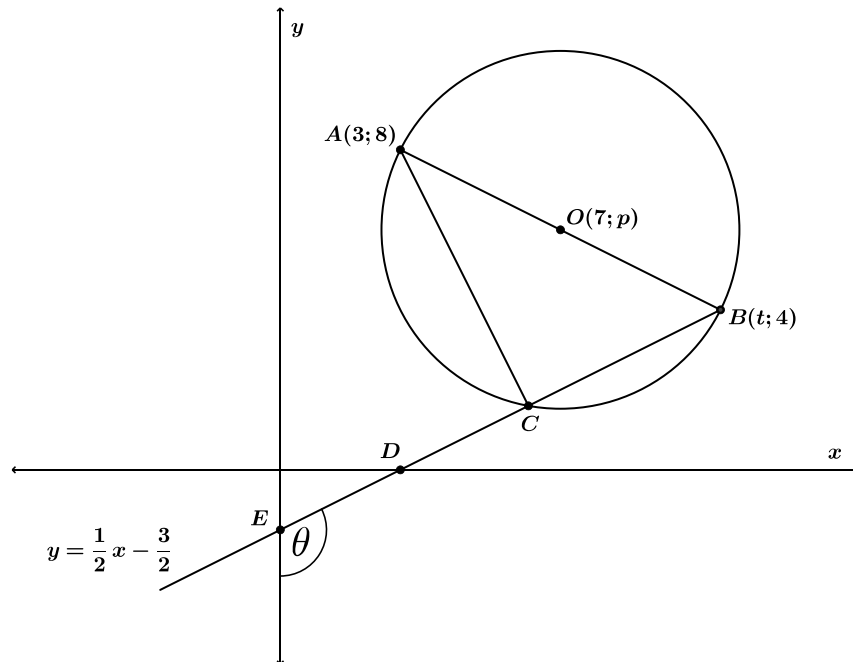




## SECTION A

## QUESTION 1

- (a) In the diagram,  $AB$  is the diameter of the circle with centre  $O(7; p)$ .  $A(3; 8)$ ,  $B(t; 4)$  and  $C$  lie on the circle. The straight line  $BCDE$  has equation  $y = \frac{1}{2}x - \frac{3}{2}$ , with  $D$  on the  $x$ -axis and  $E$  on the  $y$ -axis. The angle  $\theta$  is shown.



- (1) Determine the values of  $p$  and  $t$ .

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(2)

- (2) Show that  $D$  lies vertically below  $A$ .

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(3)

- (3) Write down, giving a reason, the size of angle  $\hat{A}CB$  and hence determine the equation of line  $AC$ .

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(5)

- (4) Determine, correct to one decimal digit, the size of  $\theta$ .

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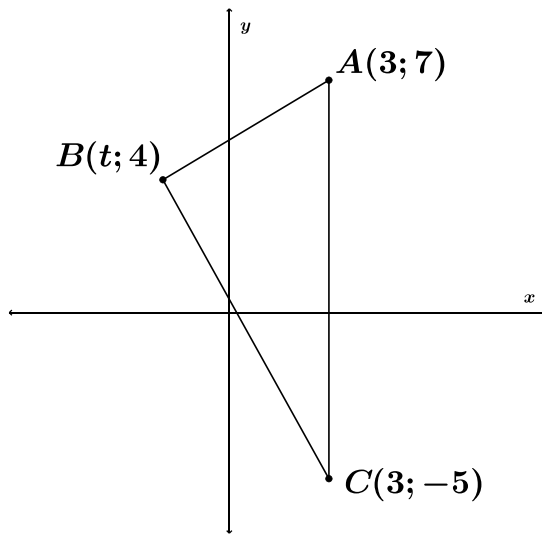
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(3)

- (b)  $A(3; 7)$ ,  $B(t; 4)$  and  $C(3; -5)$  are points in the Cartesian plane.



- (1) If  $BC = \sqrt{106}$ , show that  $t = -2$ .

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(4)

- (2) Hence determine the area of  $\triangle ABC$ .

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(3)

[20]

**QUESTION 2****PLEASE ENSURE THAT YOUR CALCULATOR IS IN DEGREE MODE**

- (a) (1) Prove the following identity:  $\frac{\sin 2\theta}{1 + \cos 2\theta} = \tan \theta$

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(4)

- (2) Hence, or otherwise, determine the values of  $\theta \in [0^\circ; 360^\circ]$  for which  $\frac{1 + \cos 2\theta}{\sin 2\theta}$  is undefined.

