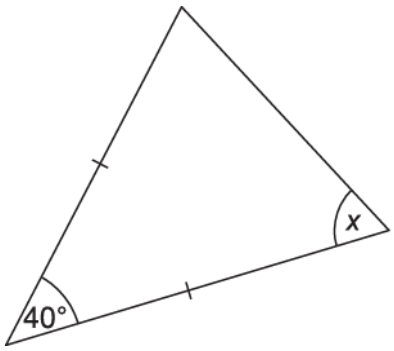
1. The diagram shows a triangle.



Not to scale

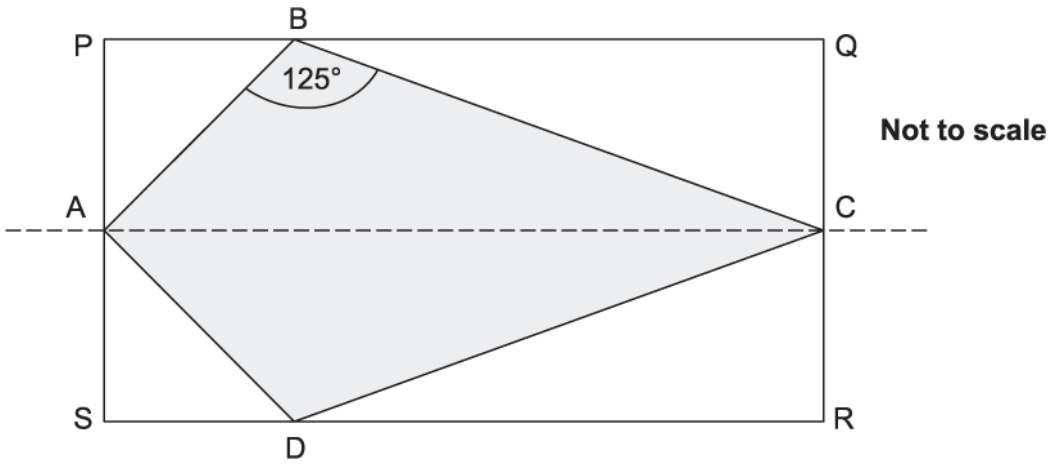
Find the value of x.
Give a reason for each step of your working.

x = _____ ° [3]

2. PQRS is a rectangle.

A, B, C and D are points on SP, PQ, QR and RS respectively.

AC is the line of symmetry for the diagram.



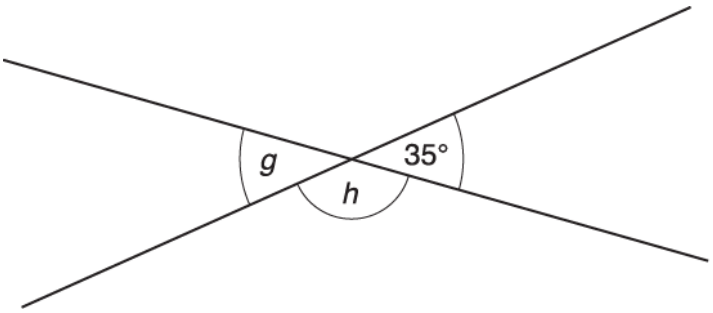
AP is the same length as PB.

Work out the size of angle BCD.

Show your reasoning clearly.

Angle BCD = _____ ° **[4]**

3(a). This diagram shows two straight lines crossing.



Not to scale

(i) Work out angle *g*.

_____ °

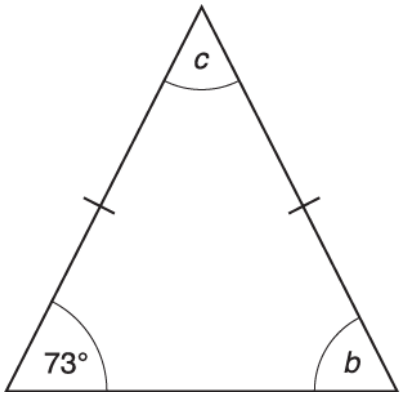
[1]

(ii) Work out angle *h*.

_____ °

[1]

(b). This diagram shows an isosceles triangle.



Not to scale

(i) Work out angle *b*.

