



MATHEMATICS: PAPER II

Time: 3 hours

150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 13 pages, an Answer/Diagram Booklet of 9 pages (i – ix) and an Information Sheet of (i) page. Please check that your paper is complete.
 2. Answer Questions 3, 6, 10 and 12 on the Answer Booklet/Diagram Booklet.
 3. Read the questions carefully.
 4. Answer **all** the questions
 5. Please note that diagrams are not necessarily drawn to scale.
 6. A diagram sheet is provided. Any changes made to a diagram must be shown on this sheet and not on the question paper.
 7. Number your answers exactly as the questions are numbered.
 8. You may use an approved non-programmable and non-graphical calculator, unless otherwise stated.
 9. Ensure that your calculator is in DEGREE mode.
 10. Round off your answers to **one decimal digit** where necessary, unless otherwise indicated.
 11. All necessary working details must be clearly shown.
 12. It is in your own interest to write legibly and to present your work neatly.
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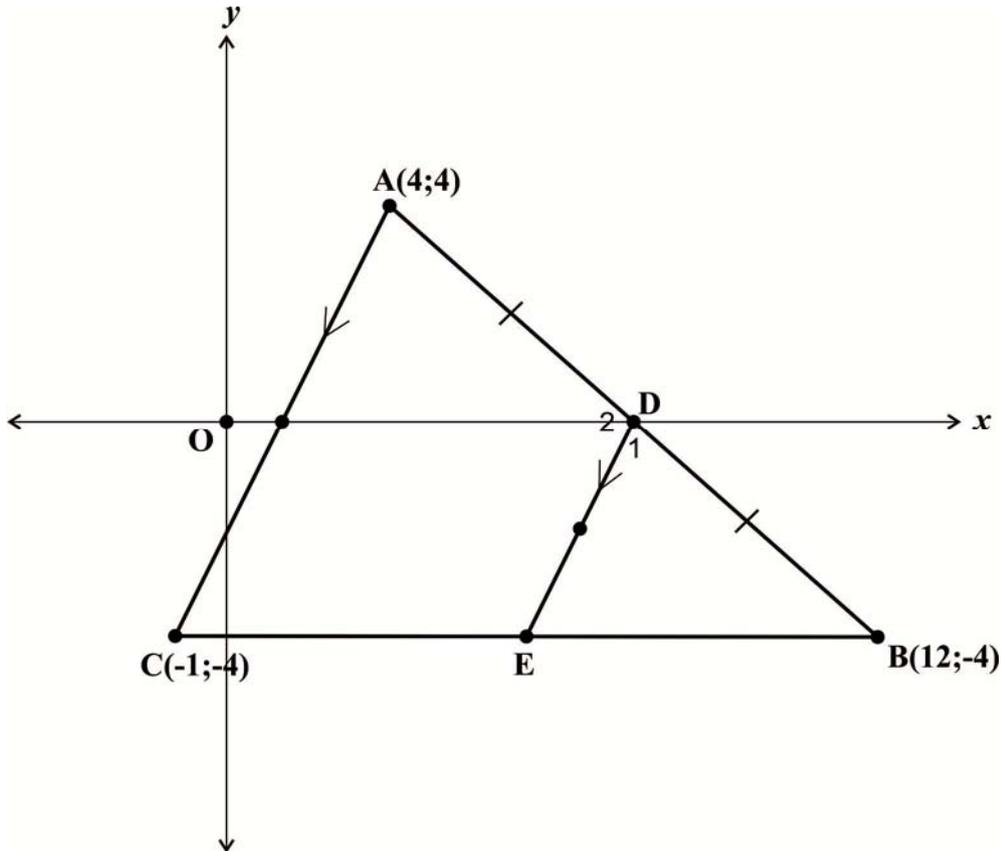
SECTION A

QUESTION 1

In the diagram below, the coordinates of $A(4; 4)$, $B(12; -4)$ and $C(-1; -4)$ are given.

$AC \parallel DE$ and CEB is a straight line.

D is the midpoint of AB .



