4.58(602...) or 4.6 ($BC^2 =$) $19.3^2 - 12.6^2$ or 372.49 – 158.76 or 213(.73) (BC =) $\sqrt{19.3^2 - 12.6^2}$ or $\sqrt{213.73}$ or 14.6(195...)			M1 or for $AD = 12.6/\cos 20^\circ$ (=13.4..) and $12.6^2 + AB^2 = 13.4^2$ M1 or for (AB =) $\sqrt{13.4^2 - 12.6^2}$ M1 M1
		19.2	5	A1 for 19.19 – 19.21

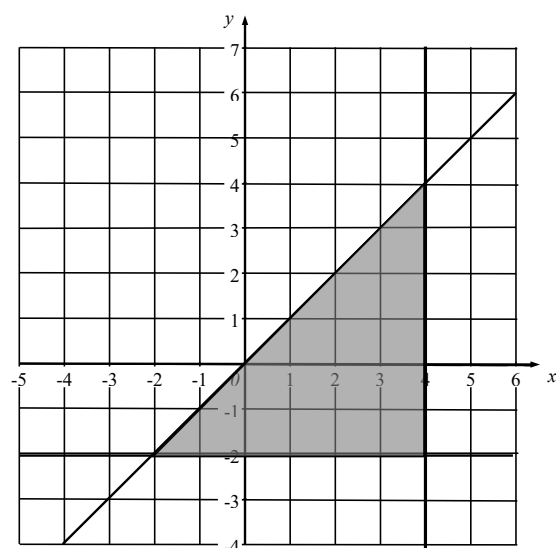


25	$y = \frac{7-5x}{2}$ or $y = \frac{7}{2} - \frac{5}{2}x$ or $y = 3.5 - 2.5x$ or $2y = 7 - 5x$ oe		2	M1 for making y or $2y$ the subject
		-2.5		A1 for $-\frac{5}{2}$ or -2.5
				Total 2 marks

26	$\cos 35^\circ = \frac{15}{AB}$ or $\sin 55^\circ = \frac{15}{AB}$		5	M1
	$(AB =) \frac{15}{\cos 35^\circ} (=18.3)$ or $(AB =) \frac{15}{\sin 55^\circ} (=18.3)$			M1 NB 18.3(116...)
	'18.3' $\times 4$ ($= 73.2$)			M1 dep 1st M1
	$80 - '18.3' \times 4$ or $80 - '73.2'$			M1
		6.75		A1 accept 6.75 – 6.8
				Total 5 marks

Alternative Mark Scheme for Q26 [do not mix and match with above MS]				
26	$15 \times 4 (= 60)$		5	M1
	$\cos 35^\circ = \frac{'60'}{AE}$ or $\sin 55^\circ = \frac{'60'}{AE}$			M1
	$(AE =) \frac{'60'}{\cos 35^\circ} (= 73.2)$ or $(AE =) \frac{'60'}{\sin 55^\circ} (= 73.2)$			M1 dep 1st M1
	$80 - '73.2'$			M1
		6.75		A1 accept 6.75 – 6.8
				Total 5 marks

Appendix 1



27	eg $\tan BAP = \frac{2}{5}$ or $\sin BAP = \frac{2}{\sqrt{5^2 + 2^2}}$ or $\frac{\sin BAP}{2} = \frac{\sin 90}{\sqrt{5^2 + 2^2}}$ $\cos BAP = \frac{5}{\sqrt{5^2 + 2^2}}$ or $\cos BAP = \frac{5^2 + (\sqrt{5^2 + 2^2})^2 - 2^2}{2 \times 5 \times \sqrt{29}}$		5	M1 for setting up a trig equation for angle BAP
	eg $(BAP) \tan^{-1} \left(\frac{2}{5} \right) (= 21.8\dots)$ or $(BAP) \sin^{-1} \left(\frac{2}{\sqrt{5^2 + 2^2}} \right)$ or $(BAP) \sin^{-1} \left(\frac{2 \sin 90}{\sqrt{5^2 + 2^2}} \right)$ $(BAP) \cos^{-1} \left(\frac{5}{\sqrt{5^2 + 2^2}} \right)$ or $BAP = \cos^{-1} \left(\frac{5^2 + (\sqrt{5^2 + 2^2})^2 - 2^2}{2 \times 5 \times \sqrt{5^2 + 2^2}} \right)$			M1 for a complete method to find angle BAP (= 21.8....) [M2 for $90 - \tan^{-1} \frac{5}{2}$ ie $90 - 68.2$]
	eg (int angle =) $(6 - 2) \times 180 \div 6 (= 120)$ or (ext angle =) $360 \div 6 (= 60)$			M1 Indep for a method to find the size of one interior or one exterior angle in a regular hexagon – could be seen on diagram
	eg “120” – “21.8” or 180 – “60” – “21.8”			M1 for a complete method to find angle PAF where all values have come from a correct method
		98.2		A1 accept 98.1 – 98.3
				Total 5 marks

