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EDEXCEL INTERNATIONAL GCSE MATHS: QUESTIONS BY TOPIC

Angles, Polygons & Bearings (G1)

International GCSE Mathematics A (4MA1) · Higher tier

33 questions · 139 marks · Mark schemes included

Past papers June 2018 - June 2025 · 3 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.

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G1a ANGLE FACTS & PARALLEL LINES		6 Qs · 26 marks	3
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QUESTION	SOURCE	MARKS	PAGE
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QUESTIONS

33 questions · 139 marks · 3 sub-topics

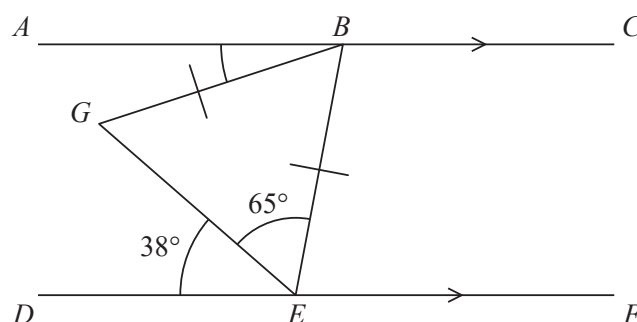
SUB-TOPIC G1a

ANGLE FACTS & PARALLEL LINES

Sub-topic G1a · 6 questions · 26 marks · lowest tariff first



6

Diagram **NOT**
accurately drawn ABC and DEF are parallel lines. $BG = BE$ Angle $DEG = 38^\circ$ Angle $GEB = 65^\circ$ Find the size of angle ABG .

(Total for Question 6 is 3 marks)



- 6 The diagram shows the triangle PQR .

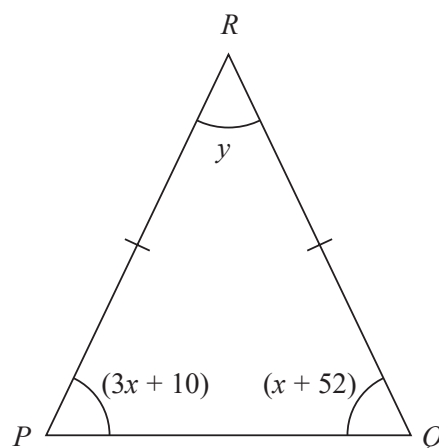


Diagram **NOT**
accurately drawn

In the diagram, all the angles are in degrees.

$$RP = RQ$$

Find the value of y .

Show clear algebraic working.

$$y =$$

(Total for Question 6 is 4 marks)



- 4 The diagram shows a triangle.

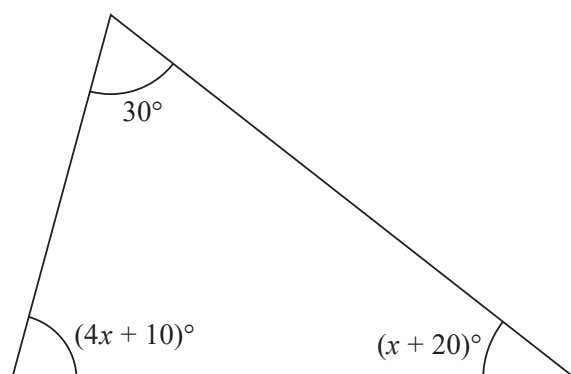


Diagram **NOT**
accurately drawn

Work out the value of x .

$x =$

(Total for Question 4 is 4 marks)



5

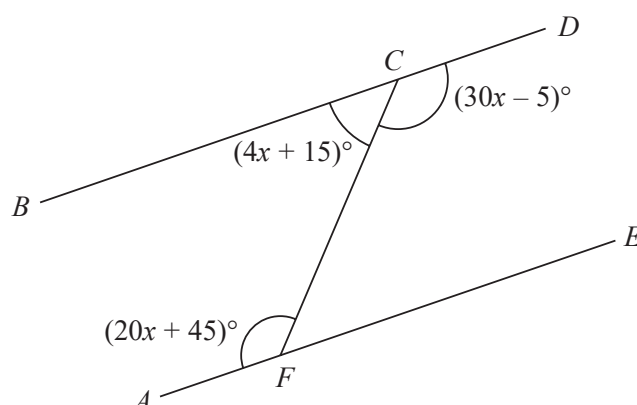


Diagram **NOT**
accurately drawn

BCD and AFE are straight lines.

Show that BCD is parallel to AFE .

Give reasons for your working.

(Total for Question 5 is 5 marks)



3

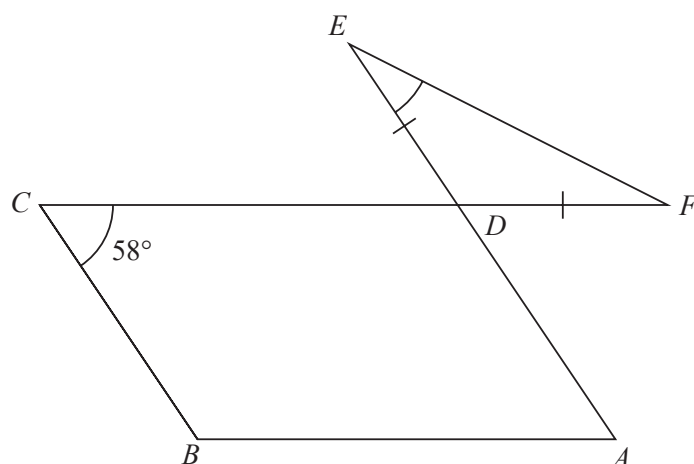


Diagram **NOT**
accurately drawn

The diagram shows a parallelogram $ABCD$ and an isosceles triangle DEF in which $DE = DF$

CDF and ADE are straight lines.

Angle $BCD = 58^\circ$

Work out the size of angle DEF .

Give a reason for each stage of your working.

.....°

(Total for Question 3 is 5 marks)



5

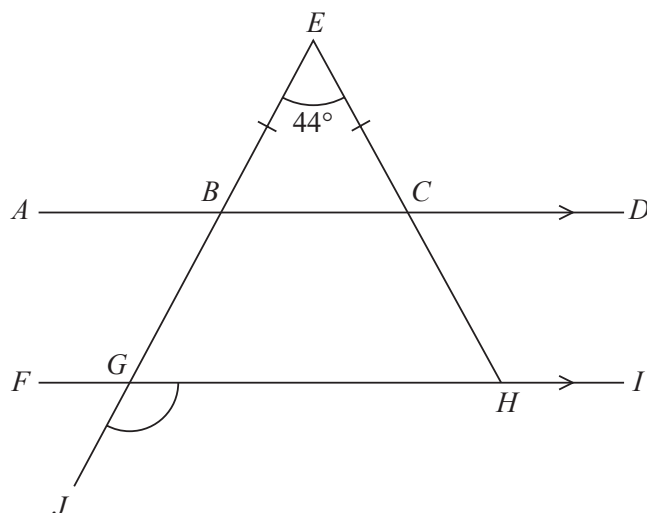


Diagram **NOT**
accurately drawn

$ABCD$ and $FGHI$ are parallel straight lines.
 $EBGJ$ and ECH are straight lines.

$BE = CE$
Angle $BEC = 44^\circ$

Work out the size of angle JGH .
Give a reason for each stage of your working.

(Total for Question 5 is 5 marks)



SUB-TOPIC G1b

POLYGONS & PROPERTIES OF SHAPES

Sub-topic G1b · 20 questions · 82 marks · lowest tariff first



- 2 Each interior angle of a regular polygon is 162°

Work out the number of sides the polygon has.

(Total for Question 2 is 3 marks)



- 12 The diagram shows two congruent isosceles triangles and parts of two congruent regular polygons, X and Y.

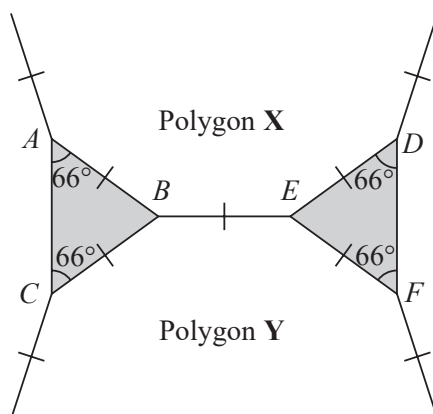


Diagram **NOT**
accurately drawn

The two regular polygons each have n sides.

Work out the value of n .

$n = \dots\dots\dots$

(Total for Question 12 is 3 marks)



- 4 The diagram shows a pentagon.

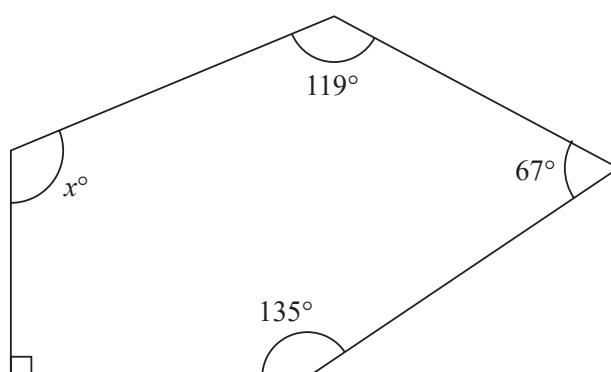


Diagram **NOT**
accurately drawn

Work out the value of x

$x =$

(Total for Question 4 is 3 marks)



11 Here is a 9-sided regular polygon $ABCDEFGHIJ$, with centre O

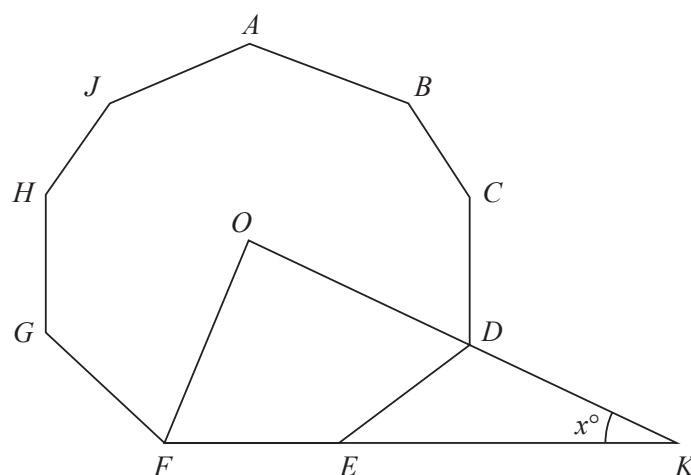


Diagram **NOT**
accurately drawn

ODK and FEK are straight lines.

