Paper 1MA1: 3H				
Question	**Working**	**Answer**	**Mark**	**Notes**
18 **Q1**	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 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 $\frac{360-2\times\text{"56.25.."}}{360}$ ×2×π×5 (=21.598..) or $\frac{2\times\text{"56.25.."}}{360}$ ×2×π×5 (=9.8174..)
			A1	for answer in the range 21.5 to 21.65

Paper: 1MA1/1H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
11 **Q2**	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

Paper: 1MA1/2H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
13 (a) **Q3**	Shown	M1 A1 C1	for finding one missing angle eg *BDE* = *y* **or** *ODE* = 90 **or** *ODF* = 90 **or** *DBO* = *x* **or** *BCD* = 180 – *y* **or** (reflex) *BOD* = 2*y* for a complete correct method leading to $y - x = 90$ (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°	Could be shown on the diagram or in working
(b)	Explanation	C1	for explanation eg No as *y* must be less than 180 as it is an angle in a triangle	

Paper: 1MA1/2H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
18 **Q4**	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

Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
14 **Q5**	60 (supported)	M1	for angle *DBF*, eg 180 – 100 (= 80)	Angles may be shown on the diagram or in working
		M1	for angle *BFD*, eg 180 – "80" – 40 (= 60) or for angle *CBF* = 40	
		A1	for angle *ABD* = 60	
		C1	(dep M2) for at least 2 reasons from Opposite angles of a cyclic quadrilateral add up to 180 Angles in a triangle add up to 180 Alternate segment theorem **OR** Opposite angles of a cyclic quadrilateral add up to 180 Alternate segment theorem Angles on a straight line add up to 180	Underlined words need to be shown; reasons need to be linked to their method

Paper: 1MA1/2H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
14 **Q6**	25 with reasons	M1	for method to find angle *BCD* eg 180 ÷ (3 + 1) (= 45) **or** *BAD* = 180 ÷ (3 + 1) × 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

Paper: 1MA1/1H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
12 **Q7**	21	C1 C1 C1	for angle *OAB* = 90 – 56 (= 34) 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 cao	Throughout, angles may be written on the diagram; accept as evidence if correct. Ignore absence of degree sign Reasons need not be given.

Paper: 1MA1/2H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
21 **Q8**	proof	C1	uses cyclic quad eg if *CAB* = x then *CRO* = 180 – x (Opposite angles of a cyclic quadrilateral add up to 180º.)	Underlined words need to be shown; reasons need to be linked to their method; any reasons not linked do not credit.
		C1	establishes relationship outside a circle eg *ORB* = x (Angles on a straight line add up to 180)	Correct method can be implied from angles on the diagram if no ambiguity or contradiction.
		C1	uses properties of a circle eg *RO* = *OB* (both radii) so *ABC* = x (Base angles of an isosceles triangle are equal.)	
		C1	Complete proof and conclusion	Full reasons given without any redundant reasons and correct reasoning throughout.

Paper: 1MA1/1H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
22 **Q9**	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	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
17 **Q10**	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	

Paper: 1MA1/1H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
18	Result shown	M1	for angle $OBC = 90$ **or** for method to find angle OBA or angle OAB, eg $\frac{180-x}{2}$ oe **or** for angle $ABC = 90 -$ angle OBA, eg angle $ABC = 90 - y$ **or** marks point on circumference and draws triangle using A and B and point marked	Angles must be clearly labelled on the diagram or otherwise identified. Correct method can be implied from angles on the diagram if no ambiguity or contradiction.
		M1	for method to find angle ABC, eg $90 -$ "$\frac{180-x}{2}$" oe **or** for $x = 180 - 2 \times$ angle OBA, eg $x = 180 - 2y$ **or** for angle at circumference = $\frac{1}{2}x$	
Q11		C1	for correct algebra leading to angle $ABC = \frac{1}{2}x$ **and** one circle theorem relevant to their method, eg The <u>tangent</u> to a circle is perpendicular to the <u>radius</u> **OR** for $x = 180 - 2y$ and angle $ABC = 90 - y$ **and** one circle theorem relevant to their method, eg The <u>tangent</u> to a circle is perpendicular to the <u>radius</u> **OR** for angle $ABC = \frac{1}{2}x$ **and** one circle theorem relevant to their method, eg The <u>angle</u> at the <u>centre</u> of a circle is <u>twice</u> the <u>angle</u> at the <u>circumference</u> or <u>Alternate segment</u> theorem	Underlined words need to be shown; reasons need to be linked to their method.

Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
16 **Q12**	40	M1	for *ABD* = 120 and *AED* = 60 **or** for using the properties of a cyclic quadrilateral eg *EAB* + *BDE* = 180	Angles may be shown on the diagram
		M1	for using the ratio of 2 : 1 eg showing sizes of angles such that *EAB* : *BCD* = 2 : 1	May be expressed using algebra eg *EAB* = $2x$ and *BCD* = x
		M1	(dep on M1) for linking an angle from the cyclic quadrilateral with angle(s) in the triangle (other than *EAB* : *BCD* = 2 : 1) eg *BDE* = *BCD* + 60 or *BDE* = 180 – *BDC* or *EAB* + *BCD* + *AEC* = 180	Could be expressed using algebra eg $x + 60 = 180 - 2x$
		A1	for *BCD* = 40 from correct working	

Paper: 1MA1/2H

Question	Answer	Mark	Mark scheme		Additional guidance
20	98	M1	for *BAD* = 132 ÷ 2 (= 66)		Angles may be seen on diagram
		M1	eg *BCD* = 180 – "66" (= 114) **or** *ABE* = 180 – "66" – 16 (= 98)	M2 for reflex *BOD* = 360 – 132 (= 228) **and** *BCD* = "228" ÷ 2 (= 114)	
		A1	for finding *CDE* = 98		
Q13		C1	(dep on at least M2) for one circle theorem relevant to their method eg The angle at the centre of a circle is twice the angle at the <u>circumference</u> **or** Opposite angles of a cyclic quadrilateral add up to 180		Underlined words need to be shown; reasons need to be linked to their method.

Q14

Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
15	Proof	C1	for angle *PQX* = angle *SRX* as angles in the same segment are equal (or angles at the circumference subtended from the same arc/chord of a circle are equal) or angle *QPX* = angle *RSX* as angles in the same segment are equal (or angles at the circumference subtended from the same arc/chord of a circle are equal) or angle *PXQ* = angle *SXR* as vertically opposite angles/ vertically opposite angles are equal **or** for identifying two pairs of corresponding equal angles with no reason given	Underlined words need to be shown; reasons need to be linked to their method. Could be shown on the diagram
		C1	for identifying two pairs of corresponding equal angles with correct reasons given	
		C1	for stating that the triangles are similar because all three pairs of corresponding angles are equal with complete reasons given.	Note that the students third/final reason may be: Angles in a triangle add up to 180

Paper: 1MA1/3H				
Question	**Working**	**Answer**	**Mark**	**Notes**
20 **Q15**		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 180º, angles on a straight line add up to 180º

Paper: 1MA1/2H				
Question	Working	Answer	Mark	Notes
15 **Q16**		Proof	C1 C1 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) 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 for stating the three pairs of equal angles of the two triangles e.g. *ABE* = *DCE*, *BEA* = *CED*, *EAB* = *EDC* with fully correct reasons