1		29°	C1	angle $OTP = 90°$, quoted or shown on the diagram
			M1	method that leads to 180 – (90 + 32) or 58 shown at TOP OR that leads to 122 shown at SOT
			M1	complete method leading to "58"÷2 or (180 – "122") ÷ 2 or 29 shown at TSP
			C1	for angle of 29° clearly indicated and appropriate reasons linked to method eg angle between radius and tangent = 90° and sum of angles in a triangle = 180°; ext angle of a triangle equal to sum of int opp angles and base angles of an isos triangle are equal or angle at centre = 2x angle at circumference or ext angle of a triangle equal to sum of int opp angles

2		Proof	C1	for identifying one pair of equal angles with a correct reason, e.g. (angle) BAE = (angle) CDE; angles in the same segment are equal or angles at the circumference subtended on the same arc are equal or for identifying two pairs of equal angles with no correct reasons given (angles must be within the appropriate triangles)
			C1	for identifying a second pair of equal angles with a correct reason, e.g. (angle) AEB = (angle) DEC; opposite angles or vertically opposite angles are equal or for identifying the three pairs of equal angles with no correct reasons given
			C1	for stating the three pairs of equal angles of the two triangles e.g. $ABE = DCE$, $BEA = CED$, $EAB = EDC$ with fully correct reasons

3	Note $DOC=DOA$, $ADO=CDO$	21.6	P1	Recognises that OAD or OCD is 90° or right angle
			P1	for using trigonometry to set up an equation in DOA or ADO eg $\text{Cos } DOA = \frac{5}{9}$
			P1	for using inverse trigonometry to find DOA or ADO eg $DOA = \text{Cos}^{-1}\frac{5}{9}$ (= 56.25…)
			P1	for a complete process to find arc length ABC or AC eg $\frac{360-2\times\text{"56.25.."}}{360}\times2\times\pi\times5$ (=21.598..) or $\frac{2\times\text{"56.25.."}}{360}\times2\times\pi\times5$ (=9.8174..)
			A1	for answer in the range 21.5 to 21.65

4		Proof	C1	draws OC and considers angles in an isosceles triangle (algebraic notation may be used, eg two angles labelled x)
			C1	finds sum of angles in triangle ABC, eg $x + x + y + y = 180$, or sum of angles at O, eg $180 - 2x + 180 - 2y$
			C1	complete method leading to $ACB = 90$
			C1	complete proof with all reasons given, eg base angles of an isosceles triangle are equal, angles in a triangle add up to 180°, angles on a straight line add up to 180°

5	$90 - 2x$	M1	for identifying an unknown angle eg $BAO = x$, $AOB = 180 - 2x$, $OBC = 90$, $ABC = 90 + x$	Could be shown on the diagram alone
		M1	full method to find the required angle eg a method leading to $180 - x - x - 90$	Needs to be an algebraic method Accept $x + x + 90 + y = 180$ for M2
		A1	for $90 - 2x$	
		C2	(dep M2) full reasons for their method, from base angles in an isosceles triangle are equal angles in a triangle add up to 180° a tangent to a circle is perpendicular to the radius (diameter) angles on a straight line equal 180° the exterior angle of a triangle is equal to the sum of the interior opposite angles	Underlined words need to be shown; reasons need to be linked to their method; any reasons not linked do not credit.
		(C1	(dep M1) for a tangent to a circle is perpendicular to the radius (diameter))	Apply the above criteria

6	(a)	Shown	M1	for finding one missing angle eg $BDE = y$ **or** $ODE = 90$ **or** $ODF = 90$ **or** $DBO = x$ **or** $BCD = 180 - y$ **or** (reflex) $BOD = 2y$	Could be shown on the diagram or in working
			A1	for a complete correct method leading to $y - x = 90$	
			C1	(dep on A1) for all correct circle theorems given appropriate for their working eg The tangent to a circle is perpendicular (90°) to the radius (diameter) Alternate segment theorem **OR** Angle at the centre is twice the angle at the circumference Opposite angles in a cyclic quadrilateral sum to 180°	
	(b)	Explanation	C1	for explanation eg No as y must be less than 180 as it is an angle in a triangle	