Work out the value of x

$x = \dots\dots\dots$

(Total for Question 11 is 3 marks)



9

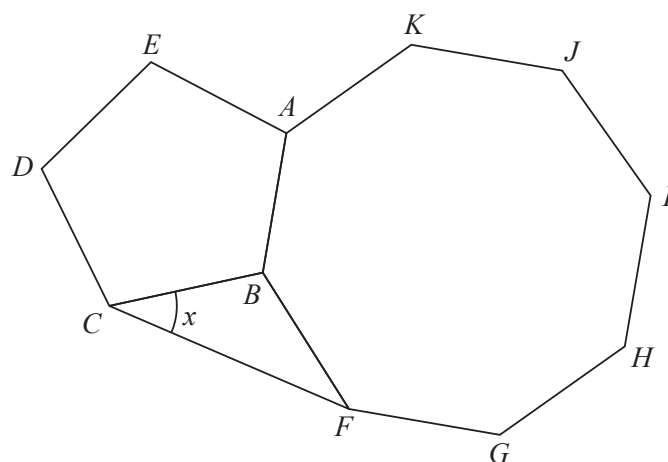


Diagram **NOT**
accurately drawn

The diagram shows a regular pentagon, $ABCDE$, a regular octagon, $ABFGHIJK$, and an isosceles triangle, BCF .

Work out the size of angle x .

(Total for Question 9 is 4 marks)



6

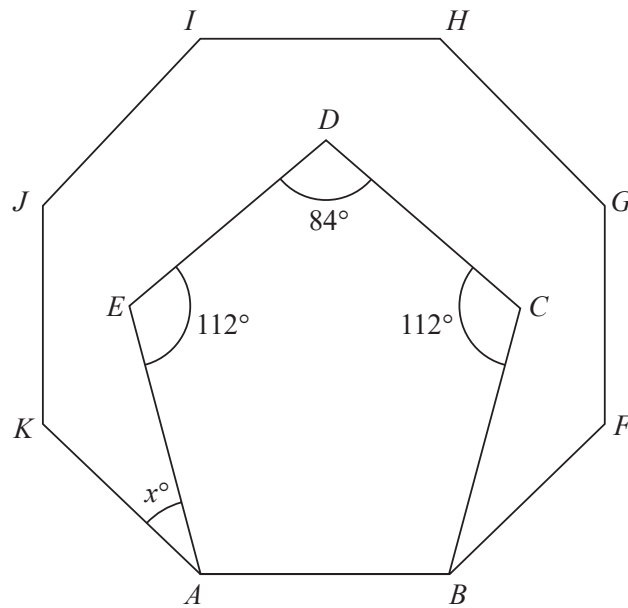


Diagram **NOT**
accurately drawn

Pentagon $ABCDE$ is drawn inside the regular octagon $ABFGHIJK$.
The pentagon has exactly one line of symmetry.

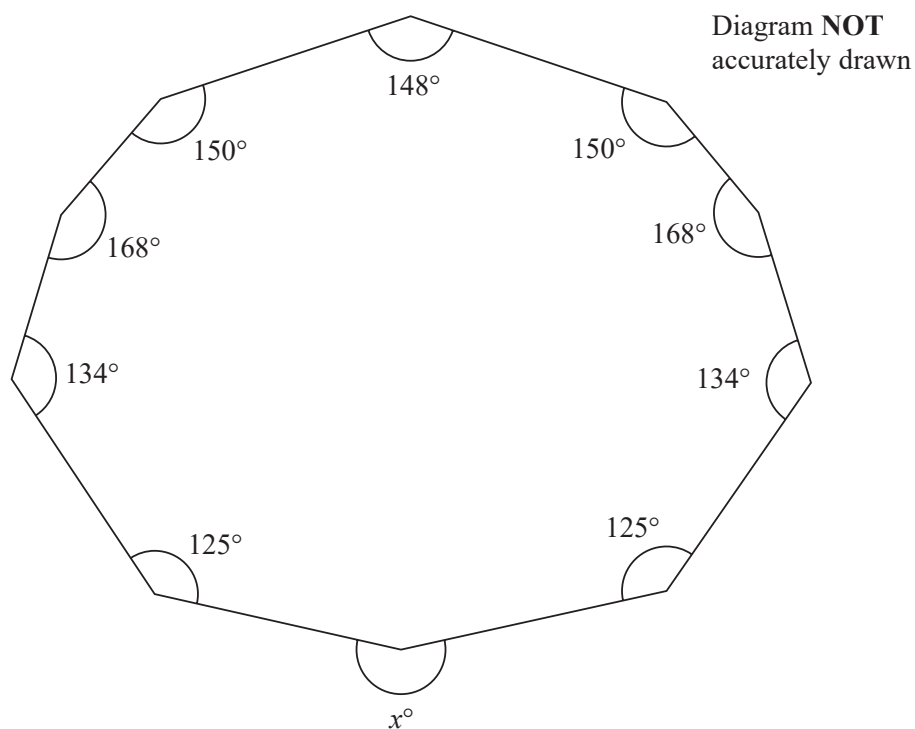
Work out the value of x .

$x =$

(Total for Question 6 is 4 marks)



8 Here is a 10-sided polygon.



Work out the value of x .

$x =$

(Total for Question 8 is 4 marks)



- 11 The diagram shows a regular 10-sided polygon, $ABCDEFGHIJ$

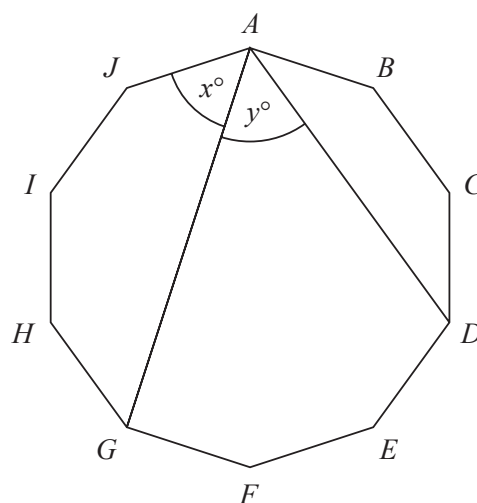


Diagram **NOT**
accurately drawn

Show that $x = y$

(Total for Question 11 is 4 marks)



- 4 The diagram shows a regular octagon $ABCDEFGH$ and a regular pentagon $ABIJK$

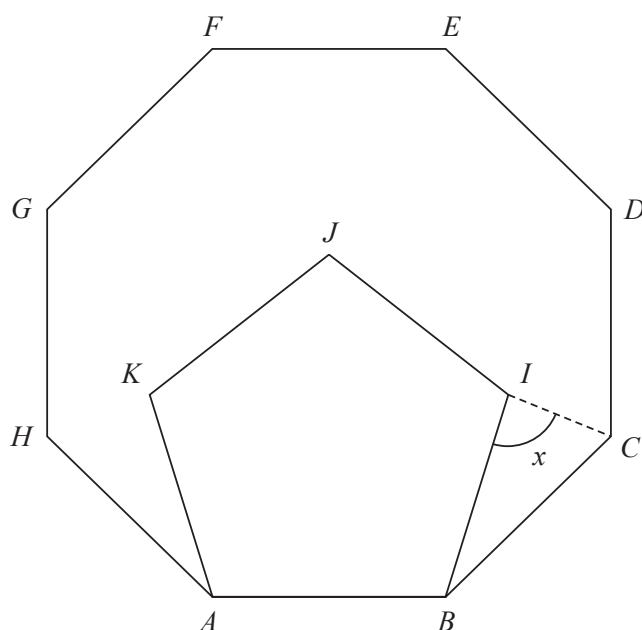


Diagram **NOT**
accurately drawn

Work out the size of the angle x

(Total for Question 4 is 4 marks)



- 4 The diagram shows parts of three regular polygons, **A**, **B** and **C**, meeting at a point.

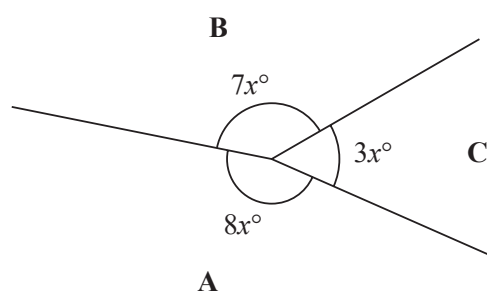


Diagram **NOT**
accurately drawn

Polygon **B** has n sides.