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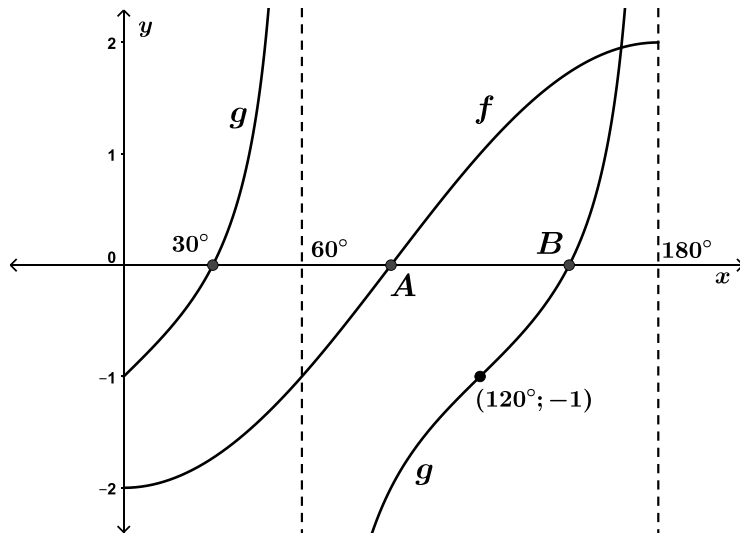
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(4)



- (d) The graph shows the curves of  $f(x) = a \cos x$  and  $g(x) = \tan(bx) + c$  for  $x \in [0^\circ; 180^\circ]$ .



- (1) Find the values of  $a$ ,  $b$  and  $c$ .

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(3)

- (2) Write down the co-ordinates of points  $A$  and  $B$ .

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(2)

- (3) For what values of  $x$  is  $f(x) \cdot g(x) < 0$ ?

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(2)

- (4) If  $f$  was a representation of a sine curve, write down a possible equation to define  $f$ .

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(2)

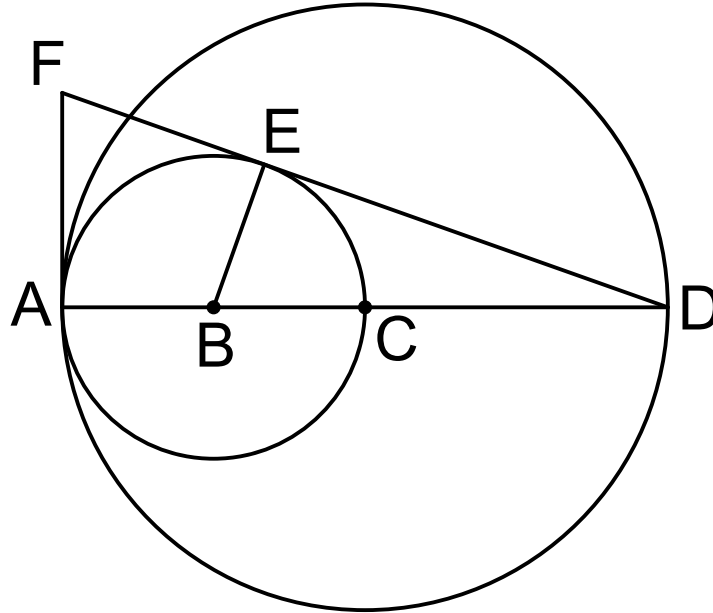
[25]







- (c) In the diagram, AD is a diameter of the larger circle with centre C and AC is the diameter of the smaller circle with centre B. FD is a tangent to the smaller circle at E while FA is a tangent to both circles at A.



- (1) Prove that  $\triangle DEB \sim \triangle DAF$ .