_____ °

[1]

(ii) Work out angle *c*.

_____ °

[2]

4(a). Work out the size of the exterior angle of a regular 9-sided polygon.

_____ °

[2]

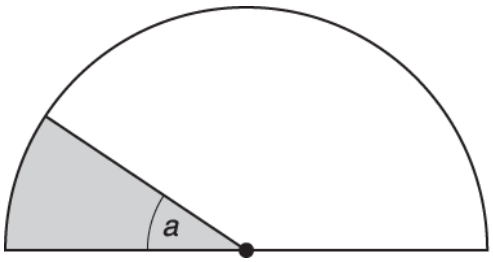
(b). Hence work out the size of the interior angle of a regular 9-sided polygon.

_____ °

[1]

5. Half of a circular cake is shared equally between 6 people.

One of these six slices is shown shaded in the diagram.



Not to scale

(i) Work out the size of angle *a*.

(i)_____ ° [2]

(ii) Each slice is a fraction of the **whole** cake.

Write down this fraction.

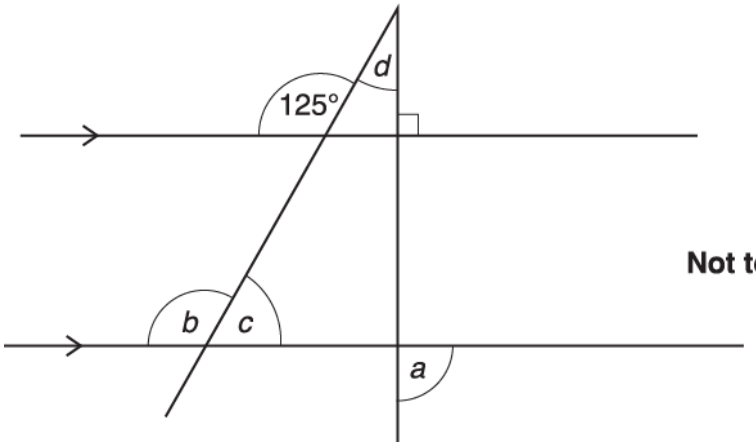
(ii)_____ [1]

6. Select the mathematical name of a quadrilateral that has four equal sides but **is not** a square. Draw a ring around the correct answer.

Rectangle Parallelogram Trapezium Rhombus Kite

[1]

7(a). This diagram shows two parallel lines with two lines crossing them.



Not to scale

Find the size of

angle *a*,

_____° [1]

(b). angle *b*,

_____° [1]

(c). angle *c*,

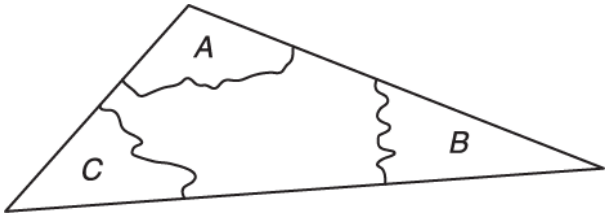
_____° [1]

(d). angle *d*.

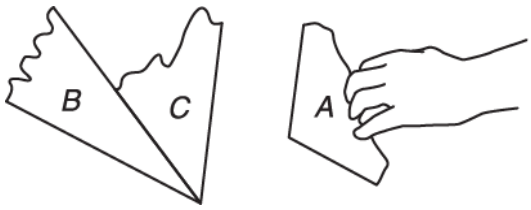
_____° [3]

8(a). Andreas cuts a triangle from paper.

He writes the letters *A, B* and *C* in the corners and then tears the corners off.



He joins corners *A*, *B* and *C* so that they meet at a point, with no overlap.



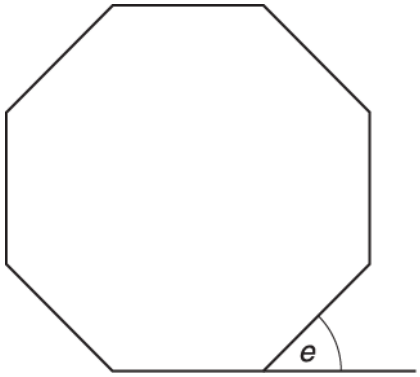
Not to scale

What total angle will the three pieces make at the point?