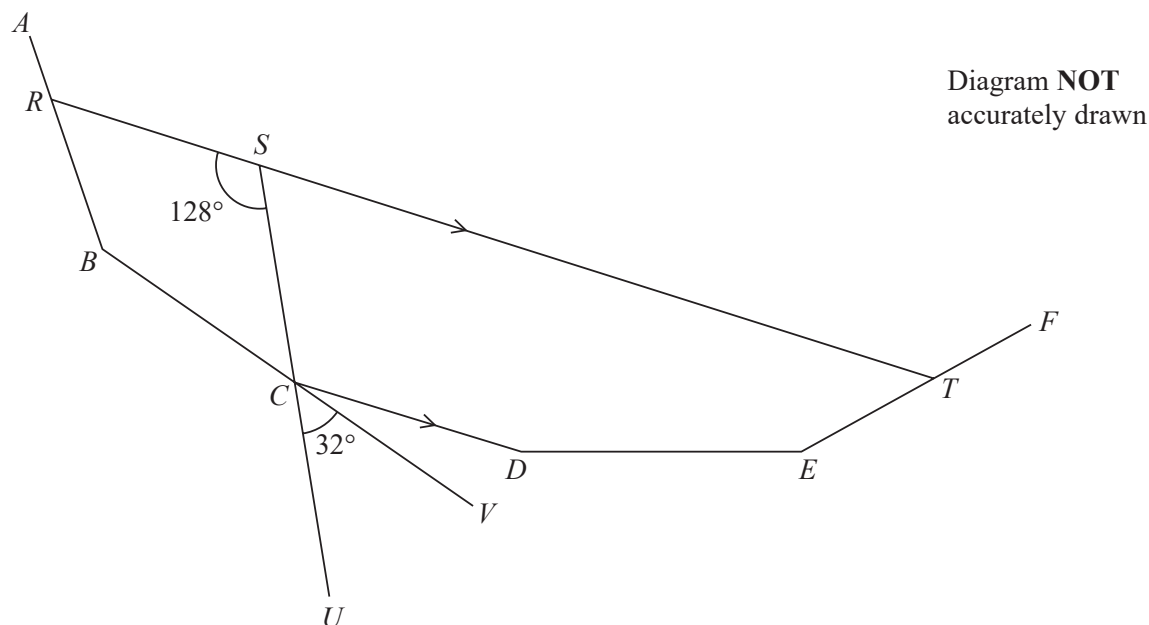
Work out the value of n .

$n = \dots\dots\dots$

(Total for Question 4 is 4 marks)



11



AB , BC , CD , DE and EF are five sides of a regular polygon.

RST , SCU and BCV are straight lines.

RST is parallel to CD

Angle $RSC = 128^\circ$

Angle $UCV = 32^\circ$

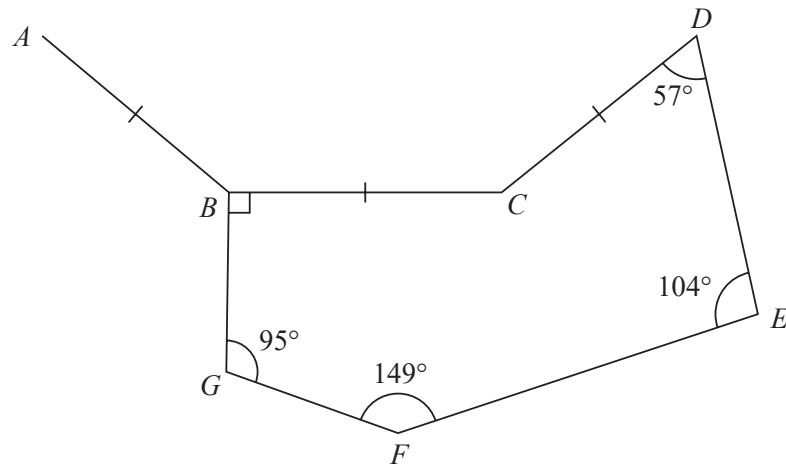
Work out how many sides the polygon has.

Show your working clearly.

(Total for Question 11 is 4 marks)



15

Diagram **NOT**
accurately drawn*BCDEFG* is a hexagon.*AB*, *BC* and *CD* are three sides of a regular n -sided polygon.Calculate the value of n

Show your working clearly.

 $n = \dots\dots\dots$

(Total for Question 15 is 4 marks)



3 $ABCD$ is a trapezium.

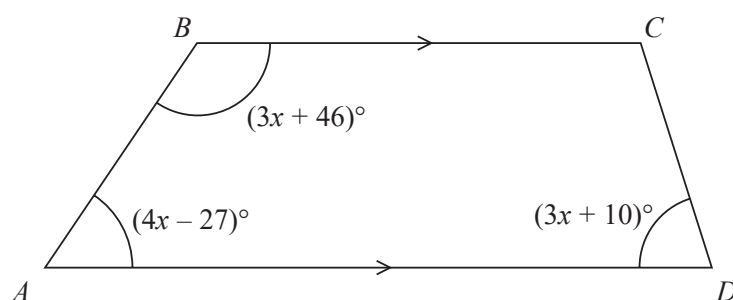


Diagram **NOT**
accurately drawn

BC is parallel to AD

Find the size of the largest angle inside the trapezium.

(Total for Question 3 is 4 marks)

- 5 In the diagram, $ABCDE$ is a regular pentagon.

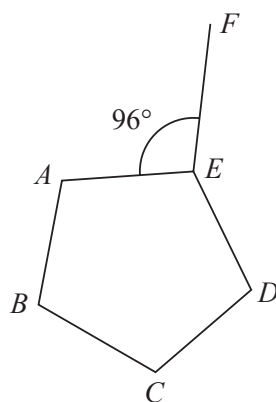


Diagram **NOT**
accurately drawn

Angle $AEF = 96^\circ$

Work out the size of the obtuse angle FED
Show your working clearly.

(Total for Question 5 is 4 marks)



3

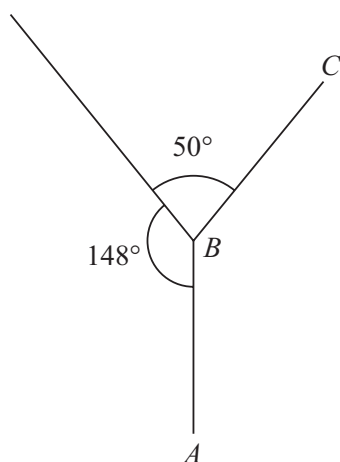


Diagram **NOT**
accurately drawn

AB and BC are two sides of a regular polygon with n sides.

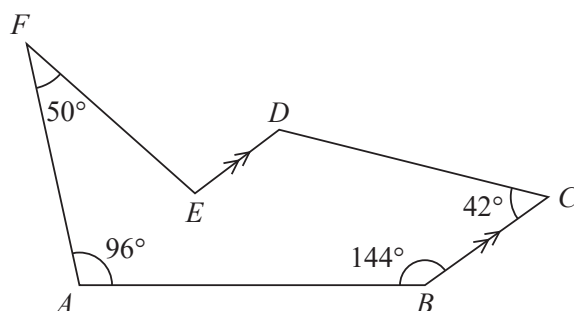
Work out the value of n
Show your working clearly.

$n = \dots\dots\dots$

(Total for Question 3 is 4 marks)



12

Diagram **NOT**
accurately drawn

The diagram shows a hexagon $ABCDEF$.
 BC is parallel to ED .

Work out the size of the obtuse angle DEF .

(Total for Question 12 is 5 marks)

- 8 The diagram shows a regular pentagon, $ABCDE$, a regular hexagon, $CFGHID$, and a quadrilateral, $EDIJ$.

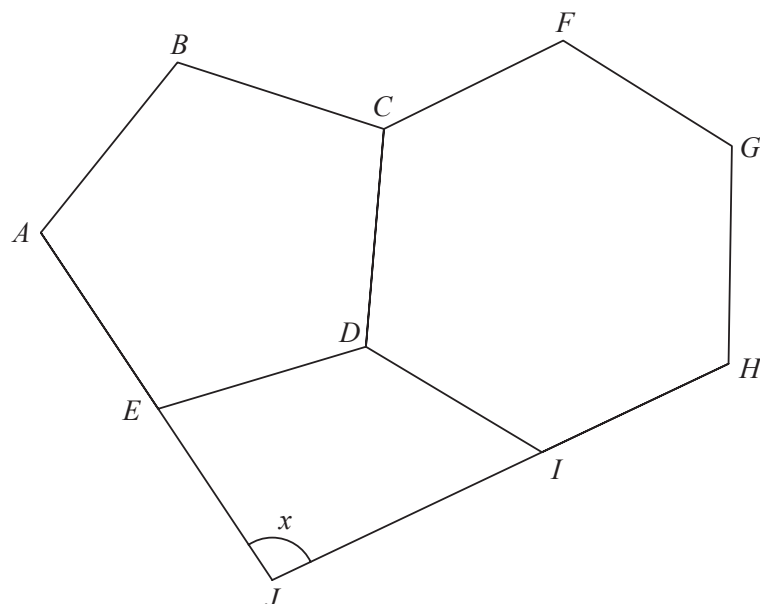


Diagram **NOT**
accurately drawn

AEJ and HIJ are straight lines.

Work out the size of the angle marked x .
Show your working clearly.

(Total for Question 8 is 5 marks)



- 5 The diagram shows a regular octagon $ABCDHIJK$ and a pentagon $DEFGH$.

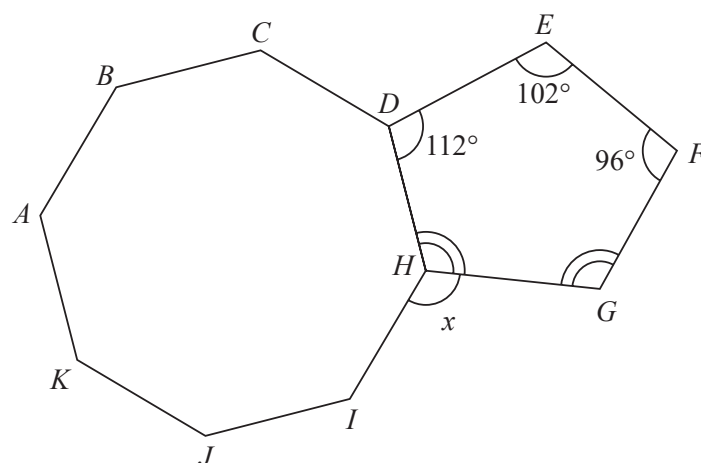


Diagram **NOT**
accurately drawn

Angle $GHD = \text{angle } FGH$.

Work out the size of the angle marked x .
Show your working clearly.

