

1	$180^\circ - (104^\circ + 42^\circ) (= 34^\circ)$ or $\frac{180^\circ - 34^\circ}{2}$		4	M1 for one correct stage
		73		A1 for 73
	<ul style="list-style-type: none"> Angles in a triangle sum to 180° or (angles in a triangle sum to 180°) Angle BDC and angle DBA are alternate angles Base angles in an isosceles triangle are equal or (Allied / co-interior angles add up to 180°)	correct reasons		B2 dep fully correct method. for all correct reasons for the method used NB allied angles may not be needed if using ABD sum to 180° (B1 dep M1 for one correct reason)
Total 4 marks				

2	$ADC = 180 - 58 (= 122)$ or $EDF = 122$ or $CDE = 58$ or $ADF = 58$		5	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
				B2 dep on M2 for fully correct reasons for their method (B1 dep on M1 for one correct reason stated and used) e.g. Allied angles, co-interior angles, Alternate angles, Corresponding angles, Vertically opposite angles are equal (or Vertically opposite angles are equal), Angles on a straight line add up to 180° (or angles on a straight line add to 180°), Sum of two angles in a triangle are equal to opposite exterior angle, Angles in a triangle add up to 180° (or Angles in a triangle add up to 180°), Base angles in an isosceles triangle Angles in a quadrilateral add up to 360. (accept "4-sided shape" or parallelogram) Opposite angles of a parallelogram are equal
Total 5 marks				

3	$\angle ABC = 360^\circ - 298^\circ (= 62^\circ)$ or $\angle BCA = 97^\circ$		4	M1 Could be marked on diagram
		21		A1
	vertically opposite, (are equal) angles at (around) a point. (= 360°) angles in a triangle (= 180°)			B2 B2 for 3 correct reasons which must include the underlined words B1 for 1 or 2 correct reasons which must include the underlined words Any B marks dep on M1
Total 4 marks				

4	(a)(i)		38	1	B1
	(ii)		Angles in a triangle sum to 180°	1	B1 Allow Angles in a triangle sum to 180°
	(b)	Quad $ABDE$ $360 - 78 - 90 - 17 - (a)(i)$ $(360 - 223)$	Line and quad $ACDE$ $360 - 90 - 78 - (180 - 125)$ $360 - 90 - 78 - 55^\circ$	3	M1 fit from (ai)
			137		A1
			Reason(s)		B1 for full reasons E.g. Angles in a quadrilateral sum to 360° (accept Angles in a quadrilateral sum to 360°) OR Angles on a straight line sum to 180° (accept Angles on a straight line sum to 180°) and Angles in a quadrilateral sum to 360° (accept Angles in a quadrilateral sum to 360°) Accept 4 sided shape for quadrilateral
Total 5 marks					

5	[interior angle of pentagon =] $540 \div 5 (= 108)$ oe or [exterior angle of pentagon =] $360 \div 5 (= 72)$		3	M1 for a correct calculation for an interior or an exterior angle of a regular pentagon
	$360 - (90 + "108")$ or $90 + "72"$ or $180 - ("108" - 90)$ oe			M1 for a fully correct method "108" or "72" must come from correct working and be used correctly
	<i>Working not required, so correct answer scores full marks (unless from obvious incorrect working)</i>	162		A1
Total 3 marks				

6	Angle EBC or $ECB = (180 - 44) \div 2 (= 68)$ 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 $BGF = 180 - "68" (= 112)$		5	M1 Could be seen on diagram 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)
	<i>Working not required, so correct angle scores 3 marks (unless from obvious incorrect working)</i>	112		A1 Could be seen in correct place on diagram
	<i>NB: reasons must include the underlined words Accept \angle for angle(s) and \triangle for triangle</i> 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 <u>isosceles</u> triangle (or <u>2 equal sides</u> , <u>2 equal angles</u>) Angles in a <u>triangle</u> sum to <u>180°</u> or <u>angles</u> in a <u>triangle</u> Angles on a <u>straight line</u> sum to <u>180°</u> Angles on a <u>straight line</u> sum to <u>180°</u> Exterior angle in a <u>triangle</u> is equal to the two <u>opposite interior</u> angles. Vertically <u>opposite</u> angles are equal. Vertically <u>opposite angles</u> are equal. Corresponding angles are equal. Alternate angles are equal Allied angles sum to <u>180°</u> (or <u>co-interior</u> angles) Angles at a <u>point</u> (or <u>full turn</u>) add up to <u>360°</u> (or <u>angles at a point</u>) (B1 for one correct reason appropriate to their method, dep on M1)
Total 5 marks				

7	$360 - (59 + 115 + 68) (= 118)$		4	M1 angle values may be seen on diagram throughout
		$x = 62$		A1 from correct working
	Angles in a <u>quadrilateral</u> add up to 360. Accept "4-sided shape" Angles on a <u>straight line</u> add to <u>180°</u> Base angles in an <u>isosceles</u> triangle (are equal)			B2 (dep on M1) for all correct reasons for their method (B1 (dep on M1) for 1 correct reason for their method)
Total 4 marks				

8	$ABD = 180 - 143 (= 37)$ or $AEJ = 76$ or $CED = 76$ or $ECD = 180 - 143 (= 37)$ $180 - 76 - "37"$		3	M1 may be marked on diagram M1 A correct calculation for EDC A1
		67		
Total 3 marks				

