

# Edexcel GCSE

## Mathematics (Linear) – 1MA0

# CIRCLE THEOREMS

### Materials required for examination

Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser.  
Tracing paper may be used.

### Items included with question papers

Nil



### Instructions

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Use black ink or ball-point pen.

Fill in the boxes at the top of this page with your name, centre number and candidate number.

Answer all questions.

Answer the questions in the spaces provided – there may be more space than you need.

Calculators may be used.

### Information

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The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.

Questions labelled with an **asterisk (\*)** are ones where the quality of your written communication will be assessed – you should take particular care on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.

### Advice

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Read each question carefully before you start to answer it.

Keep an eye on the time.

Try to answer every question.

Check your answers if you have time at the end.

1.

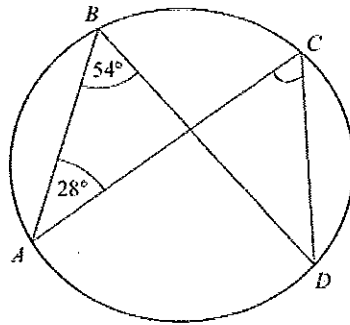


Diagram NOT accurately drawn

$A, B, C$  and  $D$  are points on the circumference of a circle.  
Angle  $ABD = 54^\circ$ .  
Angle  $BAC = 28^\circ$ .

(i) Find the size of angle  $ACD$ .

.....54..... $^\circ$

(ii) Give a reason for your answer.

.....angles from the same points (in the same segment) are equal.....

(3 marks)

2.

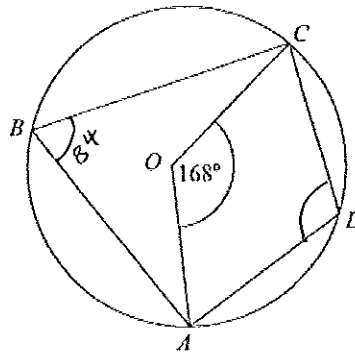


Diagram NOT accurately drawn

$A, B, C$  and  $D$  are points on the circumference of a circle, centre  $O$ .

Angle  $AOC = 168^\circ$

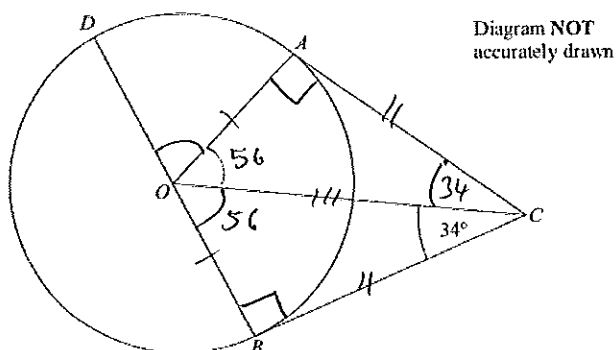
Work out the size of angle  $ADC$ .

You must give reasons for your working.

$\hat{A}BC = 84^\circ$  (Angle at centre is double angle at circumference)  
 $\hat{A}DC = 180 - 84 = 96^\circ$  (Opp. angles in cyclic quadrilateral add to  $180^\circ$ )  
.....96..... $^\circ$

(4 marks)

3.



$A, B$  and  $D$  are points on the circumference of a circle, centre  $O$ .  
 $BOD$  is a diameter of the circle.  
 $BC$  and  $AC$  are tangents to the circle.  
 Angle  $OCB = 34^\circ$ .

$$\hat{OAC} + \hat{OBC} = 90^\circ \text{ (tangent meets radius)}$$

Work out the size of angle  $DOA$ .

$$\hat{BOC} = 56^\circ \text{ (Angles in triangle add to } 180^\circ)$$

$$\hat{AOC} = \hat{BOC} \text{ (congruent triangles)}$$

$$180 - 56 - 56 = 68^\circ \text{ (Angles on a straight line = } 180^\circ)$$

.....  $68^\circ$  .....

**(4 marks)**

4.