(Total for Question 5 is 5 marks)

11

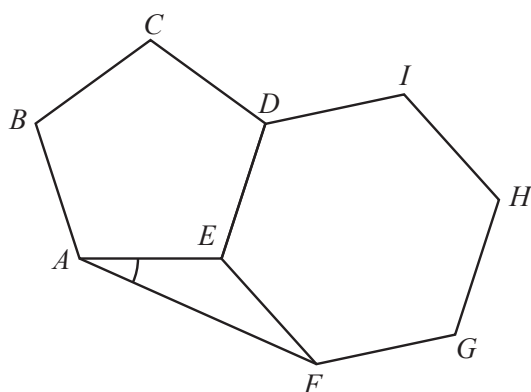


Diagram **NOT**
accurately drawn

ABCDE is a regular pentagon.
DEFGHI is a regular hexagon.

AF is a straight line.

Work out the size of angle *EAF*

(Total for Question 11 is 5 marks)

24 A polygon has n sides, where $n > 5$

The interior angles of the polygon form an arithmetic sequence.

The smallest angle of the polygon is 84°

The common difference of the sequence is 4°

Work out the sum of the interior angles of the polygon.

Show clear algebraic working.



Turn over for Question 25



SUB-TOPIC G1c

BEARINGS

Sub-topic G1c · 7 questions · 31 marks · lowest tariff first



2 Show that $2\frac{4}{7} \div 1\frac{1}{8} = 2\frac{2}{7}$

(Total for Question 2 is 3 marks)

- 3 The bearing of Paris from London is 149°
Work out the bearing of London from Paris.

(Total for Question 3 is 2 marks)



- 5 The scale drawing shows the position of a hall and the position of a library.



Scale: 1 cm represents 20 metres

A post box is 140 metres from the library on a bearing of 220°

- (a) Show the position of the post box on the scale drawing.
Mark the position with a cross (X) and label it *P*.

(2)

- (b) Use your scale drawing to find

- (i) the real distance, in metres, of the hall from the post box,

m

- (ii) the bearing of the hall from the post box.

o

(2)

(Total for Question 5 is 4 marks)



- 5 The scale diagram shows the position on a map of a house, A

Scale: 1 cm represents 200 metres



House C is on a bearing of 110° from A
The distance from A to C is 700 m

- (a) Mark the position of C on the diagram with a cross ($\times$)
Label your cross C

(3)

- (b) Write the scale of the map in the form $1 : n$

1 :
(1)

(Total for Question 5 is 4 marks)



25 A boat sails from point X to point Y and then to point Z .

Y is on a bearing of 280° from X .

Z is on a bearing of 220° from Y .

The distance from X to Y is 3.5 km.

The distance from Y to Z is 6 km.

Work out the bearing of Z from X .

Give your answer correct to 1 decimal place.

(Total for Question 25 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS



16 The diagram shows the positions of three ships, A , B and C .

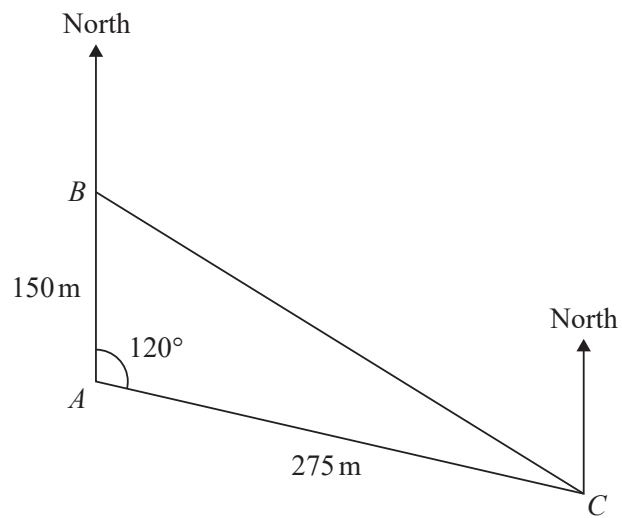


Diagram **NOT**
accurately drawn

Ship B is due north of ship A .

The bearing of ship C from ship A is 120°

Calculate the bearing of ship C from ship B .

Give your answer correct to the nearest degree.



(Total for Question 16 is 5 marks)



18 The diagram shows the positions of three villages, A , B and C

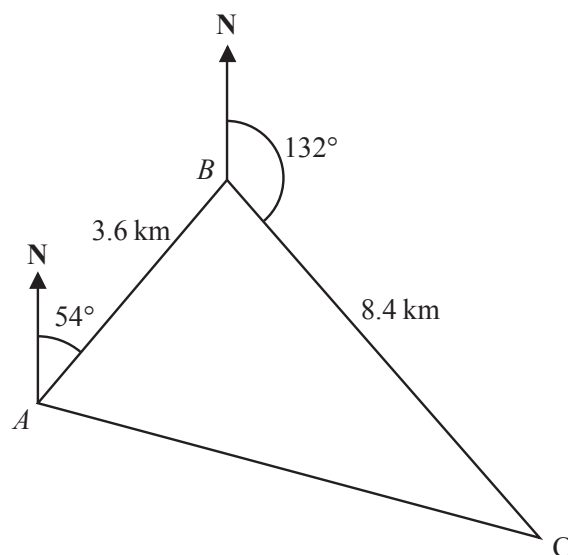


Diagram **NOT**
accurately drawn

The bearing of B from A is 054°

The bearing of C from B is 132°

Melur walks from A to B

She then walks from B to C and from C to A

Melur walks at an average speed of 6 km/h

Work out the total time Melur takes.

Give your answer in hours and minutes.

..... hours minutes

(Total for Question 18 is 5 marks)



24 A , B and C are three points on horizontal ground.

$AB = 8.4$ metres $BC = 9.2$ metres

B is on a bearing of 067° from A

C is on a bearing of 129° from B

Calculate the bearing of A from C

Give your answer correct to the nearest degree.



o

(Total for Question 24 is 6 marks)

Turn over for Question 25



MARK SCHEMES

official mark schemes, in the same order as the questions



5	For example,	No + reason	2	M1 for evaluating E correctly for any value of n
	n			
	1			
	2			
	3			
	4			
	5			A1 for No with E evaluated correctly as a non-prime number
				Total 2 marks

6	Angle $EBG = 180 - 2 \times 65 (= 50)$ or Angle $ABE = 180 - (38 + 65) (= 77)$	27	3	M1
	Angle $ABE = 180 - (38 + 65) (= 77)$ and Angle $ABG = "77" - "50"$			M1 for a complete method to find angle ABG
				A1
				Total 3 marks
	Alternative scheme 1			
	Angle $EBG = 180 - 2 \times 65 (= 50)$ or Angle $EBC = 103$			M1
	Angle $EBC = 103$ and Angle $ABG = 180 - (103 + "50")$			M1 for a complete method to find angle ABG
				A1
				Total 3 marks

Question	Working	Answer	Mark	Notes	
5	$30.5 \div 8 (= 3.8125)$ OR $60 \div 8 (= 7.5)$ $"3.8125" \times 60$ OR $30.5 \times "7.5"$	228.75	3	M1 M1 A1	M2 for $30.5 \div \frac{8}{60}$ oe accept 229, 228.8
6	$3x + 10 = x + 52$ $3x - x = 52 - 10$ or $2x = 42$ or $x = 21$ $y = 180 - 2 \times ("21" + 52)$ or $y = 180 - 2 \times (3 \times "21" + 10)$ or $y = 180 - ("21" + 52) - (3 \times "21" + 10)$	34	4	M1 M1 M1 A1	for equating the expressions for angle <i>P</i> and angle <i>Q</i> for isolating the terms in <i>x</i> for a complete method dep on M2
7	eg $\frac{187}{147}$ or $\frac{147}{187}$ or $\frac{90}{187}$ or $\frac{187}{90}$ eg $90 \div \frac{187}{147}$ or $90 \times \frac{147}{187}$ or $147 \times \frac{90}{187}$ or $147 \div \frac{187}{90}$	71	3	M1 M1 A1	for an appropriate scale factor, candidates may work in either cm or m for a complete method, candidates may work in either cm or m 70.7 – 71



3	$\frac{14}{3}(+)\frac{19}{5}$ or $(4)\frac{10}{15}(+)(3)\frac{12}{15}$ or $(4)\frac{10a}{15a}(+)(3)\frac{12a}{15a}$		3	M1 for correct improper fractions or fractional part of numbers written correctly over a common denominator
	eg $\frac{14 \times 5 + 19 \times 3}{3 \times 5}$ or $\frac{70}{15} + \frac{57}{15}$ or $\frac{70a}{15a} + \frac{57a}{15a}$ or $4\frac{10}{15} + 3\frac{12}{15} = 7\frac{22}{15}$ oe			M1 for correct fractions with a common denominator of 15 or a multiple of 15
	$\frac{70}{15} + \frac{57}{15} = \frac{127}{15} = 8\frac{7}{15}$ or $7\frac{22}{15} = 8\frac{7}{15}$ or if shows $8\frac{7}{15} = \frac{127}{15}$ at the beginning then show that the addition comes to $\frac{127}{15}$	Shown		A1 dep on M2 for a correct answer from fully correct working or shows that $\text{RHS} = \frac{127}{15}$ and fully correct working shows $\text{LHS} = \frac{127}{15}$
Total 3 marks				

4	$30 + 4x + 10 + x + 20 (= 5x + 60)$ or $180 - 30 (=150)$		4	M1 Allow $5x + 60 = n$ where $n \neq 180$ or for subtracting 30 from 180	M2 for $5x + 30 = 150$ oe
	e.g. $30 + 4x + 10 + x + 20 = 180$ or $5x + 60 = 180$ oe or $180 - 30 - 10 - 20 (=120)$			M1 for setting up the equation or for subtracting all numerical values of angles from 180	
	$5x = '120'$ or $'120' \div 5$			M1 for correctly simplifying to $ax = b$ or for dividing '120' by 5	
		24		A1 for 24	
Total 4 marks					