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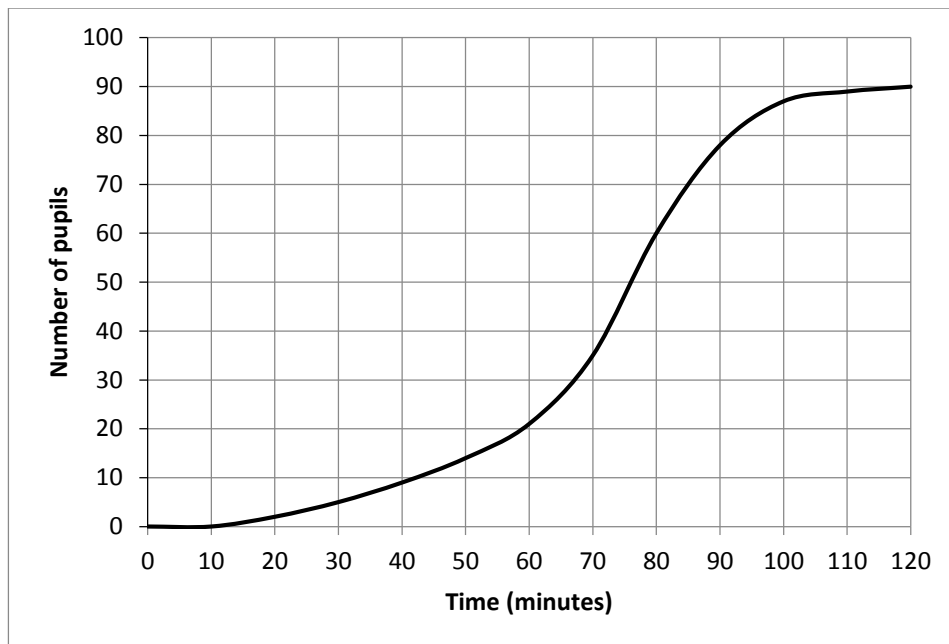
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(4)



**QUESTION 4**

A group of Matric pupils wrote a Maths test and were asked to indicate how long they had spent preparing for the test the previous day. The data is presented below as an ogive.



- (a) How many pupils wrote the test?

\_\_\_\_\_ (1)

- (b) How many pupils spent more than an hour preparing for the test?

\_\_\_\_\_ (1)

- (c) Use the ogive to estimate the lower quartile, median and upper quartile.

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\_\_\_\_\_

\_\_\_\_\_ (3)

- (d) If it is further given that the shortest and longest times spent preparing for the test were 15 min and 120 min respectively, describe the skewness of the time distribution. Explain your answer.

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(2)

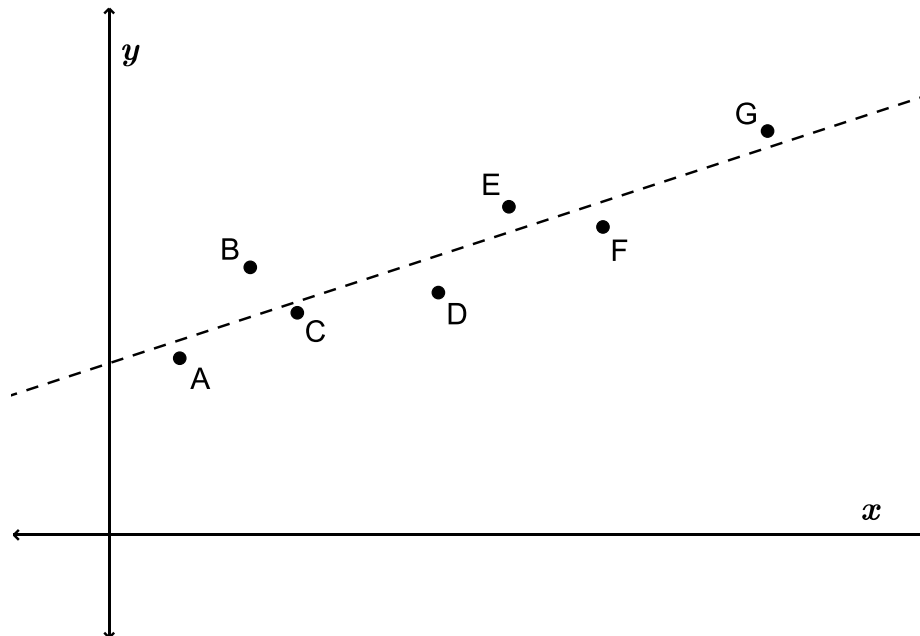
[7]

**75 marks**

## SECTION B

## QUESTION 5

- (a) The graph below shows the points  $A(3; 35)$ ,  $B(6; 53)$ ,  $C(8; 44)$ ,  $D(14; 48)$ ,  $E(17; 65)$ ,  $F(21; 61)$  and  $G(28; 80)$ . The dotted line represents the line of best fit,  $y = ax + b$ .



- (1) Determine the values of  $a$  and  $b$ .