_____ ° [1]

(b). This **regular** shape has 8 sides.

One side of the shape is extended as shown.



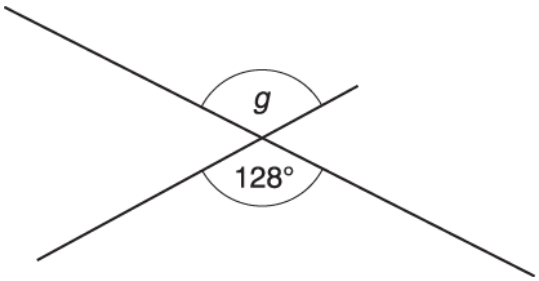
Not to scale

Work out the size of angle *e.*

_____ ° [2]

9(a). Find each angle marked by a letter in the following diagrams.

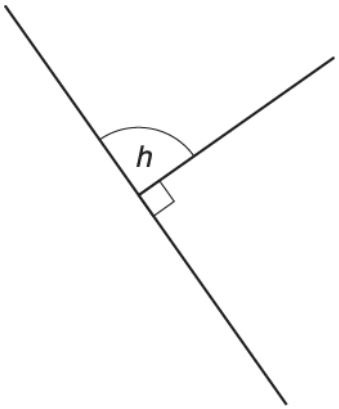
(i)



Not to scale

(i) _____ ° [1]

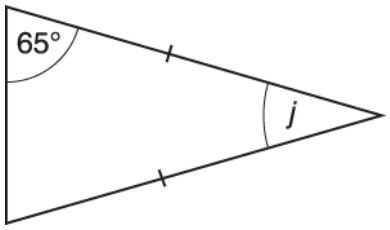
(ii)



Not to scale

(ii) _____ ° [1]

(iii)

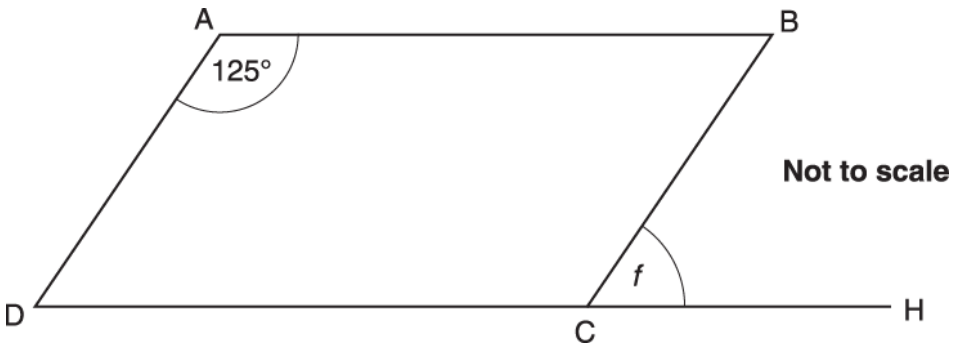


Not to scale

(iii) _____ ° [2]

(b). ABCD is a parallelogram and DCH is a straight line.

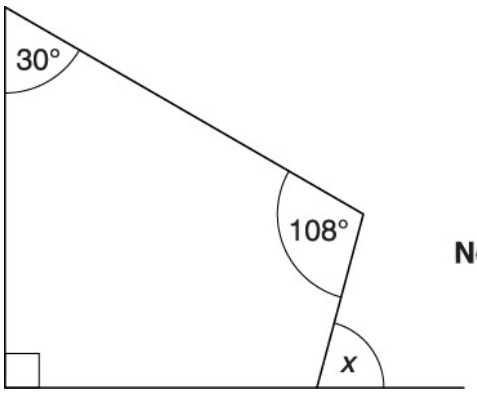
Work out angle *f*.



_____ ° [2]

10(a) Work out angle *x*.