5		Fully correct angle bisector with all relevant arcs shown	2	B2 Fully correct angle bisector with all arcs shown. B1 for all arcs and no angle bisector drawn or for a correct angle bisector within guidelines but not arcs or insufficient arcs	
					Total 2 marks

Question	Working	Answer	Mark	Notes
5	E.g. $4x + 15 + 30x - 5 = 180$ OR $20x + 45 + 4x + 15 = 180$ OR $4x + 15 + 20x + 45 = 180$ OR $30x - 5 = 20x + 45$ $x = 5$ E.g. $20 \times "5" + 45 (=145)$ or $4 \times "5" + 15 (=35)$ or $30 \times "5" - 5 (=145)$ OR E.g. $4x + 15 + 30x - 5 = 180$ AND $30x - 5 = 20x + 45$ E.g. $AFC = 145$ and $FCD = 145$ OR $AFC = 145$ and $BCF = 35$ OR $x = 5$ from the solution of two equations	Shown correctly with reasons	5	M1 for forming an appropriate equation A1 dep on previous M1 M1 for substituting their value for x into the expression NOT used to form the equation solved OR forms a second equation in x A1 dep on previous M1 NB : It must be clear which angles are being found B1 For full reasons: <u>Alternate angles</u> are equal and <u>angles</u> in a straight <u>line</u> add to <u>180°</u> OR <u>Allied angles</u> (or co-interior) add to <u>180°</u> and <u>angles</u> in a straight <u>line</u> add to <u>180°</u>

3	$ADC = 180 - 58 (= 122)$ or $EDF = 122$ or $CDE = 58$ or $ADF = 58$			M1 may be seen marked on the diagram
	e.g. $DEF = 58 \div 2$ or $DEF = (180 - 122) \div 2$			M1 complete method to find angle DEF
		29		A1
			5	B2 dep on M2 for fully correct reasons for their method (B1 dep on M1 for one correct reason stated and used) e.g. <u>Allied angles</u> , <u>co-interior angles</u> , <u>Alternate angles</u> , <u>Corresponding angles</u> , <u>Vertically opposite angles</u> are equal (or <u>Vertically opposite angles</u> are equal), <u>Angles</u> on a straight line add up to 180° (or angles on a straight line add to 180°), Sum of <u>two angles</u> in a triangle are equal to <u>opposite exterior angle</u> , <u>Angles</u> in a triangle add up to 180° (or Angles in a triangle add up to 180°), Base angles in an <u>isosceles triangle</u> , <u>Angles</u> in a <u>quadrilateral</u> add up to 360. (accept "4-sided shape" or parallelogram) <u>Opposite angles</u> of a <u>parallelogram</u> are equal
Total 5 marks				
4	eg $76 \div (5 + 2 - 3)$ oe (= 19) or $5x + 2x - 3x = 76$ and $x = 76 \div (5 + 2 - 3) (= 19)$ oe			M1 For a correct method to find the value of 1 share
	$3 \times "19" (= 57)$			M1
	"57" - 48.5(0)			M1
		8.5(0)	4	A1
Total 4 marks				

Question	Working	Answer	Mark	Notes
5	Angle EBC or $ECB = (180 - 44) \div 2 (= 68)$		5	M1 Could be seen on diagram
	Angle $GBC = 180 - "68" (= 112)$ or Angle $GBC = "68" + 44 (= 112)$ or Angle $BGH = "68"$ (same as EBC) Angle $ABE = 180 - "68" (= 112)$ and Angle $BGF = "112"$ or Angle $ABG = "68"$ and Angle $BGH = "68"$ or Angle $FGJ = "68"$ or Angle $BGF = 180 - "68" (= 112)$			M1 for a method to as far as one step away from working out Angle JGH (an angle corresponding or vertically opposite to JGH or at the same point on a straight line with JGH) Could be seen on diagram. (the award of this mark also implies the previous M1)
	Working not required, so correct angle scores 3 marks (unless from obvious incorrect working)	112		A1 Could be seen in correct place on diagram
	NB: reasons must include the underlined words Accept $\angle$ for angle(s) and $\triangle$ for triangle For all angles: They must be clearly stated as the correct angle or shown on the diagram in the correct position. (eg just seeing 68 in working without a label is not sufficient for the award of a mark for angle EBC)			B2 for correct answer with full reasons for their method eg isosceles triangle (or 2 equal sides, 2 equal angles) Angles in a <u>triangle</u> sum to 180° or <u>angles</u> in a <u>triangle</u> Angles on a straight <u>line</u> sum to 180° <u>Angles</u> on a straight <u>line</u> sum to 180° <u>Exterior</u> angle in a <u>triangle</u> is <u>equal</u> to the two <u>opposite interior</u> angles. <u>Vertically opposite</u> angles are equal. Vertically <u>opposite angles</u> are equal. <u>Corresponding</u> angles are equal. <u>Alternate</u> angles are equal <u>Allied</u> angles sum to 180° (or <u>co-interior</u> angles) Angles at a <u>point</u> (or <u>full turn</u>) add up to 360° (or <u>angles</u> at a <u>point</u>) (B1 for one correct reason appropriate to their method, dep on M1)
				Total 5 marks



International GCSE Maths				
Apart from questions 5a, 10, 18a, 19, 22, 23, 24 (where the mark scheme states otherwise) the correct answer, unless clearly obtained from an incorrect method, should be taken to imply a correct method.				
Question	Working	Answer	Mark	Notes
1	e.g. $\pi \times 8.2^2 (= 211.24\dots, \frac{1681}{25}\pi)$ or $1.5 \times 1000 (= 1500)$ or $\pi \times 8.2^2 \times 10 (= 2112.4\dots, \frac{3362}{5}\pi)$		3	M1 for a correct first step
	e.g. $(1.5 \times 1000) \div (\pi \times 8.2^2) (= 7.1009\dots)$ or $(1.5 \times 1000) \div "2112.4" \times 10$ oe $(= 7.1009\dots)$ or $10 - ((\text{"2112.4"} - 1.5 \times 1000) \div (\pi \times 8.2^2)) (= 7.1009\dots)$			M1 for a complete method to find the depth of the water or an answer of 2.89 – 2.91
		7.1		A1 accept 7.09 – 7.11
				Total 3 marks
2	Ext $\angle = 180 - 162 (= 18)$ oe or $\frac{(n-2)180}{n} = 162$ oe		3	M1
	$360 \div "18"$ oe or $18n = 360$			M1
		20		A1
				Total 3 marks

Question	Working	Answer	Mark	Notes
12	$180 - 2 \times 66 (= 48)$ $(360 - "48") \div 2 (= 156)$ $180 - "156" (= 24)$ $360 \div "24"$		3	M1 Could be marked on diagram
	Alt: $180 - 2 \times 66 (= 48)$ $360 \div (0.5 \times "48")$			M1ft Final stage of calculation
	Alt: $180 - 2 \times 66 (= 48)$ $(360 - "48") \div 2 (= 156)$ $\frac{180(n-2)}{n} = "156"$			M1 Could be marked on diagram
	"24" $n = 360$ or $\frac{180(15-2)}{15} (= 156)$			M1ft Final stage of calculation or embedded correct answer.
		15		A1
Total 3 marks				
13	$\frac{h}{2} \times (7+12) \times 10 = 608$ oe		3	M2 M1 for $\frac{h}{2} \times (7+12) \times 10$
		6.4		A1
Total 3 marks				
14	5, 7, 11, 12, 13, 14, 15, 16, 17, 18, 18		3	M1 Ordering marks (allow 1 error)
	11 and 17 selected			M1 LQ = 11 and UQ = 17 identified
		6		A1
Total 3 marks				
15 (a)		2, -1.5, -3, 0	2	B2 B1 for 2 or 3 values correct
(b)			2	M1ft At least 5 points plotted correctly ft from table dep on B1 in part (a)
				A1 For correct smooth curve.
Total 4 marks				



4	$3 \times 180 (= 540)$ or $360 - [(180 - 90) + (180 - 135) + (180 - 67) + (180 - 119)] (= 51)$ or $360 - (90 + 45 + 113 + 61) (= 51)$		3	M1
	$90 + 135 + 67 + 119 + x = "540"$ oe $411 + x = "540"$ oe or $"540" - (90 + 135 + 67 + 119)$ or $3 \times 180 - (90 + 135 + 67 + 119)$ oe or $540 - 411$ or $180 - "51"$ oe			M1
	Correct answer scores full marks (unless from obvious incorrect working)	129		A1
				Total 3 marks

5	$2 : 3 : 15$ oe or 20 or $(1 : 5) \times 3$ or $(1 : 5 \Rightarrow) 3 : 15$ or $2n : 3n : 15n$ e.g. $4 : 6 : 30$ or $G(\text{reen}) = 2, O(\text{range}) = 3, Y(\text{ellow}) = 15$		3	M1
	$\frac{2}{"20"}$, 280 oe or 14×2 or $\frac{2}{"2"+ "3"+ "15"}$, 280 oe or $\frac{2n}{"2n"+ "3n"+ "15n"}$, 280 oe			M1
	Correct answer scores full marks (unless from obvious incorrect working)	28		A1 or 28 : 42 : 210 or 28 , 42 , 210 If not in this order must be labelled correctly
				Total 3 marks



11	eg $DEK = \frac{360}{9}$ or 40 or interior angle = $\frac{(9 - 2) \times 180}{9}$ or 140 or $OFK = 140 \div 2 (= 70)$ or $FOK = \frac{2}{9} \times 360 (= 80)$ or $EDK = 180 - 0.5 \times 140 (= 110)$ Angles marked correctly (any exterior or interior angle) gains this mark		3	M1 method to find interior or exterior angle or correct interior or exterior angle stated or shown correctly on diagram or for using 70° for OFK or 80° for FOK or 110 for EDK If a student has only found an interior or exterior angle and has clearly mixed up interior and exterior angles this mark cannot be awarded but can still award for any of the others angles stated
	$EDK = 110$ and $DEK = 40$ or $FOK = 80$ and $OFK = 70$ or $ODE = 70$ and $DEK = 40$ or $FED = 140$ and $EDK = 110$ oe			M1 For two correct angles that can lead directly to the answer in a single step (eg $180 -$ both angles or one angle minus the other)
	Correct answer scores full marks (unless from obvious incorrect working)	30		A1
				Total 3 marks