Determine:

- (a) the length of AB . Give answer correct to one decimal digit. (2)
- (b) the coordinates of D , the midpoint of AB . (2)
- (c) the equation of the line DE . (4)
- (d) the coordinates of E . (3)

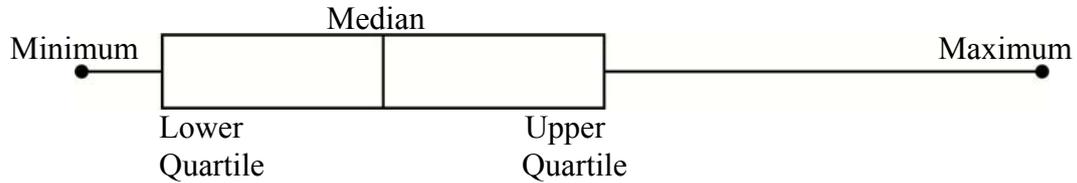
[11]

QUESTION 2

The data below represents the number of candidates who achieved a university entrance in Africa over the last 17 years.

61 889 49 950 42 310 45 186 31 386 30 431 23 010 20 931
 29 940 24 020 13 002 9 938 9 480 7 108 6 336 6 096
 4 714

- (a) Determine the range of the data. (1)
- (b) Determine the median. (1)
- (c) Write down the five number summary of the data. (5)
- (d) Determine the interquartile range. (1)
- (e) If a value in the data set is less than $Q_1 - (1,5 \times IQR)$ or greater than $Q_3 + (1,5 \times IQR)$, then that value is an outlier. Show that there are no outliers in this data set. (4)
- (f) In the diagram below, the box and whisker diagram summarises the data.



Would you describe the data as symmetric, positively or negatively skewed? Justify.

(2)
[14]

QUESTION 3

Answer this question in the Answer/Diagram Booklet.

The following table shows the heartbeat per minute of 100 adults of between the ages 20 to 60.

Heart beats per minute Intervals	Number of individuals	Cumulative Frequency
51 – 60	4	(i)
61 – 70	18	(ii)
71 – 80	26	(iii)
81 – 90	32	(iv)
91 – 100	6	(v)
101 – 110	7	(vi)
111 – 120	2	(vii)
121 – 130	5	(viii)

- (a) Write down the cumulative frequency represented by numbers (i) – (viii). (2)
- (b) Draw an ogive (cumulative frequency) curve to represent the data. (6)
- (c) Show on your graph where you would read off:
- (1) The median (use the letter A) (1)
- (2) The 75th percentile (use the letter B) (1)

[10]

QUESTION 4**PLEASE ENSURE YOUR CALCULATOR IS IN DEGREE MODE.**(a) If $t = 134,5^\circ$ and $u = 32,5^\circ$ calculate correct to three decimal digits, the value of:

(1) $\sin t + \cos u$ (1)

(2) $\frac{\cos^2 t + \sin^2 t}{\tan u}$ (2)

(b) Given: $\sin \theta = \frac{2}{5}$ and $\theta \in (90^\circ; 270^\circ)$.Without the use of a calculator determine $\cos \theta$ (leave your answer in surd form). (3)

(c) Simplify:

$$\frac{\sin(90^\circ - \theta) \cdot \tan(-\theta) \cdot \cos(\theta + 180^\circ)}{\cos(1080^\circ + \theta) \cdot \cos(90^\circ + \theta)}$$
 (6)

(d) Solve for θ :

$$3 \tan \theta = \sqrt{3} \quad \text{for } \theta \in [0^\circ; 360^\circ]$$
 (2)

(e) Simplify to a single trigonometric ratio for $\theta \in [0^\circ; 90^\circ]$:

$$\sqrt{(1 - \sin \theta)(1 + \sin \theta)}$$
 (3)

(f) Prove that:

$$\frac{\tan x - \sin x \cdot \cos x}{\sin x \cdot \cos x} = \tan^2 x$$
 (5)

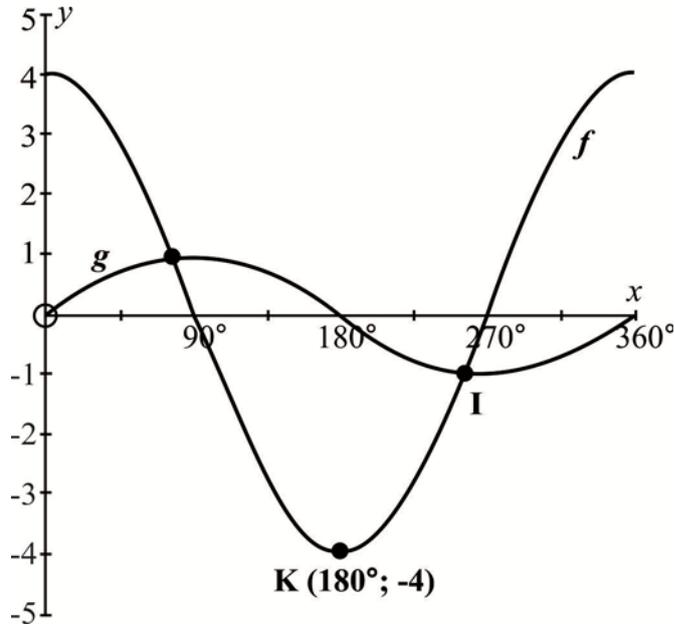
[22]