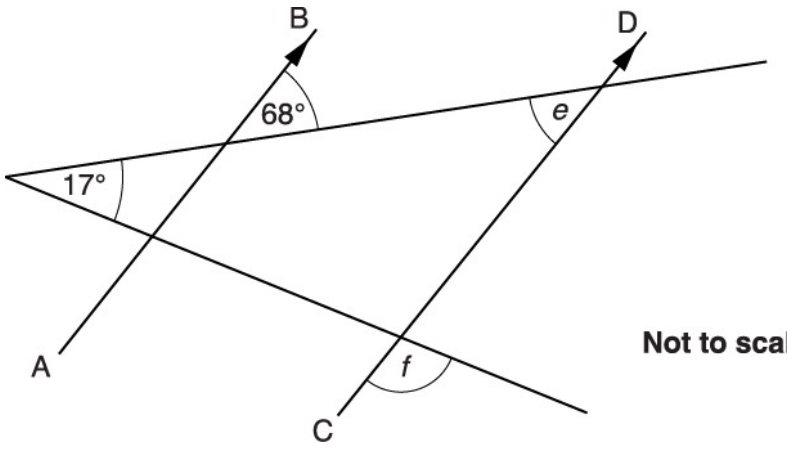
.



Not to scale

_____ ° [3]

(b). In the diagram AB is parallel to CD.



Not to scale

Work out the following angles, giving reasons for each answer.

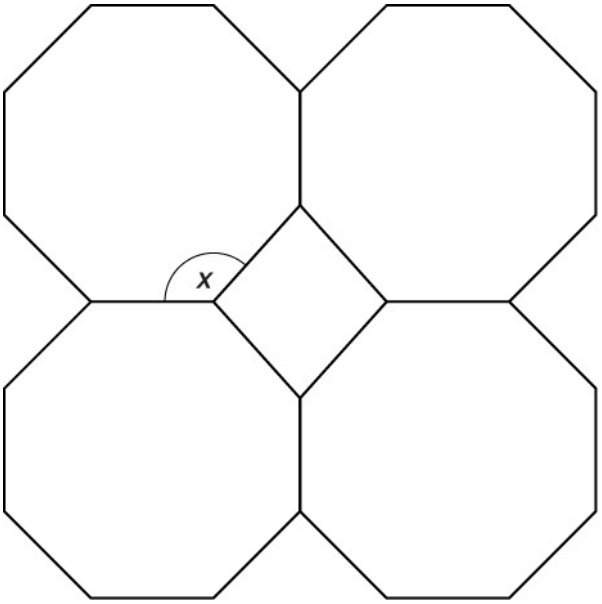
(i) Angle *e* = _____ ° because _____

_____ [1]

(ii) Angle *f* = _____ ° because _____

_____ [3]

11. * This sketch shows four identical regular octagons and a square.



Not to scale

Work out angle *x*.

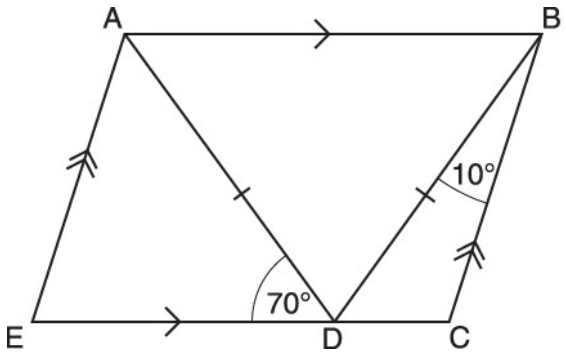
Give a reason for each step of your working.

_____ ° **[4]**

12. The diagram shows parallelogram ABCE.

D is a point on EC.

AD = BD, angle ADE = 70° and angle CBD = 10°.



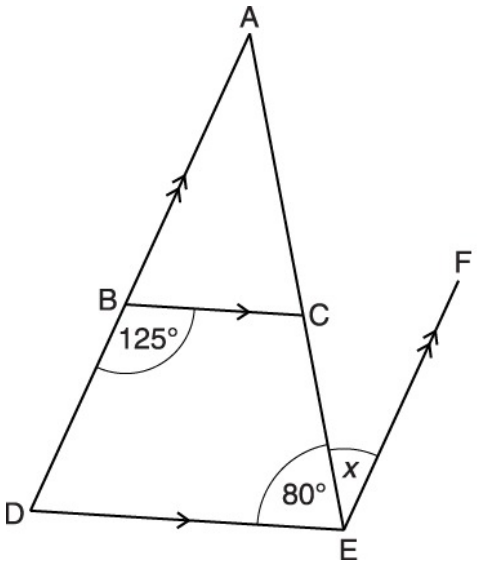
Not to scale

Work out angle BCD.