Question	Working	Answer	Mark	Notes
7 (a)		$5y^4$	2	B2 B1 for fully simplifying terms in x or terms in y
(b)	$h - f = 3e$ or $\frac{h}{3} = e + \frac{f}{3}$ or $\frac{h-f}{3}$	$e = \frac{h-f}{3}$	2	M1
			A1 oe, accept $e = \frac{f-h}{-3}$	
				Total 4 marks
8	$160^2 + 200^2$ (=65600)		3	M1
	$\sqrt{160^2 + 200^2}$			M1
		256		A1 accept 256 – 256.2
				Total 3 marks
9	Interior angle of pentagon ($180 \times 3 \div 5$ (= 108) oe		4	M1 or exterior angle of pentagon = $\frac{360}{5}$ (= 72)
	Interior angle of octagon ($180 \times 6 \div 8$ (= 135) oe			M1 or exterior angle of octagon = $\frac{360}{8}$ (= 45)
	(CBF =) $360 - ("108" + "135")$ (= 117)			M1 (CBF =) "72" + "45" (= 117)
		31.5		A1
				Total 4 marks



Question	Working	Answer	Mark	Notes
4	$0.07 \times 10\,800 (= 756)$ oe $10\,800 + '756'$	11 556	3	M1 M1 M2 for $1.07 \times 10\,800$ oe A1
5 (a)		<i>P</i> in correct region on overlay	2	M1 Correct bearing ($\pm 2^\circ$) or correct distance (± 2 mm) A1 Fully correct position for <i>P</i>
(b) (i)		154	2	B1 150 – 158 ft from diagram
(ii)		332		B1 330 – 334 ft from diagram
6	$360 \div 8 (= 45)$ or $180 - (360 \div 8) (= 135)$ or $\frac{6 \times 180}{8} (= 135)$ oe e.g. $\frac{540 - 112 - 112 - 84}{2} (= 116)$ or $\frac{540 - 308}{2} (= 116)$ or $\frac{232}{2} (= 116)$ e.g. '135' – '116' or $180 - '116' - '45'$	19	4	M1 Correct method to find the interior or exterior angle of octagon M1 Correct method to find a missing angle from pentagon M1 Complete method A1

8	$(10 - 2) \times 180$ oe (= 1440) or $(6 - 2) \times 180$ oe (= 720)		4	M1 for a method to find the sum of the interior angles of a decagon or a hexagon
	'1440' - 148 - 2×150 - 2×168 - 2×134 - 2×125 (=138) or '1440' - 1302 (= 138) or '720' - 148÷2 - 150 - 168 - 134 - 125 (= 69) or '720' - 651 (= 69)			M1 Allow omission of one angle
	360 - '138' or 360 - 2 × '69'			M1
		222		A1
	Alternative method (exterior angles)			
	$360 - 2 \times (180 - 125) - 2 \times (180 - 134) - 2 \times (180 - 168) - 2 \times (180 - 150) - (180 - 148)$ or $360 - 2 \times 55 - 2 \times 46 - 2 \times 12 - 2 \times 30 - 32$		4	M2 If not M2 then award M1 for at least 3 or (180 - 125) , (180 - 134) , (180 - 168) , (180 - 150), (180 - 148) or at least 3 of 55, 46, 12, 30, 32
	180 + '42'			M1
		222		A1
				Total 4 marks

9	E.g. $1 - 0.2$ (= 0.8) or $100(\%) - 20(\%)$ (= 80(%)) or $\frac{1080}{80}$ (= 13.5) oe		3	M1
	E.g. $1080 \div 0.8$ or $1080 \div 80 \times 100$ or '13.5' × 100 $1080 \times 100 \div 80$			M1 for a complete method
		1350		A1
				Total 3 marks

11	$\frac{360}{10}$ (= 36) ext angle or $\frac{(10 - 2) \times 180}{10}$ (= 144)		4	M1 method to find interior or exterior angle. (angles may be seen on diagram)
	$x = "144" - 90 (= 54)$ or $x = \frac{"540" - 3 \times "144"}{2} (= 54)$ or $x = 90 - "36" (= 54)$ 54 on the diagram is insufficient – must see working			M1 method to find x (must show it is intended to be x) eg use of int angle – 90° use of ext angle + $x = 90^\circ$ use of pentagon $GHIJA$ All figures in “ “ must come from correct working
	$BAD = CDA = GDE = DGF = \frac{360 - 2 \times "144"}{2} (= 36)$			M1 A correct method to find an angle of 36° within the shape (not exterior angle) or 36° shown in correct place in diagram
	There are other correct methods. Please check for correct working.	$x = 54$ $y = 54$		A1 dep on M3 to find each of x and y and the correct value of 54 for both from correct working
Total 4 marks				
ALT	$ADG = "144" - 2 \times "36" (= 72)$			M1
	JA is parallel to GD			M1
	$DGA = DAG (y)$ [isosceles triangle]			M1
	$x = DGA = y$	shown		A1
	There are other correct methods. Please check for correct working.			Total 4 marks



4	360 ÷ 8 (= 45) or 360 ÷ 5 (= 72) or 180 – (360 ÷ 8) (= 135) oe or 180 – (360 ÷ 5) (= 108) oe		4	M1 finding interior or exterior angle of octagon or pentagon Angles may be seen on diagram – but must be obtuse if interior and acute if exterior.
	'72' – '45' (= 27) or '135' – '108' (= 27)			M1 (dep 1st M1) using a pair of interior or pair of exterior angles to find angle IBC Angle may be seen on diagram.
	$\frac{180 - '27'}{2}$ (= 76.5)			M1
		76.5		A1
Total 4 marks				
5	7200 × 0.025 (= 180) or 7200 × 1.025 (= 7380) oe or 7200 × 1.075 (= 7740) oe or 7200 × 0.075 (= 540) oe		3	M1
	(7200 + '180') × 0.025 (= 184.5) and (7200 + '180' + '184.5') × 0.025 (= 189.1125) and 7200 + '180' + '184.5' + '189.1...' (= 7753.6125)			M1 NB year end values are 7380 and 7564.5(0) 7753.6125
		7754		A1 answer in range 7753 – 7754
Total 3 marks				

4	$7x + 3x + 8x = 360$ oe		4	M1	M2 for $7x = 140$
	$(x =) 360 \div 18 (= 20)$			M1	(140 can be on diagram)
	$360 \div (180 - 7 \times "20")$ oe or $360 \div (180 - "140")$				M1 for $360 \div$ exterior angle
	$\frac{(n-2) \times 180}{n} = 7 \times "20"$ oe or $360 \div 40$				
		9		A1	
					Total 4 marks

5	(a)	$n^2 - 6n + 4n - 24$		2	M1 for any 3 correct terms or for 4 out of 4 correct terms ignoring signs or for $n^2 - 2n \dots$ or for $\dots - 2n - 24$
			$n^2 - 2n - 24$		A1 oe
	(b)	$8x - 12$ or $\frac{3}{4}x - \frac{5}{4}$ oe or $0.75x - 1.25$ oe		3	M1 for correct multiplication by 4 or separate fractions on the RHS
		$8x - 3x = -5 + 12$ oe or $5x = 7$ oe or $2x - \frac{3}{4}x = -\frac{5}{4} + 3$ or $2x - 0.75x = -1.25 + 3$ oe			M1 ft (dep on 4 terms) for terms in x on one side of equation and number terms on the other
			$\frac{7}{5}$		A1 oe dep on M1 1.4 or $1\frac{2}{5}$ oe
					Total 5 marks

10	eg $\pi \times 3^2 \times 7$ ($= 63\pi$ or 197.9...)		3	M1 for method to find the volume of Solid A
	eg $\frac{2000}{[\text{vol A}]}$ or $\frac{3375}{450}$ ($= 7.5$ oe) or $\frac{2000 + 3375}{[\text{vol A}] + 450}$			M1 (indep) for method to find the density of Solid A , B or C , allow use of their volume for Solids A and C
	Correct answer scores full marks (unless from obvious incorrect working)	8.3		A1 accept 8.29 – 8.31
				Total 3 marks

11	$SCD = 128^\circ$ or $BCS = 32^\circ$ or $TSC = 180 - 128 (= 52)$		4	M1 angles need to be identified or may be seen marked on the diagram	M2 for $(BCD =) 128 + 32 (= 160)$ or $(DCV =) 52 - 32 (= 20)$ (may be seen marked on the diagram). To award these marks 160 or 20 must be clearly used or identified as the interior or exterior angle.
	eg (int $\angle =$) $128 + 32 (= 160)$ or (ext $\angle =$) $180 - (128 + 32) (= 20)$ or (ext $\angle =$) $52 - 32 (= 20)$			M1 (dep on previous M1) for method to find the size of one interior or exterior angle, may be seen marked on the diagram.	
	eg $180(n - 2) = 160n$ or $360 \div 20$			M1 for setting up an equation for the sum of interior angles or $360 \div 20$	
	Working required	18		A1 dep on M2	
					Total 4 marks



15	eg $(6 - 2) \times 180 (= 720)$		4	M1 for a method to find the sum of the interior angles for a hexagon
	eg "720" – $(90 + 95 + 149 + 104 + 57)(= 225)$			M1 for a method to find the missing angle in the hexagon
	eg $\frac{360}{"225"-180}$ or $\frac{360}{"45"}$ or $\frac{180(n-2)}{n} = 360 - "225"$ oe or $\frac{180(n-2)}{n} = "135"$			M1 for a complete method
	Working required	8		A1 cao dep on M2 NB: the answer of 8 can be gained from assuming that AB splits reflex <i>GBC</i> into 2 equal angles – without gaining the first 2 method marks [M0M0 is awarded] Award SCB1 for the student who gains an answer of 8 from this assumption or trial and improvement or no method shown
				Total 4 marks