QUESTION 5

In the diagram, the graphs of f and g are drawn.

$$f(x) = a \cos x \text{ and } g(x) = \sin bx, \quad x \in [0^\circ; 360^\circ]$$

$I(x; y)$ is a point of intersection of the graphs.

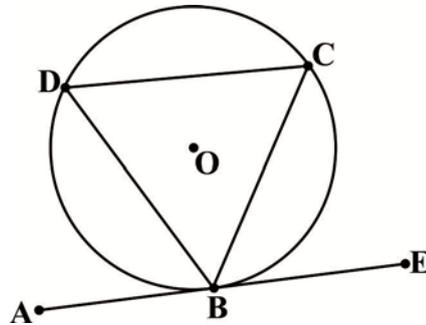


- (a) Determine the value of a and b . (2)
 - (b) Write down the range of f . (1)
 - (c) Determine the coordinate of I rounded off to two decimal digits. (4)
- [7]**

QUESTION 6

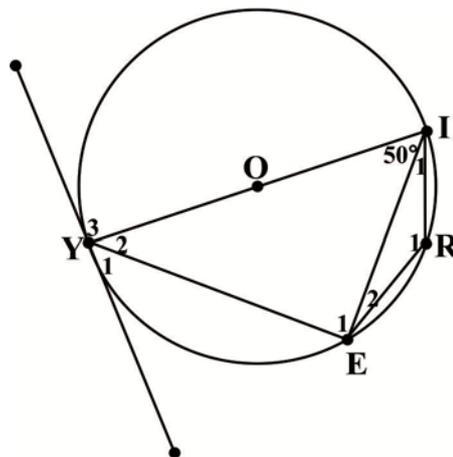
Answer this question in the Answer/Diagram Booklet.

- (a) Prove the theorem that states that the acute angle formed between a tangent and chord is equal to the angle in the opposite segment.



(6)

- (b) In the diagram O is the centre of the circle and $\hat{YIE} = 50^\circ$.



Determine, with the reasons, the size of the following angles:

- (1) \hat{Y}_1
- (2) \hat{E}_1
- (3) \hat{Y}_3
- (4) \hat{Y}_2
- (5) \hat{R}_1

(10)

[16]

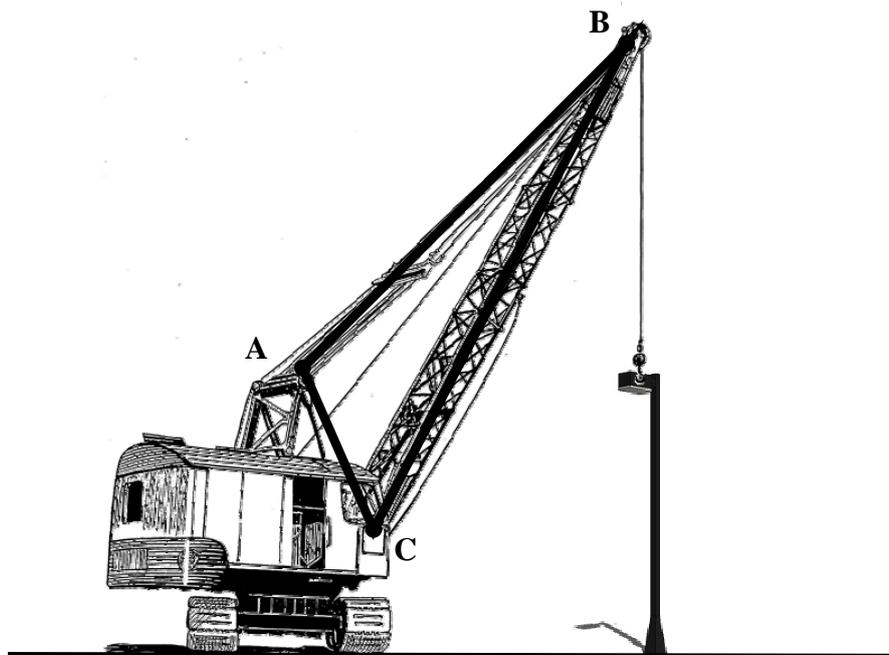
80 marks

SECTION B

QUESTION 7

(a) The diagram represents a small crane lifting a light pole.