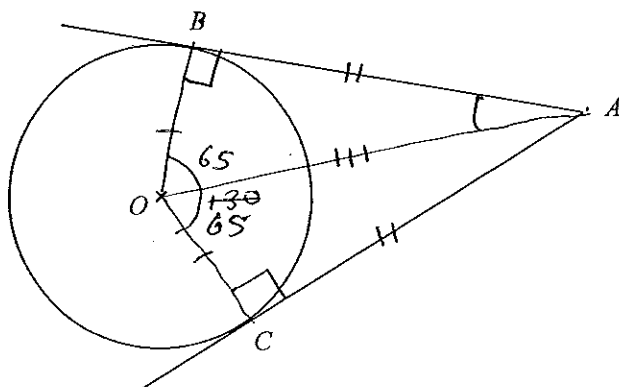


Diagram NOT accurately drawn

$B$  and  $C$  are points on a circle, centre  $O$ .  
 $AB$  and  $AC$  are tangents to the circle.  
 Angle  $BOC = 130^\circ$ .

Work out the size of angle  $BAO$ .

.....  $25^\circ$  .....

**(4 marks)**

5.

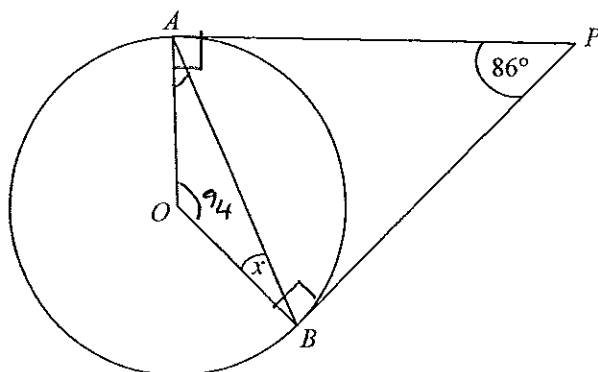


Diagram NOT accurately drawn

$A$  and  $B$  are points on the circumference of a circle, centre  $O$ .  
 $PA$  and  $PB$  are tangents to the circle.  
 Angle  $APB$  is  $86^\circ$ .

Work out the size of the angle marked  $x$ .

$$360 - 90 - 90 - 86 = 94^\circ$$

$$\frac{180 - 94}{2}$$

$$\dots\dots\dots 43^\circ$$

(3 marks)

6.

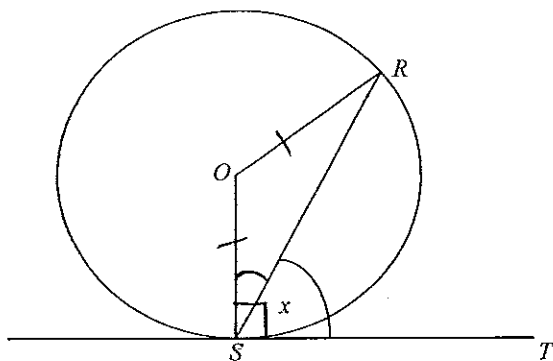


Diagram NOT accurately drawn

$R$  and  $S$  are two points on a circle, centre  $O$ .  
 $TS$  is a tangent to the circle.  
 Angle  $RST = x$ .

Prove that angle  $ROS = 2x$ .

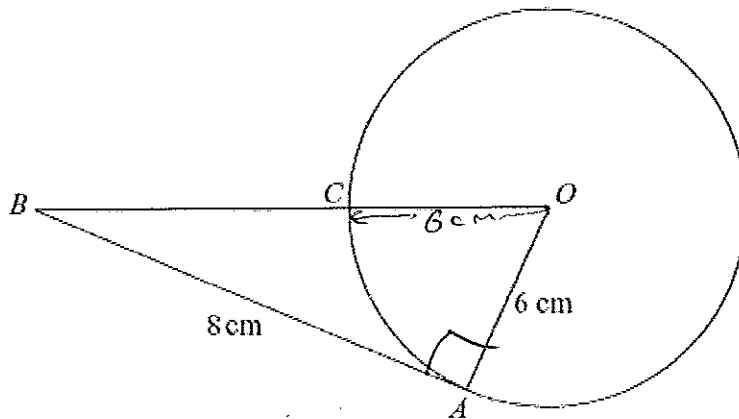
You must give reasons for each stage of your working.

$$\begin{aligned} \hat{OST} &= 90^\circ \text{ (tangent meets radius)} \\ \hat{OSR} &= 90 - x \\ \hat{ORS} &= 90 - x \text{ (isosceles triangle)} \\ ROS &= 180 - (90 - x) - (90 - x) \\ &= 180 - 90 + x - 90 + x \\ &= \underline{2x} \text{ (Angles in a triangle add up to } 180^\circ) \end{aligned}$$

(4 marks)

7.