3	$(4x - 27) + (3x + 46) = 180$ oe or “expression for C” + $(3x + 10) = 180$ or $7x + 19 = 180$ or $3x + 46 + 4x - 27 + 3x + 10 + [“180 - (3x + 10)”] = 360$		4	M1 Sum angles A and B to 180, or find an expression for BCD and sum all angles to 360. [condone missing brackets and condone use of any letter or expression for angle C (even x or BCD)]
				A1 $x = 23$
	eg $3 \times “23” + 46 (= 115)$ or eg $180 - (3 \times “23” + 10) (= 101)$			M1ft dep on M1 using their x to calculate a value for angle B or ‘their’ C (cannot be a negative value and cannot just be x)
	Correct answer scores full marks (unless from obvious incorrect working)	115		A1 Allow $3x + 46$ or ABC if 115 is clearly seen in working or on diagram
				Total 4 marks



4	$1 + 0.15 (= 1.15)$ or $x + 0.15x = 943$ or $100(\%) + 15(\%) (= 115(\%))$ or $\frac{943}{115} (= 8.2)$ oe		3	M1
	$943 \div "1.15"$ or $943 \div "115" \times 100$ or $943 \times 100 \div "115"$ oe or 8.2×100			M1 dep on M1
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	820		A1
				Total 3 marks
5	$(5 - 2) \times 180 (= 540)$ or $360 \div 5 (= 72)$		4	M1 NB If angles are on the diagram they must be from correct working and correctly assigned
	$\frac{540}{5} (= 108)$ or $180 - "72" (= 108)$ or $180 - 96 (= 84)$			M1
	$"72" + "84"$ or $360 - (96 + "108")$ or $180 - ("108" - "84")$			M1 for a complete method
	<i>Working required</i>	156		A1 dep on M2
				Total 4 marks



3	eg 360 – (148 + 50) (= 162) or 180 – 50 (= 130) or 180 – 148 (= 32)			4	M1	for method to interior angle of the polygon or start to the method of finding the exterior angle of the polygon
	eg 180 – “162” (= 18) or 148 – “130” (= 18) or 50 – “32” (= 18)	eg $180(n - 2) = \text{“162”}n$ or $180(n - 2) \div n = \text{“162”}$			M1	for method to find the exterior angle or for setting up an equation using sum of interior angles formula
	eg $360 \div \text{“18”}$	eg $(n =) 360 \div (180 - \text{“162”})$			M1	for a complete method
	Working required		20		A1	dep on M1

4	(a)	12	1	B1 accept x^{12}
	(b)	5	1	B1 accept y^5
	(c)	$125a^{12}r^6$	2	B2 for $125a^{12}r^6$ (B1 for a product in the form $ka^p r^q$ where 2 from k , p or q are correct eg $5a^{12}r^6$ Allow $125a^{12}$ or $125r^6$ or $a^{12}r^6$ so as long as not added to any other terms)
	Total 4 marks			

5	eg $1 - 0.28 (= 0.72)$ oe or $0.72x = 198$ or $100(\%) - 28(\%) (= 72(\%))$ or $\frac{198}{72} (= 2.75)$ oe		3	M1 for a correct first step
	eg $(x =) 198 \div "0.72"$ oe or $198 \div "72" \times 100$ oe or $"2.75" \times 100$			M1 for a complete method
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	275		A1 cao
				Total 3 marks



NB: splitting the shape incorrectly (FDC and DEA are not straight lines) gains no marks for angles calculated from false information. However angles calculated that follow the scheme, such as $\angle EDC = 138^\circ$ or interior angles of hexagon = 720° can be awarded. Other ways of correctly splitting the shape can be awarded full marks, eg FE to a point on AB or adding a parallel line eg from E parallel to AB
NB: some students show lots of lines but actually work with the angles correctly so please check carefully.

Question	Working	Answer	Mark	Notes
12	$\angle EDC = 180 - 42 (=138)$ $(2 \times 6 - 4) \times 90 (=720)$		5	M1 May be marked on diagram. M1indep Method to find sum of interior angles of hexagon or the correct sums for the interior angles of shapes used (eg 540° & 180° if the line through FE to point on AB drawn or 720° and 180° if line drawn from E parallel to AB or 540° & 180° if line through FE extended and joined to line through CB extended) oe
	eg " $138^\circ + 42 + 50 + 96 + 144 + E' = 720^\circ$ " or " $138^\circ + 42 + 50 + 96 + 144 + (360 - E) = 720^\circ$ " or $42 + 144 + "138" + (50 + 96) + DEP = "540"$ (where P is on AB and FE extended) oe			M1 dep on previous M marks Equation for E or E' where E is the obtuse angle of the hexagon and E' is the interior (reflex) angle or for an answer of 250 from correct working
	E' = " $720^\circ - "138" - 42 - 50 - 96 - 144$ " (= $720 - 470 = 250$) and E = $360 - "250"$ or E = " $138^\circ + 42 + 50 + 96 + 144 + 360 - "720"$ " (= $830 - 720$)			M1 A completely correct calculation for the correct angle E
		110		A1 from no incorrect working
Total 5 marks				



8	$(5 - 2) \times 180 \div 5 (= 108)$ or $360 \div 5 (= 72)$		5	M1	for method to find an interior or exterior angle of a pentagon
	$(6 - 2) \times 180 \div 6 (= 120)$ or $360 \div 6 (= 60)$			M1	for method to find an interior or exterior angle of a hexagon
	$360 - 108 - 120 (= 132)$ or $60 + 72 (= 132)$ or $(180 - '120') + (180 - '108')$			M1	dep on M2 for a correct method to find angle <i>EDI</i> using correct figures
	$360 - '72' - '60' - '132' (= 96)$			M1	for a complete method to find angle <i>x</i>
		96		A1	dep on correct working
					Note: Angles may be seen on diagram throughout
					Total 5 marks

9	a		$2^6 \times 3 \times 11^4$	2	B2	oe, accept 2811072
					B1	for $2^a \times 3^b \times 11^c$ oe where two of <i>a</i> , <i>b</i> and <i>c</i> are correct
	b		$2^9 \times 3^5 \times 11^8$	2	B2	cao
					B1	for $2^a \times 3^b \times 11^c$ oe where two of <i>a</i> , <i>b</i> and <i>c</i> are correct or $2.666... \times 10^{13}$ or an equivalent expression for e.g. $2^2 \times 2^7 \times 3^5 \times 11^3 \times 11^5$
						Total 4 marks



5	$(5 - 2) \times 180 - 112 - 102 - 96 (= 230)$ oe eg $540 - 112 - 102 - 96 (= 230)$ or $360 - (180 - 112) - (180 - 102) - (180 - 96)$ $(= 360 - 68 - 78 - 104 = 360 - 230 = 130)$ oe		5	M1
	$\frac{'540' - 112 - 102 - 96}{2} (= 115)$ or $'130' \div 2 (= 65)$			M1 dep on previous mark
	$\frac{180 \times (8 - 2)}{8} (= 135)$ or $180 - (360 \div 8) (= 135)$ or $\frac{360}{8} (= 45)$ as exterior angle of octagon			M1 indep Withhold the mark for $\frac{360}{8} (= 45)$ if shown as an interior angle
	$360 - '115' - '135'$ or $'65' + '45'$			M1
	Working required	110		A1 dep on M1
Total 5 marks				



11	int angle of pentagon = $(3 \times 180) \div 5 (= 108)$ oe or ext angle of pentagon = $360 \div 5 (= 72)$ oe		5	M1	allow in working but not if labelled in wrong place on diagram (unless clearly started again)
	int angle of hexagon = $(4 \times 180) \div 6 (= 120)$ or ext angle of hexagon = $360 \div 6 (= 60)$			M1	allow in working but not if labelled in wrong place on diagram (unless clearly started again)
	$360 - ("108" + "120") (= 132)$ oe or $"60" + "72" (= 132)$ or $(180 - "108") + (180 - "120") (= 132)$			M1	A fully correct method to find the size of obtuse angle AEF but not if labelled in wrong place on diagram [Figures in inverted commas must come from correct working]
	$[180 - ("60" + "72")] \div 2$ oe or $\frac{180 - "132"}{2}$ oe or $[180 - (180 - "108") - (180 - "120")] \div 2$ oe			M1	A fully correct method to find the size of angle EAF [Figures in inverted commas must come from correct working]
	Correct answer scores full marks (unless from obvious incorrect working)	24		A1	cao
					Total 5 marks

24	$\frac{n}{2}[2(84) + (n-1)(4)]$ or $\frac{n}{2}[168 + 4n - 4]$ or $\frac{n}{2}[164 + 4n]$ oe or $82n + 2n^2$ oe		6	M1 for correctly substituting into $S_n = \frac{n}{2}[2a + (n-1)d]$
	$\frac{n}{2}[2(84) + (n-1)(4)] = (n-2) \times 180$ or $\frac{n}{2}[164 + 4n] = (n-2) \times 180$ oe or $82n + 2n^2 = (n-2) \times 180$ oe			M1 for equating S_n with $(n-2)180$ S_n must come from correct substitution of a and d into $\frac{n}{2}[2a + (n-1)d]$
	eg $n^2 - 49n + 180 (= 0)$ oe Allow $n^2 - 49n = -180$			M1dep on M2 for multiplying out and collecting terms, forming a three term quadratic in any form of $an^2 + bn + c (= 0)$ where at least 2 coefficients (a or b or c) are correct
	eg $(n-45)(n-4) (= 0)$ $n = \frac{- -49 \pm \sqrt{(-49)^2 - 4 \times 1 \times 180}}{2}$ e.g. $\left(n - \frac{49}{2}\right)^2 - \left(\frac{49}{2}\right)^2 = -180$			M1ft dep on M2 method to solve their 3 term quadratic using any correct method (allow one sign error and some simplification – allow as far as eg $\frac{49 \pm \sqrt{2401 - 720}}{2}$ or if factorising allow brackets which expanded give 2 out of 3 terms correct) or correct value for $n = 45$ (ignore $n = 4$)
	("45"-2) × 180 or $\frac{"45"}{2}[2(84) + ("45"-1)(4)]$ oe or ("44"-2) × 180 or $\frac{"44"}{2}[2(84) + ("44"-1)(4)]$ oe			M1 dep on previous M1 NB $n > 5$
	Working required	7740		A1 dep on M5 Accept 7560 or 7480
				Total 6 marks