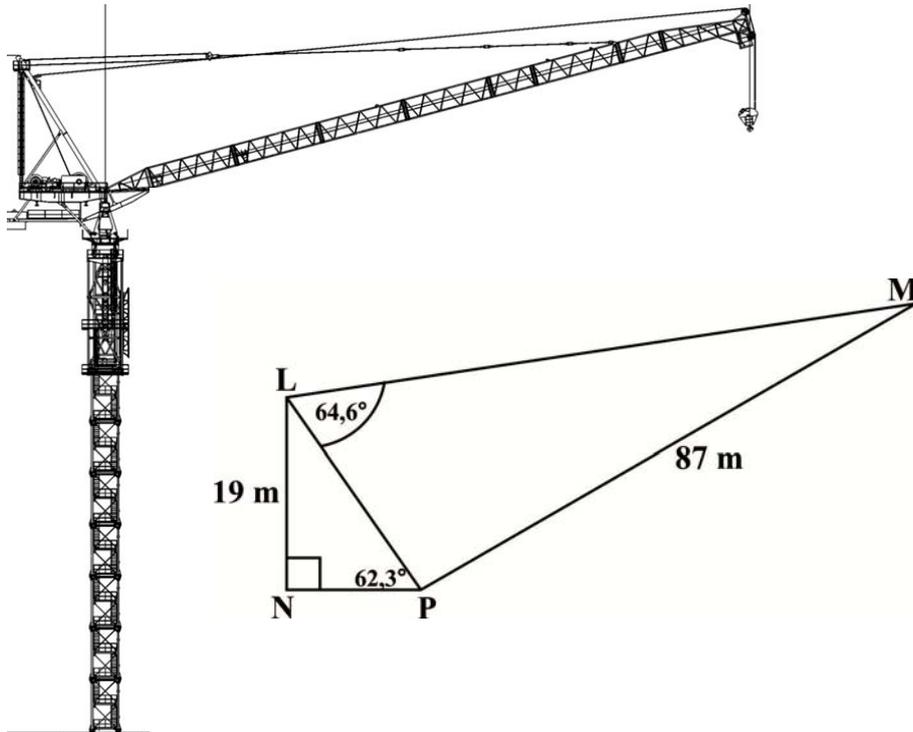
$AC = 1,5$ metres, $AB = 2,2$ metres and $BC = 2,9$ metres.



Determine \hat{A} , \hat{B} and \hat{C} , correct to one decimal digit.

(7)

- (b) The diagram LNPQM represents a section of a construction crane.
 $LN = 19$ metres, $PM = 87$ metres, $\angle LPN = 62,3^\circ$ and $\angle PLM = 64,6^\circ$



- (1) Determine \hat{M} , correct to one decimal digit. (5)
- (2) Calculate the area of $\triangle LMP$, correct to the nearest whole number. (3)
- [15]**

QUESTION 8

If $3 \sin 2\theta = \tan 56,35^\circ$, determine:

- (a) the general solution for the equation. (6)
- (b) the values of θ that satisfy the equation if $0^\circ < \theta < 360^\circ$. (2)
- [8]**

QUESTION 9

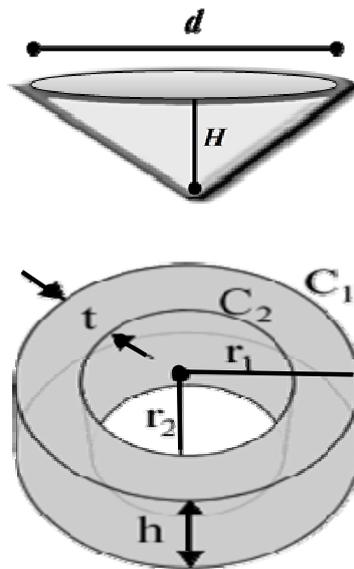
The diagram represents a design that a chocolate factory wishes to use.

The diameter (d) of the cone is 40 mm and its height (H) is 50 mm.

The cylinder (C_1) has radius (r_1) = 35 mm.