Diagram NOT  
accurately drawn



In the diagram,  $O$  is the centre of the circle.  
 $A$  and  $C$  are points on the circumference of the circle.  
 $BCO$  is a straight line.  
 $BA$  is a tangent to the circle.

$AB = 8$  cm.  
 $OA = 6$  cm.

(a) Explain why angle  $OAB$  is a right angle.

..... Where a tangent meets a radius is  $90^\circ$  .....

..... (1)

(b) Work out the length of  $BC$ .

$$OB^2 = 6^2 + 8^2$$
$$OB^2 = 100$$
$$OB = \sqrt{100} = 10 \text{ cm}$$

$$10 - 6 = 4$$

..... 4 ..... cm  
(3)

(4 marks)

8.

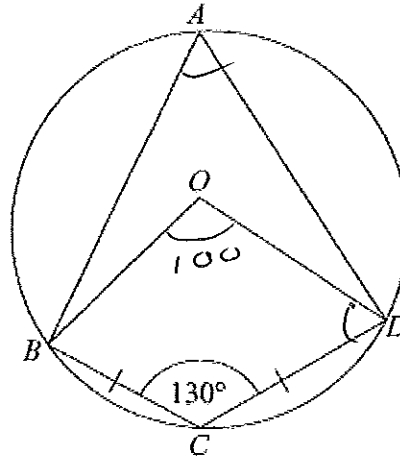


Diagram NOT  
accurately drawn

$A, B, C$  and  $D$  are points on a circle, centre  $O$ .  
 $BC = CD$ .  
 Angle  $BCD = 130^\circ$ .

- (a) Write down the size of angle  $BAD$ .  
 Give a reason for your answer.

opposite angles in a cyclic quadrilateral  
 add up to  $180^\circ$

.....50..... $^\circ$   
 (2)

- (b) Work out the size of angle  $ODC$ .  
 Give reasons for your answer.

$\hat{BOD} = 100^\circ$  (angle at centre is double angle  
 at circumference)

$$\frac{360 - 100 - 130}{2} = 65$$

angles in quadrilateral  
 add up to  $180^\circ$

$$\angle OCB = \angle ODC$$

.....65..... $^\circ$   
 (4)

(6 marks)

9.

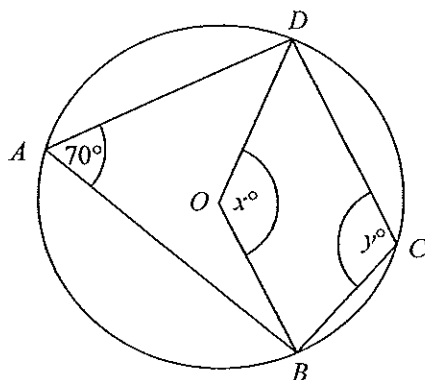


Diagram NOT accurately drawn

In the diagram,  $A$ ,  $B$ ,  $C$  and  $D$  are points on the circumference of a circle, centre  $O$ .

Angle  $BAD = 70^\circ$ .

Angle  $BOD = x^\circ$ .

Angle  $BCD = y^\circ$ .

(a) (i) Work out the value of  $x$ .

$$x = \dots\dots\dots 140 \dots\dots\dots$$

(ii) Give a reason for your answer.

.....angle at centre is double the angle at.....  
.....the circumference.....

(2)

(b) (i) Work out the value of  $y$ .

$$y = \dots\dots\dots 110 \dots\dots\dots$$

(ii) Give a reason for your answer.

.....opposite.....angles.....in.....a.....cyclic.....  
.....quadrilateral.....add.....up.....to..... $180^\circ$ .....

(2)

(4 marks)

10.

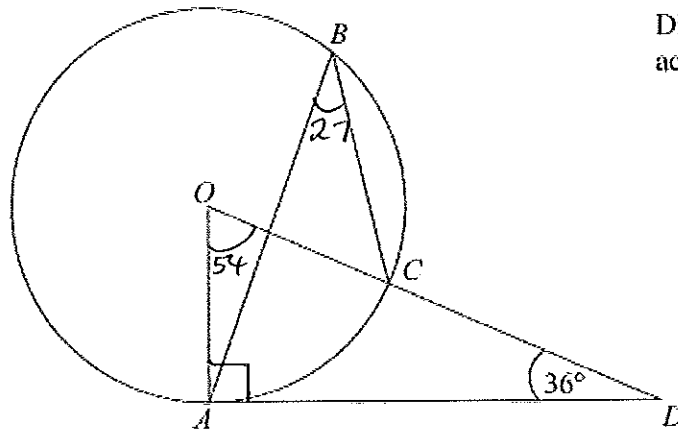


Diagram NOT accurately drawn

The diagram shows a circle centre  $O$ .  
 $A$ ,  $B$  and  $C$  are points on the circumference.