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(3)

- (2) Calculate the correlation coefficient and comment on the validity of the line of best fit.

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(2)

- (3) Point H is added to the data, causing the value of  $a$  to decrease. Clearly indicate on the graph a possible position for point H.

(1)

- (4) Point I is added to the data, causing no change to the values of either  $a$  or  $b$ . Clearly indicate on the graph a possible position for point I.

(1)

- (b) In order to evaluate a point ( $x_i$ ) in terms of its relative standing to the rest of the data, we calculate its z-score. The z-score gives the number of standard deviations the data point ( $x_i$ ) is from the mean.

$$z = \frac{x_i - \bar{x}}{\sigma}$$

- (1) Explain why a negative z-score indicates that the data point is to the left of the mean.

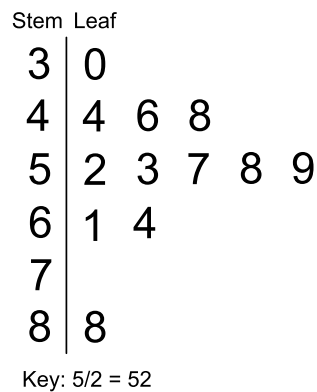
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(1)

- (2) Consider the following stem-and-leaf plot:



Calculate the z-score of the highest data point, and interpret your answer.

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(6)

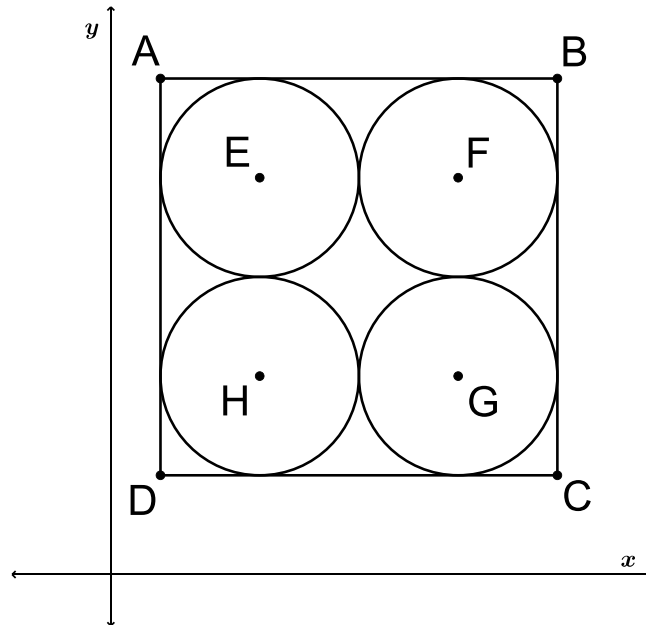






**QUESTION 7**

- (a) Four identical circles (with centres E, F, G and H) just touch each other as well as the sides of square ABCD as shown. The circle with centre **H** has equation  $x^2 + y^2 - 6x - 8y + 21 = 0$ .



- (1) Determine the equation of the circle with centre **F**.

Give your answer in the form  $(x - a)^2 + (y - b)^2 = r^2$ .

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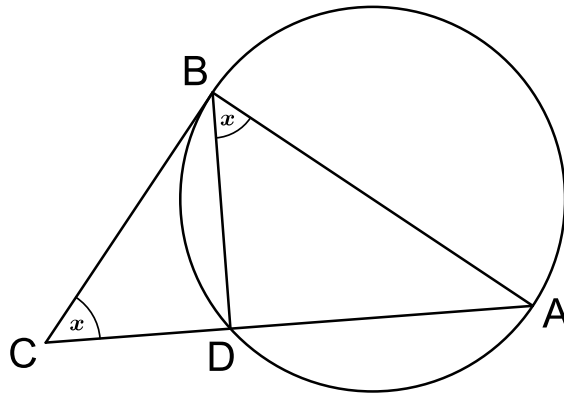




**QUESTION 8**

(a) In the diagram:

- A, B and D lie on the circle
- BC touches the circle at B
- $\hat{C} = \hat{ABD} = x$
- CDA is a straight line



Prove that AB is a diameter of the circle.