24 ALT	$\frac{n}{2}[2(96) + (n-1)(-4)]$ or $\frac{n}{2}[192 - 4n + 4]$ or $\frac{n}{2}[196 - 4n]$ oe or $98n - 2n^2$ oe		6	M1 for correctly substituting into $S_n = \frac{n}{2}[2a + (n-1)d]$ using exterior angles
	$\frac{n}{2}[2(96) + (n-1)(-4)] = 360$ or $\frac{n}{2}[196 - 4n] = 360$ oe or $98n - 2n^2 = 360$ oe			M1 for equating S_n with 360 S_n must come from correct substitution of a and d into $\frac{n}{2}[2a + (n-1)d]$
	eg $2n^2 - 98n + 360 (= 0)$ $n^2 - 49n + 180 (= 0)$ oe Allow $n^2 - 49n = -180$			M1dep on M2 for multiplying out and collecting terms, forming a three term quadratic in any form of $an^2 + bn + c (= 0)$ where at least 2 coefficients (a or b or c) are correct
	e.g. $(n-45)(n-4)(= 0)$ $n = \frac{- -49 \pm \sqrt{(-49)^2 - 4 \times 1 \times 180}}{2}$ e.g. $\left(n - \frac{49}{2}\right)^2 - \left(\frac{49}{2}\right)^2 = -180$			M1ft dep on M2 method to solve their 3 term quadratic using any correct method (allow one sign error and some simplification – allow as far as eg $\frac{49 \pm \sqrt{2401 - 720}}{2}$ or if factorising allow brackets which expanded give 2 out of 3 terms correct) or correct value for $n = 45$ (ignore $n = 4$)
	$(“45” - 2) \times 180$ or $\frac{“45”}{2}[2(84) + (“45” - 1)(4)]$ oe or $(“44” - 2) \times 180$ or $\frac{“44”}{2}[2(84) + (“44” - 1)(4)]$ oe			M1 dep on previous M1 NB $n > 5$
	Working required	7740		A1 dep on M5 Accept 7560 or 7480
				Total 6 marks

Question	Working	Answer	Mark	Notes
3	$180 + 149$ or $360 - 31$		2	M1
	<i>Working not required, so correct answer scores full marks</i>	329		A1
				Total 2 marks

Question	Working	Answer	Mark	Notes
4 (a)(i)	other seen orders of letters: a, b, d, e, i, l, n, r, z b, r, l, a, e, z, l, n, d	b, r, a, z, i, l, e, n, d	1	B1 no repeats, letters can be in any order. Condone capital letters rather than lower case letters. (no need for commas)
(ii)		b, z	1	B1 No repeats, letters can be in any order. Condone capital letters. (no need for a comma)
(b)		correct explanation that shows they know the meaning of intersection and empty set	1	B1 eg letter 'a' is in both sets $B \cap K = \{a\}$ Set B and set K have an element (or letter) in common. There is a letter that is in set B and in set K There is an intersection so it isn't the null set There is a letter in common (do not allow 'letters' or 'elements' (plural) in common) (If students mention the letter that is in common, it must be the correct one (ie a))
				Total 3 marks

5	(a)	$700 \div 200 (= 3.5)$		3	M1 or 3.5 shown on diagram – within bounds of overlay
					M1 for line drawn at correct angle $\pm 2^\circ$ within bounds of overlay
			C indicated in correct position		A1 for C drawn within bounds of overlay, inclusive of lines.
	(b)		(1 :) 20 000	1	B1
					Total 4 marks



25	e.g. $(220 - 180) + (360 - 280) (= 120)$		5	M1 for a method to find angle XYZ. Could be seen on a diagram
	$XZ = \sqrt{3.5^2 + 6^2 - 2 \times 3.5 \times 6 \times \cos("120")}$ ($= 8.3...$ or $\frac{\sqrt{277}}{2}$)			M1
	$\frac{\sin YXZ}{6} = \frac{\sin("120")}{8.32...}$			M1 or $6^2 = 3.5^2 + 8.32^2 - 2 \times 3.5 \times 8.32 \times \cos YXZ$
	$YXZ = \sin^{-1}\left(\frac{6 \sin("120")}{8.32...}\right)$ ($= 38.6...$)			M1 or $YXZ = \cos^{-1}\left(\frac{3.5^2 + 8.32^2 - 6^2}{2 \times 3.5 \times 8.32}\right)$ ($= 38.6...$)
		241.4		A1 accept 241.2 – 241.4
				Total 5 marks



16	$(BC^2 =) 150^2 + 275^2 - (2 \times 150 \times 275 \times \cos 120) (= 139\,375)$		5	M1 for correct substitution into the cosine rule
	$(BC =) \sqrt{150^2 + 275^2 + 41250}$ or $\sqrt{139375}$ or $25\sqrt{223}$ or 373....			M1 for correct order of operations and square root
	e.g. $\frac{\sin ABC}{275} = \frac{\sin 120}{373...}$ or $275^2 = 150^2 + 373...^2 - (2 \times 150 \times 373... \times \cos ABC)$ or $\cos ABC = \frac{150^2 + 373...^2 - 275^2}{2 \times 150 \times 373...}$ or $\frac{\sin ACB}{150} = \frac{\sin 120}{373...}$ or $150^2 = 275^2 + 373...^2 - (2 \times 275 \times 373... \times \cos ACB)$ or $\cos ACB = \frac{275^2 + 373...^2 - 150^2}{2 \times 275 \times 373...}$			M1 (dep on 1 st M1) ft 373... for a correct trig statement involving angle ABC or angle ACB
	$(ABC =) \sin^{-1} \left(\frac{\sin 120}{373...} \times 275 \right) (= 39.6...)$ or $(ABC =) \cos^{-1} \left(\frac{150^2 + 373...^2 - 275^2}{2 \times 150 \times 373...} \right) (= 39.6...)$ or $(ACB =) \sin^{-1} \left(\frac{\sin 120}{373...} \times 150 \right) (= 20.3...)$ or $(ACB =) \cos^{-1} \left(\frac{275^2 + 373...^2 - 150^2}{2 \times 275 \times 373...} \right) (= 20.3...)$			M1 for a complete method to find angle ABC or angle ACB
		140		A1 accept 140 – 140.4
				Total 5 marks



18	(angle $ABC =$) $54 + (180 - 132) (= 102)$		5	M1 for finding angle ABC
	$(AC^2 =) 3.6^2 + 8.4^2 - 2 \times 3.6 \times 8.4 \times \cos[102]$			M1 for applying the cosine rule correctly ft their 102 provided less than 180 and not 90
	$(AC =) \sqrt{3.6^2 + 8.4^2 - 2 \times 3.6 \times 8.4 \times \cos[102]}$ or $\sqrt{96.094...}$ or 9.8(02...)			M1 for finding AC ft their 102 provided less than 180 and not 90
	$([9.8] + 8.4 \div 3.6) \div 6 (= 3.63(3...))$ or $21.8(02...) \div 6 (= 3.63(3...))$ oe			M1 dep on previous M1M1 for finding the time taken to complete the journey (may be done in parts)
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	3 hours and 38 minutes		A1 Allow 3 hours and (37 – 38) minutes
				Total 5 marks



24	67 + 51 (= 118) or angle split into 67 and 51		6	M1 A diagram showing 118 or use of 118 in further calculations
	$AC^2 = 8.4^2 + 9.2^2 - 2 \times 8.4 \times 9.2 \times \cos "118" (= 227.(7615))$ (227 – 228)			M1 a correct method to find length AC^2
	$AC = \sqrt{8.4^2 + 9.2^2 - 2 \times 8.4 \times 9.2 \times \cos "118" (= 15.(09...))}$ (15 – 15.1)			M1 a correct method to find length AC
	$\frac{\sin ACB}{8.4} = \frac{\sin "118"}{"15.09..."}$ or $\frac{\sin BAC}{9.2} = \frac{\sin "118"}{"15.09..."}$ or $\cos ACB = \frac{9.2^2 + "15.09"^2 - 8.4^2}{2 \times 9.2 \times "15.09"}$ or $\cos BAC = \frac{8.4^2 + "15.09"^2 - 9.2^2}{2 \times 8.4 \times "15.09"}$			M1 dep on previous method marks a correct statement of the sine rule or the cosine rule to find angle ACB or angle BAC [numbers in inverted commas must come from correct working]
	$(ACB =) \sin^{-1} \left(\frac{8.4 \sin "118"}{"15.09..."} \right)$ or $\cos^{-1} \left(\frac{9.2^2 + "15.09"^2 - 8.4^2}{2 \times 9.2 \times "15.09"} \right) (= 29.(43...))$ (29 – 30) $(BAC =) \sin^{-1} \left(\frac{9.2 \sin "118"}{"15.09..."} \right)$ or $\cos^{-1} \left(\frac{8.4^2 + "15.09"^2 - 9.2^2}{2 \times 8.4 \times "15.09"} \right) (= 32.(56...))$ (32 – 33)			M1 a completely correct statement for angle ACB or angle BAC [numbers in inverted commas must come from correct a correct method]
	Correct answer scores full marks (unless from obvious incorrect working) Look for angles and lengths on their diagram	280		A1 allow 279 – 280 a correct answer from a scale drawing gains full marks but if answer is slightly inaccurate gains 0 marks
				Total 6 marks