$DCO$  is a straight line.  
 $DA$  is a tangent to the circle.

Angle  $ADO = 36^\circ$

(a) Work out the size of angle  $AOD$ .

.....54.....<sup>o</sup>  
 (2)

(b) (i) Work out the size of angle  $ABC$ .

.....27.....<sup>o</sup>

(ii) Give a reason for your answer.

.....the angle at the circumference is half.....  
 .....the angle at the centre.....  
 .....

(3)  
 (4 marks)



11.

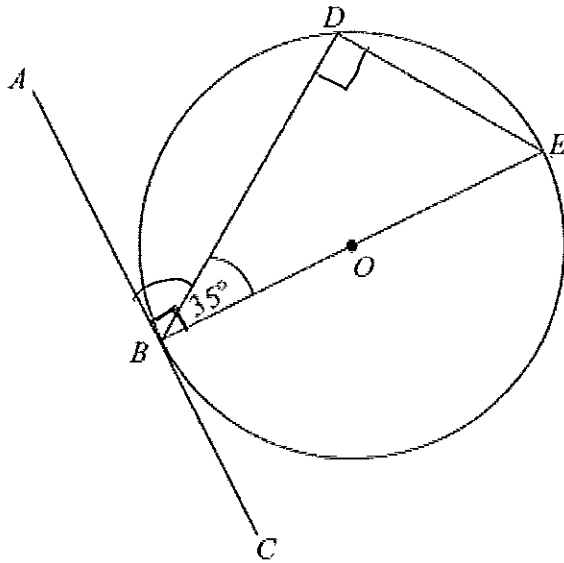


Diagram NOT  
accurately drawn

$B, D$  and  $E$  are points on a circle centre  $O$ .  
 $ABC$  is a tangent to the circle.  
 $BE$  is a diameter of the circle.  
Angle  $DBE = 35^\circ$ .

(a) Find the size of angle  $ABD$ .

Give a reason for your answer.

where a tangent meets a radius it is  
a  $90^\circ$  angle

.....55.....<sup>o</sup>  
(2)

(b) Find the size of angle  $DEB$ .

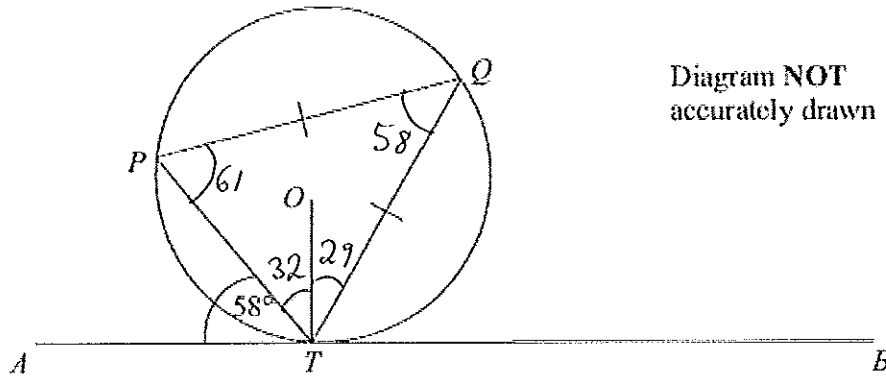
Give a reason for your answer.

Alternate segment theorem.

.....55.....<sup>o</sup>  
(2)

**(4 marks)**

12.



$P$ ,  $Q$  and  $T$  are points on the circumference of a circle, centre  $O$ .  
The line  $ATB$  is the tangent at  $T$  to the circle.

$PQ = TQ$ .  
Angle  $ATP = 58^\circ$ .