Give a reason for each angle you work out.

Angle BCD = _____ ° **[4]**

13. * In the diagram ADE is a triangle.
BC is parallel to DE and DBA is parallel to EF.

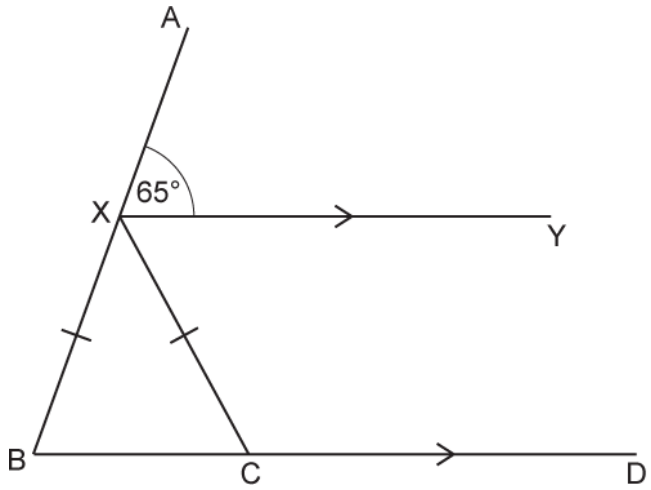


Not to scale

Work out angle *x*.
Give a reason for each step of your working.

[5]

14(a). XY and BD are parallel lines.
X is a point on AB and C is a point on BD.
XB = XC.



Not to scale

Complete this sentence.

Angle XBC = 65° because _____ [1]

(b). Work out angle BXC.
Give a reason for each angle you work out.

_____ ° [4]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Part marks and guidance	
1			70 The triangle is isosceles so the missing angle is *x* (may be on diagram) **oe** Angles in a triangle sum to 180° **oe** (may be indicated by summing of angles to 180 **oe**)	3	**B1** for each	
			Total	3		
2			20	4	**B1** for PAB = SAD = 45 **B1** for BAD = 90 **M1** for 360 – (*their* '125' + *their* '90' + 125)	May be seen on diagram
			Total	4		
3	a	i	35	1		Examiner's Comments Most understood vertically opposite angles whilst a few just measured angle g.
		ii	145	1		Examiners's Comments A good proportion of students went on to answer this correctly but more found difficulty. Common errors were 90 – 35 = 55 or 180 – 2 × 35 = 110. As with (ai) some measured angle h.
	b	i	73	1		Examiner's Comments In (i) there was good recognition of the isosceles triangle. A few calculated 180° –73°.

Question			Answer/Indicative content	Marks	Part marks and guidance	
		ii	34	2	M1 for 180 – (73 + 73) or '[angles in] triangle = 180' soi	Examiner's Comments In (ii) angle sum of a triangle was applied well. Where no marks were achieved candidates had used measuring or had provided no working.
			Total	5		

Question			Answer/Indicative content	Marks	Part marks and guidance	
4	a		40° final answer	2	**B1** for 140 or 40 seen or **M1** for 360 ÷ 9 oe	Eg 180 – 180 × 7 ÷ 9
	b		140°	1	Or **FT** 180 – *their* 40	FT *their* 40 if < 180 **Examiner's Comments** Few candidates were secure in the knowledge of exterior and interior angles. There were attempts at diagrams and 360 ÷ 9 was seen at times but arriving and stopping at 40° was rare. Candidates demonstrating some understanding were often confused between interior & exterior angles and did not realise they totalled 180°.
			Total	3		
5		i	30	2	**M1** for 180 ÷ 6 or 360 ÷ 12 Examiner's Comments Many candidates measured the diagram and answers from 33° to 35° were common. A few candidates wrote 180 ÷ 6 but were unable to complete the division.	
		ii	$\frac{1}{12}$ or $\frac{their(angle\ a)}{360}$ oe	1	Examiner's Comments The modal (and incorrect) response was $\frac{1}{6}$ showing the importance of reading the question.	Ignore attempts to cancel once correct answer seen
			Total	3		

