HIGHER

8.8 Proof of the Circle Theorems: 30-minute Pack

Total Marks

EDEXCEL 1MA1 · Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Points A, B, C and D lie on the same circle with A, B fixed and C and D on the same side of chord AB. Angle ACB = 37 degrees. Work out angle ADB. Give a reason.

(Total for Question 1 is 2 marks)

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2 Prove that opposite angles of a cyclic quadrilateral sum to 180 degrees. You may use the fact that the angle at the centre is twice the angle at the circumference.

(Total for Question 2 is 3 marks)

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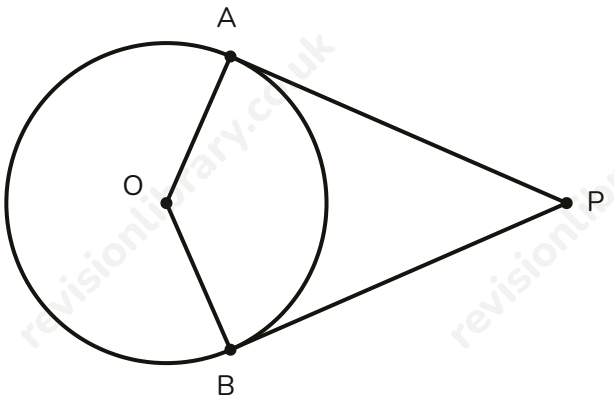
3 A line is tangent to a circle at A. B and C are points on the circumference so that B and C are distinct from A and lie on the circle. Show that the angle between the tangent at A and the chord AB is equal to the angle in the opposite arc at C, that is angle ACB.

(Total for Question 3 is 3 marks)

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4 PA and PB are tangents from an external point P to a circle with centre O, touching the circle at A and B.

Diagram NOT accurately drawn



(a) State the size of angle OAP, giving a reason for your answer. **(2)**

(b) Show that angle APB + angle AOB = 180 degrees. **(2)**

(c) Given that angle APB = (2x + 20) degrees and angle AOB = (3x + 40) degrees, find the value of x and hence the size of angle AOB. **(3)**

(Total for Question 4 is 7 marks)

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5 TP is a tangent to a circle at P. Q and R are points on the circle. Angle TPQ = (4x + 10) degrees and the angle in the alternate segment, angle PRQ, is (2x + 52) degrees. Work out the value of x and the size of angle TPQ, stating the circle theorem you use.

(Total for Question 5 is 4 marks)

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6 The line TP is a tangent to a circle, centre O, at the point P. Angle PTO = 75 degrees. Work out the size of angle POT. Give a reason for each stage of your working.

(Total for Question 6 is 3 marks)

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7 ABCD is a cyclic quadrilateral. Angle ABC = (3x + 30) degrees and angle ADC = (3x + 48) degrees. Work out the value of x and the size of each of the two angles. Give a reason for your equation.

(Total for Question 7 is 4 marks)

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Mark scheme · 8.8 Proof of the Circle Theorems: 30-minute Pack

Question 1

identify angles ACB and ADB subtend the same arc AB (angles in same segment)	**M1**
37 degrees cao	**A1**

Answer: 37 degrees; angles in the same segment are equal.

Question 2

join the diagonals or consider the arc subtended by two opposite angles and use angle at centre twice circumference	**M1**
express each opposite angle as half of the same arc(s) so they add to half + half = whole	**M1**
sum = 180 degrees cso	**A1**

Answer: Proof: Using angle at centre twice angle at circumference, the two opposite angles subtend the same full arc and so their halves add to the whole: sum = 180 degrees. (cso)

Question 3

join OA and OB and use OA = OB (radii) so triangle OAB is isosceles and angle OAB = (180 - angle AOB)/2 oe	**M1**
use angle at centre = 2 x angle at circumference to write angle AOB = 2 x angle ACB and deduce angle OAB = 90 - angle ACB oe	**M1**
therefore angle between tangent at A and chord AB = angle ACB cso	**A1**

Answer: Angle between tangent at A and chord AB = angle ACB.

Question 4

(a) 90 degrees	**B1**
(a) reason: tangent is perpendicular to the radius at the point of contact	**B1**

(a) Answer: 90 degrees

(b) 360 - 90 - 90 oe, using angle sum of quadrilateral OAPB = 360	**M1**
(b) angle APB + angle AOB = 180 cso	**A1**

(b) Answer: 180 degrees (shown)

(c) (2x + 20) + (3x + 40) = 180 oe	**M1**
(c) x = 24	**A1**
(c) angle AOB = 112 degrees, ft	**A1**

(c) Answer: x = 24, angle AOB = 112 degrees

Question 5

4x + 10 = 2x + 52	**M1**
alternate segment theorem stated	**B1**
solves the equation	**M1**
x = 21, angle TPQ = 94 degrees	**A1**

Answer: x = 21, angle TPQ = 94 degrees

Question 6

angle OPT = 90 degrees (tangent perpendicular to radius)	**B1**
180 - 90 - 75	**M1**
15 degrees cao	**A1**

Answer: 15 degrees

Question 7

3x + 30 + 3x + 48 = 180	**M1**
reason: opposite angles of a cyclic quadrilateral add to 180 degrees	**B1**
solves the equation	**M1**
x = 17, angle ABC = 81 degrees, angle ADC = 99 degrees	**A1**

Answer: x = 17, angle ABC = 81 degrees, angle ADC = 99 degrees

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