**1.** *SOT =* 360 – (90 + 90 + 44)
= 136°

 *SOT =* 360 – (90 + 90 + 44)
= 136°
136 – 90

 *SOT =* 360 – (90 + 90 + 44)
= 136°
136 ÷ 2 – 22

 46° 4

**Using triangle SOP**B1 recognition of tangent/radius property (can be awarded for a right angle marked on the diagram)
M1 180 – 90 – 22 or sight of 68º
M1 SOP – 22
A1 cao

**Using quadrilateral SPTO**B1 recognition of tangent/radius property (can be awarded for a right angle marked on the diagram)
M1 360 – (2 × 90 + 44) or sight of 136º
M1 SOT – 90
A1 cao

**Alternative method for quadrilateral SPTO**B1 recognition of tangent/radius property (can be awarded for a right angle marked on the diagram)
M1 360 – (2 × 90 + 44) or sight of 136º
M1for 136 ÷ 2 – 22
A1 cao

[4]

**2.** (a) 60 1

B1 for 60
B1 for BDC = 25

(b) 35 2

 eg Angle *BDC* = 25
*ADB* = 60 – 25

[Award the mark for equivalent approaches]
B1 ft for (a) –25

(c) Ben is correct; angle *DAB* = 65 + 25 = 90 and since angle in a
semi-circle is 90°, *BD* must be a diameter 1

B1 for full valid justification

[4]

**3.** reasons 2

B1 for numerical reason involving comparison of angle
[eg ATC = 100°should be 90°, ATB = 60° should be 50°, ATB = 50° gives 170° in triangle should be 180°, BTC  BAT]
B1 for alternate segment theorem OR angle between tangent and radius is 90°

[2]

**4.** (a) *AOD =* 90 – 36 or 180 – (90 + 36)
54 2

M1 AOD = 90 – 36 or 180 – (90 + 36)
A1 cao

(b) (i) *ABC = AOD* ÷ 2
27 2

M1 ABC = AOD ÷ 2
A1 ft from ‘54’

(ii) Reason 1

B1 Angle at centre = twice angle at circumference

[5]

**5.** 180 – 104 (= 76) 3
“76” ÷ 2 (= 38)
90 – “38”

 104 ÷ 2
= 52

M1 for (180 – 104) ÷ 2 or 180 – 90 – 104 ÷ 2 or 38 seen on the diagram for angle BAO
M1 for 90 – “angle BAO” (This could be implied by the values of angle BAO and angle BAT shown on the diagram)
A1 for 52° (shown to be their final answer, other than just shown on the diagram)

**Alternative method** (using angle at centre and alternate segment theorems)
M2 for 104 ÷ 2 seen leading directly to their final answer.
A1 cao

Angle BAO (A) = 38 with no working gets M1 (unless contradicted on the diagram with 38, say at angle BAT.
104 ÷ 2 = 52° **only** seen is a correct solution, since the candidate could be using the ‘angle at the centre’ and ‘alternate segment’ theorems.
This gets M2A1
**Warning**: sight of 104 ÷ 2 = 52° gets no marks if it is related to a different angle (say BTA or AOM, where M is the midpoint of AB) and is then followed by incorrect methods to find the required angle.

Another method is to draw a tangent through B. This is usually then joined to T which is not strictly correct. (however it is pretty close) <ATB is then found to be 76° (360 – 104 – 90 – 90) and <BAT is found using triangle ATB which is assumed is isosceles. This method is acceptable for full marks.

[3]

**6.** (i) 76 2

 180 – 2 × 52

B1 cao

(ii) tgts to a circle are equal in length

B1 for mention of equal tgts to a circle from a point

[2]

**7.** (a) 30 3

 angle *TPO* = angle *OPN* = angle *PNT*2*x* + *x* + 90 = 180

M1 for angle TPO = angle OPN = angle PNT
M1 (dep) for 2x + x + 90 = 180 (oe)
A1 cao

(b) *PS* = *SN* 3

M1 for identifying triangle NOP as isosceles
M1 for identifying angle NSO or angle PSO as 90
A1 for use of symmetry together with result

OR M2 for 3 relevant statements
[M1 for 2 relevant statements]
A1 for use of congruent triangles together with result

OR M1 for tan ONS =  and tan OPS = oe
[use of sine or cos accepted if isosceles triangle identified]
M1 for SN =and SP = 
A1 for result

[6]

**8.** (i) 27 4

 Tangent 90 to diameter /radius/ line from (through) centre

B1 for 27 cao
B1 for reason

(ii) 63

 180 (90+ “27”)
angle in semicircle (is 90)/Alternate segments
/angle at centre twice at circumference

B1 ft for 90”27” if not 63
B1 for reason

[4]

**9.** (a) (i) 150 2

B1 accept 150 or 210

(ii)

B1 for angle at the centre is twice the angle at the circumference

(b) 30 3

 360 – 90 – 90 – “150” or 180 – “150”

B1 identifies angle between radius and tangent
as 90° (may be in working or on diagram)
M1 360 – 90 – 90 – “150”
A1 ft from (a)(i) excluding a negative answer
Or
B1 for 90
M1 for 2 × (180 – 90 – ““)
A1 ft from (a)(i) excluding a negative answer
Or
B3 for 180 – (a)
SC: 180 – “210” can get B1 for 90°and/or B1 for “cyclic quadrilateral”

[5]