Question			Answer/Indicative content	Marks	Part marks and guidance	
6			Rhombus only indicated	1	Examiner's Comments Parallelogram was the common wrong answer although each response was favoured by a reasonable number of candidates.	
			Total	1		
7	a		90	1		
	b		125	1		
	c		55	1FT	180 – *their*(b)	
	d		35	3FT	**M2** for 180 – *their* (c) – 90 or **B1** for 55 or *their* (c) marked as bottom-left angle in either triangle and **B1** for 90 or *their* (a) marked as bottom-right angle in either triangle Examiner's Comments Most candidates gained marks on this question. However, this was often by following through a wrong answer but using the correct method in the next response. A number gave completely unsuitable responses such as angle *a* is 125°.	Check using their values Accept symbol
			Total	6		

Question			Answer/Indicative content	Marks	Part marks and guidance	
8	a		180	1	Condone “straight line” Examiner's Comments This was adequately answered, although some candidates clearly measured.	Condone missing degree sign
	b		45	2	**M1** for 360 ÷ 8 soi Or **B1** for 135 as interior angle Examiner's Comments This saw a surprising number of candidates lose 1 mark. Many wrote 360 ÷ 8, but then gave answers that were wrong after attempting the division. Others gave the answer as 135°, showing 45° as the interior angle. This showed a failure to appreciate the magnitude of angles (even given that the diagram was not drawn to scale).	Eg by 45 given as interior angle or seen in working
			Total	3		

Question			Answer/Indicative content	Marks	Part marks and guidance	
9	a	i	128	1		
		ii	90	1		
		iii	50	2	**M1** for 180 – 65 – 65 oe Examiner's Comments This question was often well answered. In part (i) a surprising number attempted to work out g and gave such answers as 180°, 52° and 123° (from measuring). Part (ii) was often well answered but 180° was a common error. Part (iii) was less well answered, although many did score 2 marks. A common error was 65° but some attempted 180 – 65 – 65 and failed to get 50.	
	b		55	2	**M1** for 180 – 125 or clear indication that ∠BCD = 125 Examiner's Comments This was reasonably answered but a common error was 125°. Some wrote 125 against all the angles in the parallelogram. Both responses indicated the same misunderstanding of the magnitude of angles. Again, some wrote 180 – 125 but could not get 50. In both parts the weaker candidates appear to have measured the angles on the diagram.	
			Total	6		

Question			Answer/Indicative content	Marks	Part marks and guidance	
10	a		48	3	**M1** for 360 – (90+108+30) soi by 132 and **M1 dep** for 180 – *their* 132 **Examiner's Comments** Very few were awarded all 3 marks. Finding the sum of 108, 90 and 30 was common but then knowing to and correctly subtracting from 360 was a step too far for many. The next step of subtracting from 180 was attempted by even fewer candidates.	
	b	i	68 **and** alternate [angle]	1	condone Z-angle penalise alternate and corresponding together and penalise alternate and opposite together	condone 'alternative' and 'alternating'. Allow 68 and corresponding providing 68 marked as opposite on diagram at B or D Allow 68 and [angles in a] four sided shape equals 360(angles must be marked on the diagram) Allow [angles in a] triangle equals 180 providing 95 is marked in the correct position
		i			**Examiner's Comments** The correct angle of 68 was often seen but the reason proved to be elusive for many. When correct the reason of alternate angle were seen in equal numbers.	
		ii	95	1	or FT 180 – 17 – *their* (b)(i)	

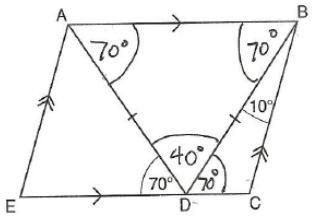
Question			Answer/Indicative content	Marks	Part marks and guidance	
		ii	one mark for each reason (maximum of **two)** from • angle[s] … triangle [add to 180] • angle[s]… quadrilateral [add to 360] • corresponding or allied [angles] • [vertically] opposite [angles] or angles round a point [add to 360] • angles … line [add to 180]	2	condone F-angle condone X-angle **Examiner's Comments** Very few full marks were awarded as many failed to work out the angle as 95°, the terminology used by the candidates was poor: 'angles in a circle' or 'a triangle adds up to180' are examples of incomplete expressions. In giving their reasons many candidates used expression such as X, Z or F angles. These will not be allowed in the future GCSE and centres are encouraged to ensure all candidates know the correct terminology.	accept 4 sided shape/trapezium
			Total	7		