The cylinder (C_2) has radius (r_2) = 25 mm.

The height of the cylinder (h) = 10 mm.



Determine the total volume of chocolate required for each chocolate model.

(Leave answers in terms of π)

NB: Volume of a cone = $\frac{1}{3} \times \text{Area of base} \times \text{height}$

Volume of cylinder = $\pi r^2 h$

(8)
[8]

QUESTION 10

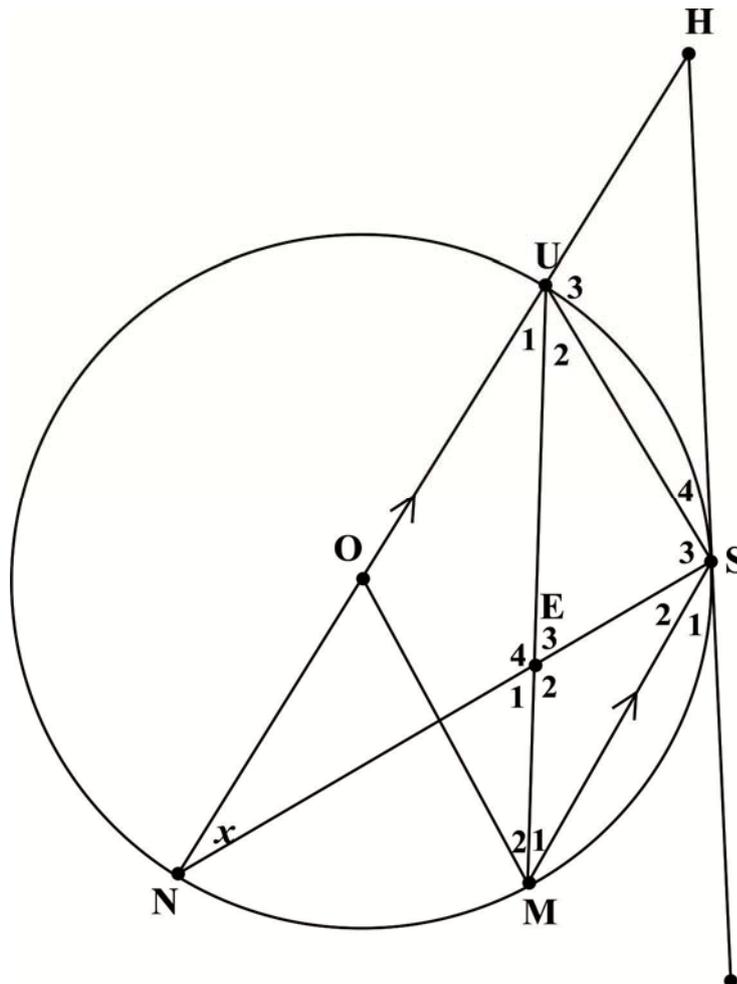
Answer this questions in the Answer/Diagram Booklet.

In the diagram, HS is a tangent to the circle with centre O at S.

N, U, S and M are points on a circle.

NOUH is a straight line. UM and NS intersect at E.

$\widehat{SM/NH}$ and $\widehat{SNU} = x$.



(a) Find, with reasons, five other angles each equal to x . (5)

(b) Prove that MU is a tangent to the circle passing through points S, H and U. (6)

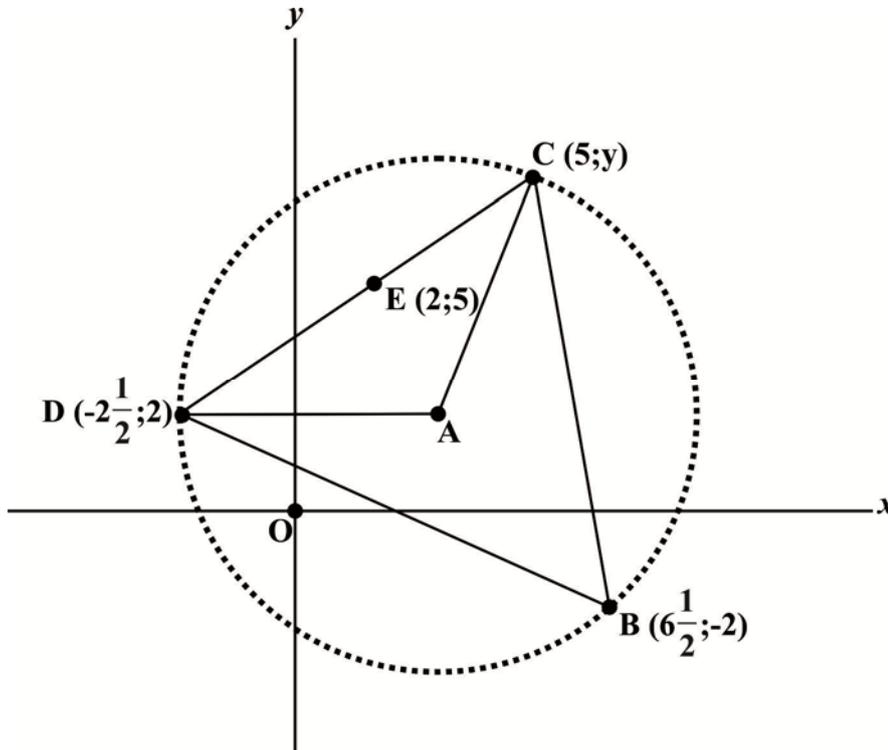
[11]