7	21	C1	for angle $OAB = 90 - 56$ (= 34)	Throughout, angles may be written on the diagram; accept as evidence if correct. Ignore absence of degree sign Reasons need not be given.
		C1	for process to find angle CAD (= 69) or angle BCA (= 56) or angle COA (= 138) , eg use of alternate segment theorem or angle at centre is twice the angle at the circumference	
		C1	cao	

8	75° with reasons	M1	for finding angle $BAD = \frac{180-40}{2}$ (= 70) or angle $BDA = \frac{180-40}{2}$ (= 70)	Could be shown on the diagram or in working
		M1	for finding angle $BCD = 180 -$ "70" (=110) or $40 + x + 70 + x = 180$	
		A1	for finding angle $ADE = 75$	
		C2	(dep M2) for Opposite angles of a cyclic quadrilateral add up to 180 **and** one other reason; all reasons given must be appropriate for their working Base angles of an isosceles triangle are equal Angles in a triangle add up to 180, Angles on a straight line add up to 180 [**or** exterior angle of a cyclic quadrilateral is equal to the interior opposite angle]	Underlined words need to be shown; reasons need to be linked to their method
		(C1	(dep M2) for Opposite angles of a cyclic quadrilateral add up to 180, **or** all other reasons given appropriate for their working)	Apply the above criteria

9	Proof	C1	for **one** correct pair of equal angles with correct reason from: angle ACB = angle ADB, (angles in the same segment are equal) angle DBC = angle DAC, (angles in the same segment are equal) angle ABD = angle ACD, (angles in the same segment are equal) **or** for recognising all angles of 60 in triangle AED **and** in triangle CEB)	Underlined words need to be shown; reasons need to be linked to their statement(s) Pairs of equal angles may be just shown on the diagram
		C1	for **one** identity, with reason(s), from the following list of alternatives: **Alternatives:** a complete method to show that angle ACB = angle DBC (= 60), **or** BC being common to both triangles **or** $DB = DE+EB = AE+EC = AC$ (sides of an equilateral triangle are equal) **or** angle $ABC = 60$ + angle $ABD = 60$ + angle ACD = angle DCB (angles in the same segment are equal) **or** angle BDC = angle CAB (angles in the same segment are equal)	
		C1	for a **second** identity, with reason(s), from the alternatives above	
		C1	for concluding the proof with a **third** identity, with reason(s), from the alternatives above, together with the condition for congruency, ASA or SAS or AAS	

10	61	B1	angle $OAD = 90$, may be marked on diagram	Angle could be shown by a right-angle symbol
		M1	method to work out angle OAB (=29)	Correct method can be implied from angles on the diagram if no ambiguity or contradiction. Reasons need not be given. Award 0 marks for an answer of 61 with no other working.
		A1	cao	

11	25 with reasons	M1	for method to find angle BCD eg $180 \div (3 + 1)$ (= 45) **or** $BAD = 180 \div (3 + 1) \times 3$ (=135)	Could be shown on the diagram or in working
		M1	for method to find angle BDA eg 180 – 20 – (180 – "45") (=25) **or** method to find angle SBD eg $SBD = BCD$ (=45)	Do not award if it ambiguous as to which angle is being found
		C2	for finding SBA (=25) and both reasons given, eg Opposite angles of a cyclic quadrilateral add up to 180 for angle $SBD = 45$ because alternate segment theorem	
		(C1	(dep M1) for one reason given Opposite angles of a cyclic quadrilateral add up to 180 for angle $SBD = 45$ because alternate segment theorem)	Underlined words need to be shown; reasons need to be linked to their method