9	(a) (i)		35	1 B1 if answer line is blank, check the diagram
	(ii) <u>vertically opposite</u> angles are equal or vertically <u>opposite angles</u> are equal			1 B1
	(b) (i) $(BEC =) 180 - 90 - 35 (= 55)$ or $(BEH =) 35 + 90$			2 M1 for a method to find angle BEC or BEH
			125	A1 if answer line is blank, check the diagram
	(ii) eg Angles in a <u>triangle</u> add to <u>180°</u> (allow angles in a <u>triangle</u> add to <u>180°</u>) Angles in a <u>triangle</u> sum to <u>180°</u> (allow angles in a <u>triangle</u> sum to <u>180°</u>) Angles on a <u>straight line</u> add to <u>180°</u> (allow angles on a <u>straight line</u> add to <u>180°</u>) The exterior angle of a triangle is equal to the sum of the interior opposite angles			1 B1 (dep on M1) for one correct reason
Total 5 marks				

10	(b)	$180 \div 3 (= 60)$		3 M1 or for an angle of 60 in the triangle
		$360 - (105 + 125 + "60")$		M1 for a correct complete method
		70		A1

11	(a)	$(DBC \Rightarrow) 180 - (93 + 42) (= 45)$ OR $(x \Rightarrow) 93 + 42$		2	M1 for method to find angle DBC OR using exterior angle is equal to the sum of the two opposite interior angles
			135		A1
	(b)(i)	$360 - (90 + 100 + 114)$ oe		2	M1 for a complete method to find y
			56		A1
	(ii)		<u>Angles at a point</u> sum to 360°	1	B1
Total 5 marks					

12	(a)(i)		58	1	B1
	(ii)	Vertically opposite angle(s) are equal or <u>Vertically opposite</u>		1	B1 reason given dep on a correct angle in (i)
	(b)	$DBA = 180 - 132 (= 48)$ or for $132 - 58$		2	M1 48 could be shown clearly on diagram
			74		A1
Total 4 marks					

13		$(ABD \Rightarrow) 360 - 52 - 112 - 90 (= 106)$ $(CBD \Rightarrow) 180 - "106" (= 74)$		4	M1 may be marked in correct place on diagram M1 may be marked in correct place on diagram A1 B1 dep on M1
		32 Reasons given			At least two appropriate reasons given. "angles in a <u>quadrilateral</u> add to 360° " accept 4-sided shape. "angles on a straight line add to 180° " or angles on a straight <u>line</u> add to 180° "angles in a <u>triangle</u> add to 180° " or angles in a <u>triangle</u> sum to 180° "base angles in an <u>isosceles</u> triangle (are equal)"
Total 4 marks					

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

15		$3 \times 180 (= 540)$ 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
		<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	129		A1
Total 3 marks					

16	$\cos 50 = \frac{18}{(AB)}$ 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 $(= 28.0030\dots)$ or 28
	$(AB =) \frac{18}{\cos 50}$ (= 28.0030...) oe or 28 or $(AB =) \frac{18}{\sin 40}$ (= 28.0030...) oe or 28			M1	
	$\frac{1}{2} \times \pi \times "28.0030\dots" (= 43.9\dots)$ oe or 44 $\pi \times "28.0030\dots" (= 87.9\dots)$ 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 <i>their d</i> + <i>their</i> $\frac{1}{2} \pi d$
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	72			A1 awrt 72
Total 5 marks					

17	angle $ABE = 73$ or angle $BEF = 73$ or angle $GEF = 180 - 73 (=107)$ or angle $DEB = 180 - 73 (=107)$ or $360 - 73 - 124$ or $180 - (124 - "107")$		4	M1	could be on diagram
	<i>A correct angle scores 2 marks</i>	163		A1	
				B2	dep on M1 and a complete method for all reasons appropriate for their method (B1 dep on M1 for one reason appropriate for their method) eg Angles on a straight line sum to <u>180°</u> Angles on a straight line sum to <u>180°</u> Vertically opposite angles are equal. Vertically opposite angles are equal. Corresponding angles are equal. Alternate angles are equal Allied angles sum to <u>180°</u> (or co-interior angles) Angles at a point (or full turn) add up to <u>360°</u> (or angles at a point)
Total 4 marks					

18	$BCD = 108$		5	M1	for angle $BCD = 108$ can be seen on diagram
	eg $360 - ("108" + 135 + 54) (= 63)$ or $360 - 297 (= 63)$			M1	for method to find angle BAD can be seen on diagram (63 or 297 implies the previous M1)
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	117		A1	for 117 can be seen on diagram
	(i) Vertically opposite angles are equal Vertically opposite angles are equal (ii) Angles in a quadrilateral sum to <u>360°</u> or angles in a quadrilateral sum to <u>360°</u> Accept "4-sided shape" (iii) Angles on a straight line add to <u>180°</u> or angles on a straight line add to <u>180°</u>			B2	(dep on M1) for two correct reasons for their method (B1 (dep on M1) for 1 correct reason for their method)
Total 5 marks					

19	(a)	60	1	B1	cao
	(b)(i)	58	1	B1	
	(ii)	correct reason	1	B1	for angles in a triangle add up to <u>180°</u> or for angles in a triangle add up to <u>180°</u>
Total 3 marks					

20	$(4x - 27) + (3x + 46) = 180$ 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 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 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

21	eg $(DEK =) \frac{360}{9}$ or 40 or (interior angle $\Rightarrow \frac{(9 - 2) \times 180}{9}$ 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 be awarded for any of the other angles stated 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) A1
	$EDK = 110$ and $DEK = 40$ or $FOK = 80$ and $OFK = 70$ or $ODE = 70$ and $DEK = 40$ or $FED = 140$ and $EDK = 110$ oe Correct answer scores full marks (unless from obvious incorrect working)	30		
				Total 3 marks