Calculate the size of angle  $OTQ$ .  
Give a reason for each stage in your working.

$$\hat{PQT} = 58^\circ \quad (\text{Alternate segment theorem})$$

$$OTQ = 32^\circ \quad \text{tangent meets radius at } 90^\circ \text{ angle}$$

$$90 - 58 = 32$$

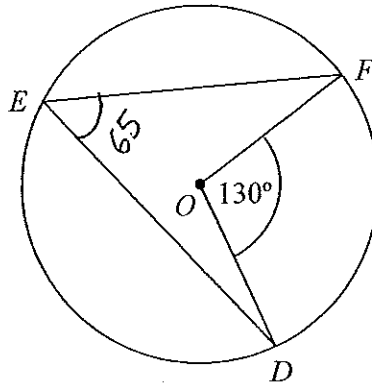
$$\hat{QPT} \text{ and } \hat{QTP} = 61^\circ \quad (\text{angles in triangle add to } 180, \text{ angles at base of isosceles triangle are equal})$$

$$OTQ = 29^\circ \quad (61 - 32)$$

.....29.....°

(4 marks)

13. (a)



$D, E$  and  $F$  are points on the circumference of a circle, centre  $O$ .  
Angle  $DOF = 130^\circ$ .

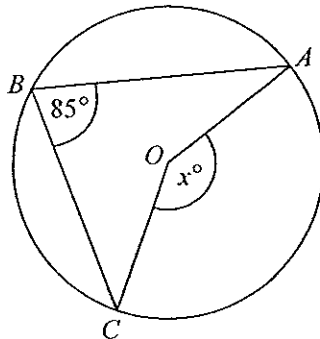
(i) Work out the size of angle  $DEF$ .

.....  $65^\circ$  .....

(ii) Give a reason for your answer.

..... angle at circumference is half  
..... angle at centre .....

(2)



(b)

In the diagram,  $A, B$  and  $C$  are points on the circumference of a circle, centre  $O$ .  
Angle  $ABC = 85^\circ$ .

(i) Work out the size of the angle marked  $x^\circ$ .

.....  $170^\circ$  .....

(ii) Give a reason for your answer.

..... angle at centre is double angle at  
..... circumference .....

(2)

(4 marks)

\*14.

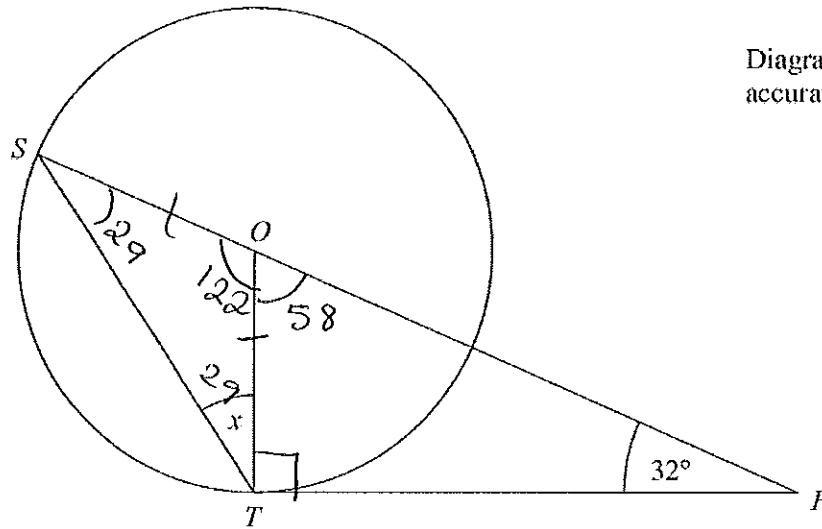


Diagram NOT  
accurately drawn

$S$  and  $T$  are points on the circumference of a circle, centre  $O$ .  
 $PT$  is a tangent to the circle.  
 $SOP$  is a straight line.

Angle  $OPT = 32^\circ$ .

Work out the size of the angle marked  $x$ .  
Give reasons for your answer.

$$\begin{aligned}\hat{T}OP &= 58^\circ && \text{(Angles in a triangle add up to } 180^\circ) \\ \hat{O}TP &= 90^\circ && \text{(Tangent meets radius)} \\ \hat{S}OT &= 122^\circ && \text{(Angles on a straight line add up} \\ &&& \text{to } 180^\circ) \\ \hat{O}TS &= 29^\circ && \text{(Angles at base of isosceles triangle are} \\ &&& \text{equal)}\end{aligned}$$

.....°

(Total 5 marks)