HIGHER

3.5 Circle Theorems: Angle Properties: 2-hour Pack

EDEXCEL 4MA1 · Calculator allowed · about 120 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 E, F, G and H are points on a circle, with G and H on the same side of the chord EF.
Angle EGF = (3x - 8) degrees and angle EHF = (6x - 38) degrees.
Find the value of x and the size of angle EGF. Give a reason.

(Total for Question 1 is 4 marks)

2 O is the centre of a circle. XY is a tangent to the circle at X, and YO is a straight line.
Angle OYX = 60 degrees. Find angle XOY. Give a reason.

(Total for Question 2 is 3 marks)

3 CA and CB are tangents from the point C to a circle with centre O, touching the circle at A and B.
Angle ACB = 42 degrees.
Find angle OAB. Give reasons.

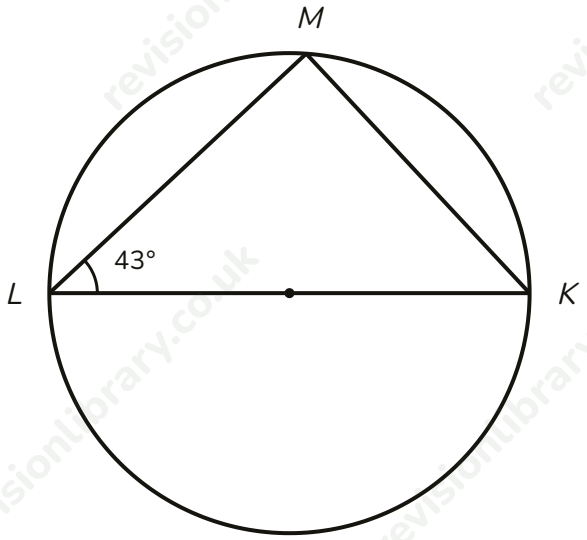
(Total for Question 3 is 4 marks)

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4 K, L and M are points on a circle. NK is a tangent to the circle at K. M lies on the arc KL on the opposite side of the chord KL from N.
Angle NKL = 79 degrees. Find angle KML. Give a reason.

(Total for Question 4 is 3 marks)

5 KL is a diameter of a circle. M is a point on the circle.
Angle KLM = 43 degrees. Find angle LKM. Give reasons.



(Total for Question 5 is 3 marks)

6 A, B and C are points on a circle with centre O. C lies on the major arc AB.
Angle ACB = 40 degrees.
Find angle AOB. Give a reason for your answer.

(Total for Question 6 is 3 marks)

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7 EFGH is a cyclic quadrilateral. Angle EFG = (4x - 15) degrees and angle EHG = (2x + 27) degrees.
Find the value of x and the size of angle EFG. Give a reason.

(Total for Question 7 is 4 marks)

8 W and X are points on a circle with centre O. Angle OWX = 48 degrees.
Find angle WOX. Give a reason.

(Total for Question 8 is 3 marks)

9 P, Q, R and S are points on a circle, with R and S on the same side of the chord PQ.
Angle PRQ = (4x - 7) degrees and angle PSQ = (2x + 15) degrees.
Find the value of x and the size of angle PRQ. Give a reason.

(Total for Question 9 is 4 marks)

10 O is the centre of a circle. LM is a tangent to the circle at L, and MO is a straight line.
Angle LOM = 49 degrees. Find angle OML. Give a reason.

(Total for Question 10 is 3 marks)

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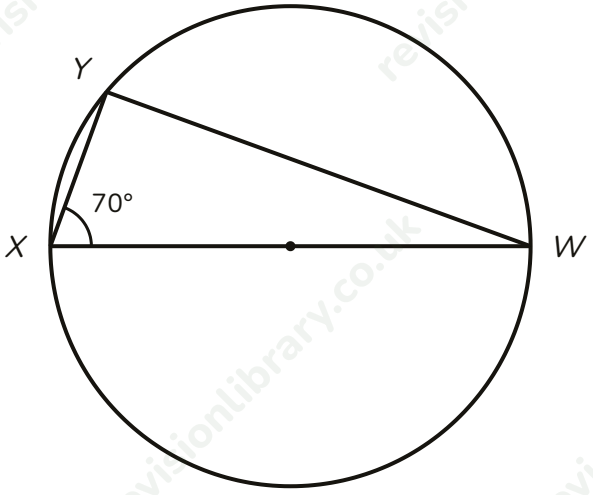
11 YW and YX are tangents from the point Y to a circle with centre O, touching the circle at W and X.
Angle WYX = 46 degrees.
Find angle WOX. Give a reason.

(Total for Question 11 is 3 marks)

12 K, L and M are points on a circle. NK is a tangent to the circle at K. M lies on the arc KL on the opposite side of the chord KL from N.
Angle NKL = 37 degrees. Find angle KML. Give a reason.