Question			Answer/Indicative content	Marks	Part marks and guidance	
11			* **Shows $x = 135$** with 4A a complete method, with reasons given to support. Easy to follow	4		
			3A Shows $x = 135$ with some method that is easy to follow that is not incorrect or insufficient reasons Or 3B Shows a complete correct method,with some reason(s), with one small slip Or 3C Seeing a **full** method that the sum of the angles in an octagon is 1080 (eg a diagram dividing an octagon into 6 triangles and seeing 6 × 180 = 1080)	3-2	For the lower mark: 2A Shows $x = 135$ with no method or method that is difficult to follow, but not necessarily incorrect Or 2B Shows a complete correct method Or 2C Shows two of the following **soi** • Angle [in a] square [is] 90 (may be on the diagram) • [Angles in a] point/circle/[whole]turn [is] 360 • Exterior angles [of a polygon sum] is 360 • [Sum of angles on a straight] line [is] 180 • [Sum of angles in a] triangle is 180 Or 2D Shows an **exterior angle** is 45 (360 × 8) Or 2E 1080 seen	

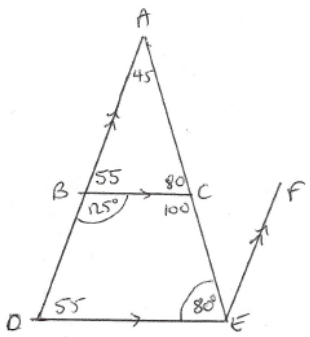
Question			Answer/Indicative content	Marks	Part marks and guidance	
			1A Shows one of the following **soi** • Angle [in a] square [is] 90(may be on the diagram) • [Angles in a] point/circle/[whole]turn [is] 360 • Exterior angles [of a polygon sum] is 360 • [Sum of angles on a straight] line [is] 180 • [Sum of angles in a] triangle is 180	1		
			No relevant method	0	**Examiner's Comments** To earn full marks on this QWC question a complete method was needed with appropriate reasons given to support their method. A few candidates found good solutions that satisfied this standard. Others endeavoured to write out a clear method, but their solutions lacked the detail required and, consequently, they were unable to gain full marks. Many solutions lacked coherence and were difficult to follow, but these often gained some marks for odd pieces of their method or some reasons given. A common error was to assume that the sum of the angles in an octagon were 360°and then to divide by eight giving an answer of 45°. There were a significant number of candidates who not get started on this question and offered no response.	

Question			Answer/Indicative content	Marks	Part marks and guidance
			Total	4	

Question			Answer/Indicative content	Marks	Part marks and guidance	
12			∠BCD = 100°	B2	Or **B1** for two correct angles found	Angles may be indicated on diagram
			Correct relevant reason seen	M1	**Relevant reasons are:** alternate [angles] isosceles [triangle] Co-interior / allied [angles] … 180 [angles in] triangle [is / equals / adds to] 180 [angles on a straight] line [is / equals / adds to] 180	100 marked on diagram can be one angle for B1, but for B2 must be identified as angle BCD. Condone Z angle for alternate Condone C angle … 180 for co-interior Condone isos for isosceles Where 180 is required in reason, this may be seen in the relevant calculation

Question			Answer/Indicative content	Marks	Part marks and guidance	
			Two relevant reasons linked with correct angles **and** no reasons linked incorrectly with angles	A1	Any of the relevant angles must be correct if stated **A0** if any reason used incorrectly or angles stated incorrectly **Examiner's Comments** Hardly any candidates were able to gain full marks from a correct answer with a fully worked solution with appropriate reasons. Some found some correct angles for which they gained some credit. The notation 'angle BCD' was not understood by all and some gave an incorrect answer even though the angles they had found on the diagram were correct. Treating triangle ABD as equilateral was a common error. Most candidates who made a fair attempt at this gave some correct reasons, for which they gained some credit, but were unable to find the appropriate reasons to tie in with the steps of their solution correctly.	 Diagram shows relevant angles
			Total	4		