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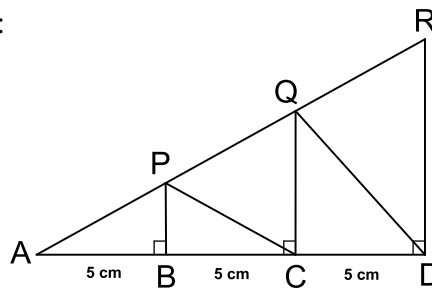
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(5)

(b) Consider the following diagram:



Prove that PC is not parallel to QD.

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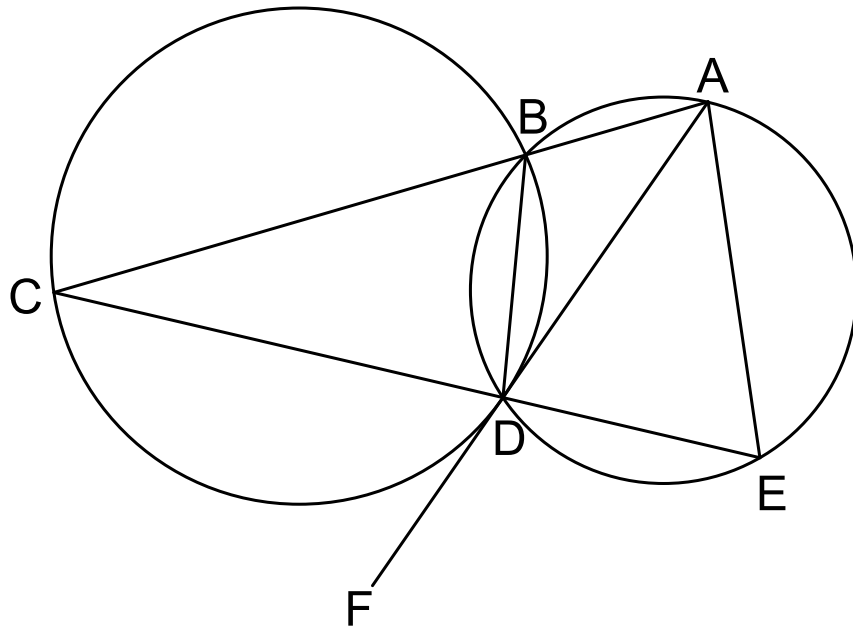
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(3)



- (d) In the diagram below,  $ADF$  is a tangent to the larger circle, passing through  $B$ ,  $C$  and  $D$ , at  $D$ .  $CBA$  and  $CDE$  are straight lines with  $A$  and  $E$  on the smaller circle.  $BD$  is a common chord.



Prove that  $AD = AE$ .

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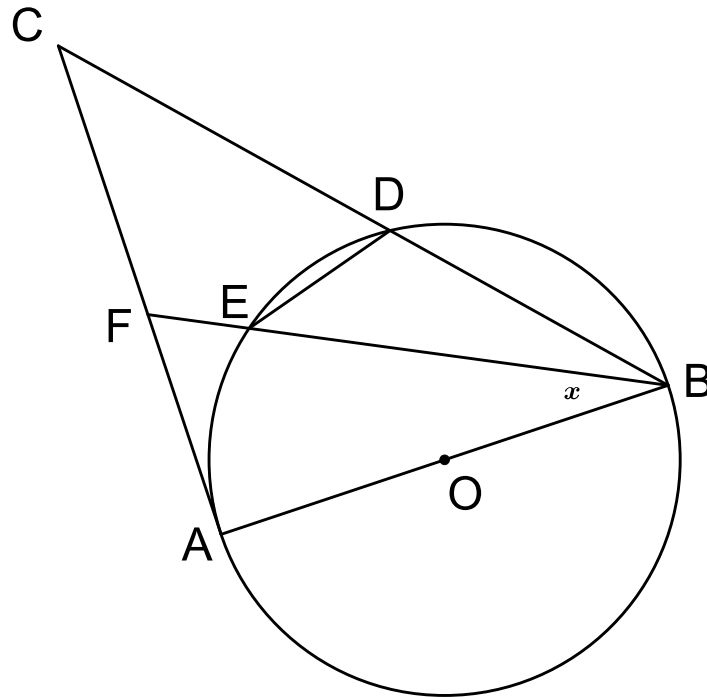


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- (e) In the diagram,  $AB$  is a diameter of the circle.  $CA$  is a tangent to the circle at  $A$ . Chord  $BE$  produced meets the tangent at  $F$ .  $\widehat{FBA} = x$ .



Prove, giving reasons, that  $CDEF$  is a cyclic quadrilateral.

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(5)

[23]