(Total for Question 12 is 3 marks)

13 WX is a diameter of a circle. Y is a point on the circle.
Angle WXY = 70 degrees. Find angle XWY. Give reasons.



(Total for Question 13 is 3 marks)

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14 W, X and Y are points on a circle with centre O. Y lies on the major arc WX.
Angle WYX = 42 degrees.
Find angle WOX. Give a reason for your answer.

(Total for Question 14 is 3 marks)

15 PQRS is a cyclic quadrilateral. Angle PQR = 37 degrees.
Find angle PSR. Give a reason.

(Total for Question 15 is 3 marks)

16 W and X are points on a circle with centre O. Angle WOX = 98 degrees.
Find angle OWX. Give a reason.

(Total for Question 16 is 3 marks)

17 W, X, Y and Z are points on a circle, with Y and Z on the same side of the chord WX.
Angle WYX = (6x + 1) degrees and angle WZX = (5x + 14) degrees.
Find the value of x and the size of angle WYX. Give a reason.

(Total for Question 17 is 4 marks)

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18 O is the centre of a circle. FG is a tangent to the circle at F, and GO is a straight line.
Angle OGF = 59 degrees. Find angle FOG. Give a reason.

(Total for Question 18 is 3 marks)

19 CA and CB are tangents from the point C to a circle with centre O, touching the circle at A and B.
Angle ACB = 50 degrees.
Find angle CAB. Give a reason.

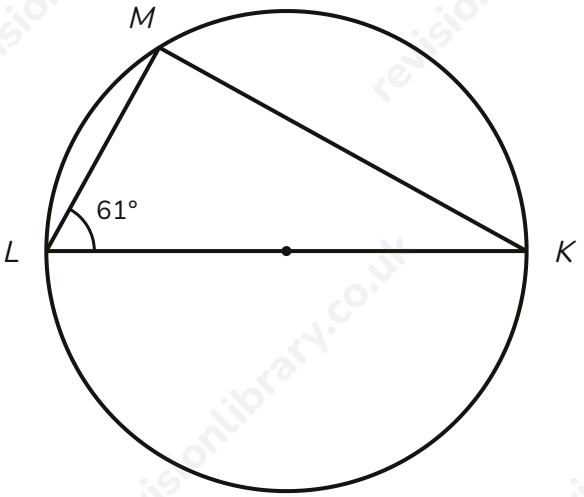
(Total for Question 19 is 3 marks)

20 P, Q and R are points on a circle. SP is a tangent to the circle at P. R lies on the arc PQ on the opposite side of the chord PQ from S.
Angle SPQ = 71 degrees. Find angle PRQ. Give a reason.

(Total for Question 20 is 3 marks)

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21 KL is a diameter of a circle. M is a point on the circle.
Angle KLM = 61 degrees. Find angle LKM. Give reasons.



(Total for Question 21 is 3 marks)

22 E, F and G are points on a circle with centre O. G lies on the major arc EF.
Angle EOF = 128 degrees.
Find angle EGF. Give a reason for your answer.

(Total for Question 22 is 3 marks)

23 PQRS is a cyclic quadrilateral. Angle PQR = 49 degrees.
Find angle PSR. Give a reason.

(Total for Question 23 is 3 marks)

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24 A, B and C are points on a circle with centre O. C lies on the major arc AB.
Angle AOB = 168 degrees.
Find angle ACB. Give a reason for your answer.

(Total for Question 24 is 3 marks)

25 E and F are points on a circle with centre O. Angle EOF = 58 degrees.
Find angle OEF. Give a reason.

(Total for Question 25 is 3 marks)

26 P, Q and R are points on a circle. SP is a tangent to the circle at P. R lies on the arc PQ on the opposite side of the chord PQ from S.
Angle SPQ = 35 degrees. Find angle PRQ. Give a reason.

(Total for Question 26 is 3 marks)

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Mark scheme · 3.5 Circle Theorems: Angle Properties: 2-hour Pack

Question 1

angles in the same segment are equal	**B1**
3x - 8 = 6x - 38	**M1**
x = 10	**A1**
angle EGF = 22 degrees	**A1**

Answer: x = 10; angle EGF = 22 degrees

Question 2

angle OXY = 90 degrees (the tangent is perpendicular to the radius)	**B1**
180 - 90 - 60	**M1**
angle XOY = 30 degrees	**A1**

Answer: Angle XOY = 30 degrees

Question 3

CA = CB (tangents from a point are equal) so angle CAB = (180 - 42)/2 = 69 degrees	**B1**
angle OAC = 90 degrees (tangent perpendicular to radius)	**B1**
90 - 69	**M1**
angle OAB = 21 degrees	**A1**

Answer: Angle OAB = 21 degrees

Question 4

uses the alternate segment theorem	**M1**
angle KML = 79 degrees	**A1**
reason: the angle between a tangent and a chord equals the angle in the alternate segment	**B1**

Answer: Angle KML = 79 degrees

Question 5

angle KML = 90 degrees (angle in a semicircle)	**B1**
angles in a triangle add to 180: 180 - 90 - 43	**M1**
angle LKM = 47 degrees	**A1**