QUESTION 11

In the diagram, the coordinates $B(6\frac{1}{2}; -2)$; $C(5; y)$; $D(-2\frac{1}{2}; 2)$ and $E(2; 5)$ are given.

DE is produced to C.

If B, C and D are points on a circle:



- (a) Determine the y-coordinate of C. (6)
 - (b) Use analytical methods to calculate \hat{B} , correct to one decimal digit. (7)
- [13]**

QUESTION 12

Answer this question in the Answer/Diagram Booklet.

Diagram (1) represents 3 pulleys that need to be positioned to ensure effective movement of a conveyer belt.

Diagram (2) is a diagrammatic representation of Diagram (1).

$\hat{BAC} = x.$

D, E and F are the centres of their respective circles.

GH is a common tangent to circles D and E.

IJ is a common tangent to circles D and F.

Radii $BD = DC = p$ cm, radius $EK = q$ cm and radius $LF = q$ cm.

$GH \parallel IJ$ and $BC \parallel EF$.

MDN, EBD and FCD are straight lines.



Figure 1

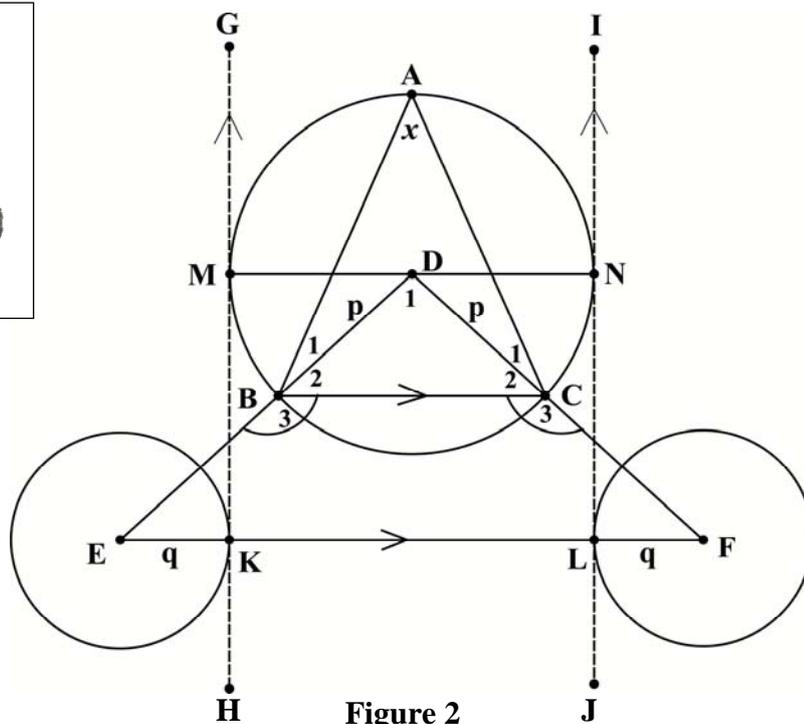


Figure 2

- (a) Determine the size of \hat{E} in terms of x . (6)
- (b) Prove that BCFE is a cyclic quadrilateral. (4)
- (c) Write down the length of EF in terms of p and q . (1)
- (d) Prove that $DE = \frac{2p \cdot \cos x + 2q \cdot \cos x}{\sin 2x}$. (4)

[15]

70 marks

Total: 150 marks