23	$\cos 50 = \frac{18}{(AB)}$ or $\sin 40 = \frac{18}{(AB)}$ or $\frac{(AB)}{\sin 90} = \frac{18}{\sin 40}$		5	M1	M2 for $(AB =) \sqrt{18^2 + (18 \tan 50)^2}$ oe (= 28.0030...) or 28
	$(AB =) \frac{18}{\cos 50}$ (= 28.0030...) oe or 28 or $(AB =) \frac{18}{\sin 40}$ (= 28.0030...) oe or 28			M1	
	$\frac{1}{2} \times \pi \times "28.0030..." (= 43.9...) \text{ oe or } 44$ $\pi \times "28.0030..." (= 87.9...) \text{ oe or } 88$				M1 for use of πd or $\frac{1}{2} \pi d$ oe Allow any value of $AB > 18$ if M2 not scored
	"28..." + "43.9..." (= 71.9900...) or "28" + "44"				M1ft from previous M1 Allow their d + their $\frac{1}{2} \pi d$
	Correct answer scores full marks (unless from obvious incorrect working)	72			A1 awrt 72
					Total 5 marks
24	(a)	0.000 625	1	B1	
	(b) 25 000 000 oe e.g. 25×10^6 or 0.25×10^8 or 2.5×10^n $n \neq 7$		2	M1	
	Correct answer scores full marks (unless from obvious incorrect working)	2.5×10^7		A1	
					Total 3 marks



26		$m = (-)4 \div 2$	$y = -2x - 1$	3	M1 B2	Correct method to work out the gradient accept $4 \div 2$ or $m = 2$ If not B2 then B1 for $L = -2x - 1$ or $-2x - 1$ or $y = 2x - 1$ or $y = -2x + c$
						Total 3 marks

Question	Working	Answer	Mark	Notes
27	$\sin 32 = \frac{BD}{3.1}$ $BD = 3.1 \times \sin 32 (= 1.6427\dots)$ $\cos 42 = \frac{3.1 \sin 32}{AB}$ Or $\frac{AB}{\sin 90} = \frac{3.1 \sin 32}{\sin 48}$ $AB = \frac{3.1 \sin 32}{\cos 42}$ or $AB = \frac{3.1 \sin 32}{\sin 48}$	2.21	5	M1 M1 Accept 1.6 or better M1 Dep or (AD =) "1.6.. x tan 42 {= 1.479} M1 Dep or (AB =) $\sqrt{1.479^2 + 1.6427^2}$ A1 2.21053... (Accept 2.20 → 2.22)
				Total 5 marks
				Total for Paper: 100 marks



24	$\tan 40 = \frac{8}{(AD)}$ or $\frac{(AD)}{\sin(90-40)} = \frac{8}{\sin 40}$ oe or $(AC =) \frac{8}{\sin 40} (= 12.4(457...))$ $(D = \text{foot of the perpendicular line})$		5	M1
	$(AD =) \frac{8}{\tan 40} (= 9.5(3...))$ or $(AD =) \frac{8}{\sin 40} \times \sin(90-40) (= 9.5(3...))$ oe or $(AD =) \sqrt{12.4^2 - 8^2} = \sqrt{90.8(977...)} (= 9.5(3...))$ oe or $(BC^2 =) 12.4^2 + 22^2 - 2 \times 12.4 \times 22 \times \cos 40 (= 219.4...)$ oe			M1
	$(DB =) 22 - 9.5(3...)$ (= 12.4(659... = 12.5)) or $(BC =) \sqrt{12.4^2 + 22^2 - 2 \times 12.4 \times 22 \times \cos 40} (= \sqrt{219.4...} = 14.8)$ oe or $(BC =) \sqrt{8^2 + (22 - 9.5(3...))^2} (= 14.8)$ oe			M1
	$\tan x = \frac{8}{12.5}$ or $\cos x = \frac{12.5}{14.8}$ or $\sin x = \frac{8}{14.8} (\times \sin 90)$ oe or $\sin x = \frac{\sin 40}{14.8} \times 12.4$ oe or $\cos x = \frac{22^2 + 14.8^2 - 12.4^2}{2 \times 22 \times 14.8}$ oe			M1
	Working required	32.7		A1 Allow 32.3 – 32.8 dep on a correct method shown
				Total 5 marks