Answer: Angle LKM = 47 degrees

Question 6

angle at the centre is twice the angle at the circumference: 2 x 40	**M1**
angle AOB = 80 degrees	**A1**
reason: the angle at the centre is twice the angle at the circumference (standing on the same arc)	**B1**

Answer: Angle AOB = 80 degrees

Question 7

opposite angles of a cyclic quadrilateral add up to 180 degrees	**B1**
(4x - 15) + (2x + 27) = 180	**M1**
x = 28	**A1**
angle EFG = 97 degrees	**A1**

Answer: x = 28; angle EFG = 97 degrees

Question 8

OW = OX (radii), so triangle OWX is isosceles with equal base angles	**B1**
180 - 2 x 48	**M1**
angle WOX = 84 degrees	**A1**

Answer: Angle WOX = 84 degrees

Question 9

angles in the same segment are equal	**B1**
4x - 7 = 2x + 15	**M1**
x = 11	**A1**
angle PRQ = 37 degrees	**A1**

Answer: x = 11; angle PRQ = 37 degrees

Question 10

angle OLM = 90 degrees (the tangent is perpendicular to the radius)	**B1**
180 - 90 - 49	**M1**
angle OML = 41 degrees	**A1**

Answer: Angle OML = 41 degrees

Question 11

angles OWY and OXY are 90 degrees (tangent perpendicular to radius)	**B1**
angles in the quadrilateral OWYX add to 360: 360 - 90 - 90 - 46	**M1**
angle WOX = 134 degrees	**A1**

Answer: Angle WOX = 134 degrees

Question 12

uses the alternate segment theorem	**M1**
angle KML = 37 degrees	**A1**
reason: the angle between a tangent and a chord equals the angle in the alternate segment	**B1**

Answer: Angle KML = 37 degrees

Question 13

angle WYX = 90 degrees (angle in a semicircle)	**B1**
angles in a triangle add to 180: 180 - 90 - 70	**M1**
angle XWY = 20 degrees	**A1**

Answer: Angle XWY = 20 degrees

Question 14

angle at the centre is twice the angle at the circumference: 2 x 42	**M1**
angle WOX = 84 degrees	**A1**
reason: the angle at the centre is twice the angle at the circumference (standing on the same arc)	**B1**

Answer: Angle WOX = 84 degrees

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Question 15

opposite angles of a cyclic quadrilateral add up to 180 degrees	**B1**
180 - 37	**M1**
angle PSR = 143 degrees	**A1**

Answer: Angle PSR = 143 degrees

Question 16

OW = OX (radii), so triangle OWX is isosceles	**B1**
(180 - 98) / 2	**M1**
angle OWX = 41 degrees	**A1**

Answer: Angle OWX = 41 degrees

Question 17

angles in the same segment are equal	**B1**
6x + 1 = 5x + 14	**M1**
x = 13	**A1**
angle WYX = 79 degrees	**A1**

Answer: x = 13; angle WYX = 79 degrees

Question 18

angle OFG = 90 degrees (the tangent is perpendicular to the radius)	**B1**
180 - 90 - 59	**M1**
angle FOG = 31 degrees	**A1**

Answer: Angle FOG = 31 degrees

Question 19

CA = CB (tangents from a point are equal), so triangle CAB is isosceles	**B1**
(180 - 50) / 2	**M1**
angle CAB = 65 degrees	**A1**

Answer: Angle CAB = 65 degrees

Question 20

uses the alternate segment theorem	**M1**
angle PRQ = 71 degrees	**A1**
reason: the angle between a tangent and a chord equals the angle in the alternate segment	**B1**

Answer: Angle PRQ = 71 degrees

Question 21

angle KML = 90 degrees (angle in a semicircle)	**B1**
angles in a triangle add to 180: 180 - 90 - 61	**M1**
angle LKM = 29 degrees	**A1**

Answer: Angle LKM = 29 degrees

Question 22

angle at the circumference is half the angle at the centre: 128 / 2	**M1**
angle EGF = 64 degrees	**A1**
reason: the angle at the centre is twice the angle at the circumference (standing on the same arc)	**B1**

Answer: Angle EGF = 64 degrees

Question 23

opposite angles of a cyclic quadrilateral add up to 180 degrees	**B1**
180 - 49	**M1**
angle PSR = 131 degrees	**A1**

Answer: Angle PSR = 131 degrees

Question 24

angle at the circumference is half the angle at the centre: 168 / 2	**M1**
angle ACB = 84 degrees	**A1**
reason: the angle at the centre is twice the angle at the circumference (standing on the same arc)	**B1**

Answer: Angle ACB = 84 degrees

Question 25

OE = OF (radii), so triangle OEF is isosceles	**B1**
(180 - 58) / 2	**M1**
angle OEF = 61 degrees	**A1**

Answer: Angle OEF = 61 degrees

Question 26

uses the alternate segment theorem	**M1**
angle PRQ = 35 degrees	**A1**
reason: the angle between a tangent and a chord equals the angle in the alternate segment	**B1**

Answer: Angle PRQ = 35 degrees

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