Question			Answer/Indicative content	Marks	Part marks and guidance	
13			$x = 45°$ with correct and clearly laid out solution. All required angles clearly identified in working with a correct reason given for each angle found. Correct mathematical terminology and notation throughout	5	e.g. ∠CED = ∠ACB = 80°, corresponding angles ∠ABC = 180° – 125° = 55°, angles on a line ∠CAB = 180° – 55° – 80° = 45°, angles in a triangle $x = 45°$, alternate angles equal	
			4a correct answer of $x = 45°$ with at least two correct angles and related reasons stated	4-3	For the lower mark **3a** correct answer of $x = 45°$ with insufficient solution / reasons seen	
			4b complete solution with full reasons and maximum one arithmetic slip to reach incorrect value for x		**3b** at least two relevant angles stated with correct reasons, may **FT** arithmetic slip **3c** at least three relevant angles found, may be indicated in correct position on diagram, may **FT** arithmetic slip	
			2a one relevant angle stated with correct reason, allow **FT** **2b** two relevant angles found, may be indicated in correct position on diagram, allow **FT** **2c** two relevant reasons stated, need not be linked with appropriate angles	2-1	For the lower mark **1a** one relevant angle found, may be indicated on diagram, allow **FT** **1b** one relevant reason stated, need not be linked with appropriate angle	

Question			Answer/Indicative content	Marks	Part marks and guidance	
			No correct work seen  		Acceptable reasons: Alternate angles equal Corresponding angles equal [Co-]interior / allied [angles] = 180 [angles in a] triangle = 180 [angles on a straight] line = 180 [angles in a] quadrilateral = 360 Similar triangles (only if correct angle pairs used) 180 may be implied in above reasons by a correct calculation seen and equal by a correct pair **soi** Condone use of Z (in place of alternate), F (in place of corresponding), C/U (in place of interior / allied) for up to 4 marks Supplementary angles alone is not sufficient, needs some context Examiner's Comments Most candidates were aware of some of the properties of angles on a straight line, angles in a triangle or within parallel lines, but did not have the skills necessary to use a step by step solution to work through the problem. Some incorrectly assumed that the triangle or the trapezium was isosceles. Candidates need to look to identify the angles in the diagram with their calculations, either by using conventional lettering or by labelling the diagram in some way.	

Question			Answer/Indicative content	Marks	Part marks and guidance
			Total	5	

Question			Answer/Indicative content	Marks	Part marks and guidance	
14	a		Corresponding	1	Do not accept F angles **Examiner's Comments** Very few candidates recognised that the required term was corresponding angles. Explanations about parallel lines were common; other responses mentioned opposite, equilateral triangle, isosceles triangle, 180° in a triangle and occasionally alternate. Use of F angles was very rare. It was evident from both parts (a) and (b) that candidates were unfamiliar with the terminology angle XBC. This confusion was problematic in (b) as some wrote all three angles of the triangle on the answer line, or added them together and gave an answer of 180°. Where a correct answer of 50° for angle BXC was reached, including both required reasons was rare. Many gave the reason relating to the angle sum of a triangle, but few also mentioned it was isosceles. It was sometimes difficult to follow working, as just a series of calculations were stated and reasons that were often correct were not always linked to specific working. Some thought triangle XBC was equilateral. Others were confused about which two angles in the isosceles triangle were equal. Angles on a straight line = 180° was a reason used by quite a few.	

Question			Answer/Indicative content	Marks	Part marks and guidance		
	b		Angle BXC = 50 [Angles in a] isosceles [triangle] Angles in a triangle add up to 180	2 1 1	**B1** for Angle XCB = 65 Accept Alternate angles [are equal] **and** Angles on a [straight] line =180	XCB may be seen on the diagram Accept C for XCB, X for BXC Condone isos for isosceles [Angles in a] isosceles triangle add up to 180 scores final 2 marks Key words for 1 mark in 'Angles in a triangle add up to 180' are 'triangle' and '180'	
			Total	5			