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TOTAL MARKS

INTERNATIONAL SECONDARY CERTIFICATE EXAMINATION
MAY 2025

MATHEMATICS: PAPER II

EXAMINATION NUMBER

Time: 3 hours

150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 25 pages and an information sheet of 2 pages (i–ii). Please check that your question paper is complete.
2. Read the questions carefully.
3. **Answer ALL the questions on the question paper and hand it in at the end of the examination. Remember to write your examination number in the space provided on the question paper.**
4. Diagrams are not necessarily drawn to scale.
5. You may use an approved non-programmable and non-graphical calculator unless otherwise stated.
6. Ensure that your calculator is in **DEGREE** mode.
7. Clearly show **ALL** calculations, diagrams, graphs, etc. that you have used in determining your answers. **Answers only will NOT necessarily be awarded full marks.**
8. Round off to **two decimal places** where needed unless otherwise stated.
9. It is in your own interest to write legibly and to present your work neatly.
10. Two blank pages (pages 24 and 25) are included at the end of the question paper. Use these pages if you run out of space for a question. Clearly indicate the number of the question you are answering should you use this additional space.

FOR OFFICE USE ONLY: MARKER TO ENTER MARKS

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	TOTAL
9	11	9	13	17	8	12	6	4	14	12	11	15	9	150

IS12MATH-2-E

SECTION A

QUESTION 1

Bonolo conducted a survey on the distance the different teams at the Paris Olympic games (2024) travel from the hotels to get to the stadium on a specific day and their corresponding petrol use in rands.

Distance to stadium (km)	12	11	8	15	9	18	7	10
Petrol (R)	1 400	1 000	850	1 600	1 600	2 200	700	1 100

(a) Determine the correlation coefficient rounded to three decimal places and comment on the relationship between the amounts spent on petrol and the distance each team travels to the stadium. (3)

(b) Determine the equation of the line of regression. (Round answers to two decimal places.) (2)

(c) Estimate the cost of petrol if a team lives 13 km from the stadium. (2)

(d) Is your answer in (c) reliable or not? Give a reason for your answer. (2)

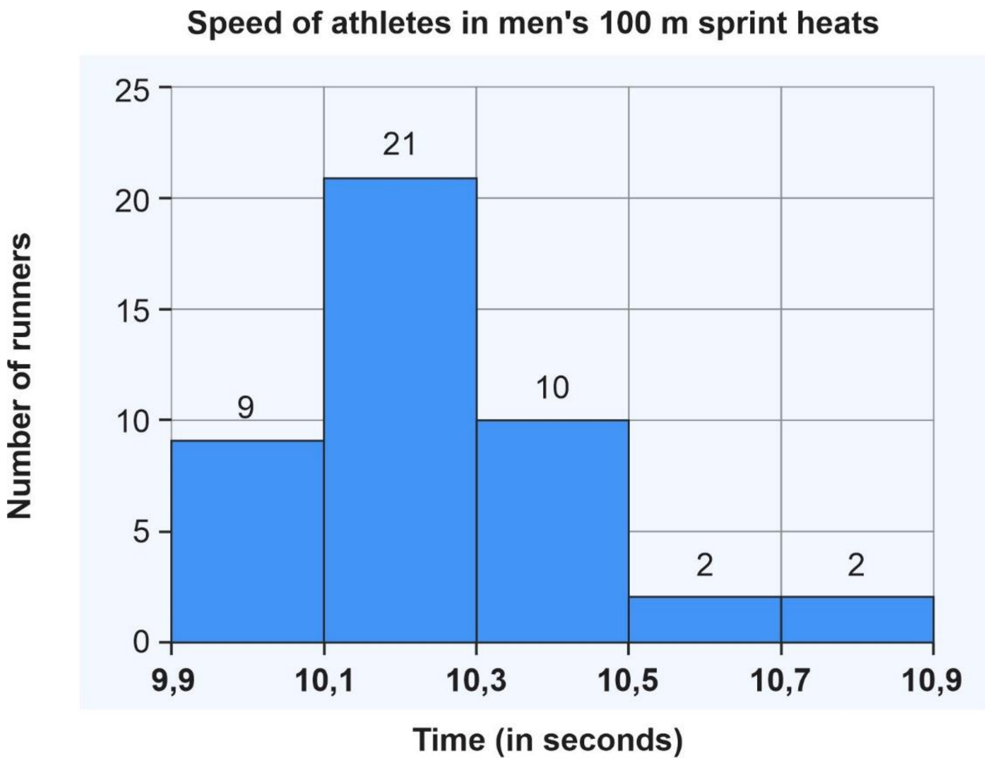
[9]

QUESTION 2

At the 2017 IAAF World Athletics Championships in London, 44 runners completed the men's 100 m sprint heats.

The time taken by the slowest runner was 10,75 seconds and the time of the fastest runner was 9,99 seconds.

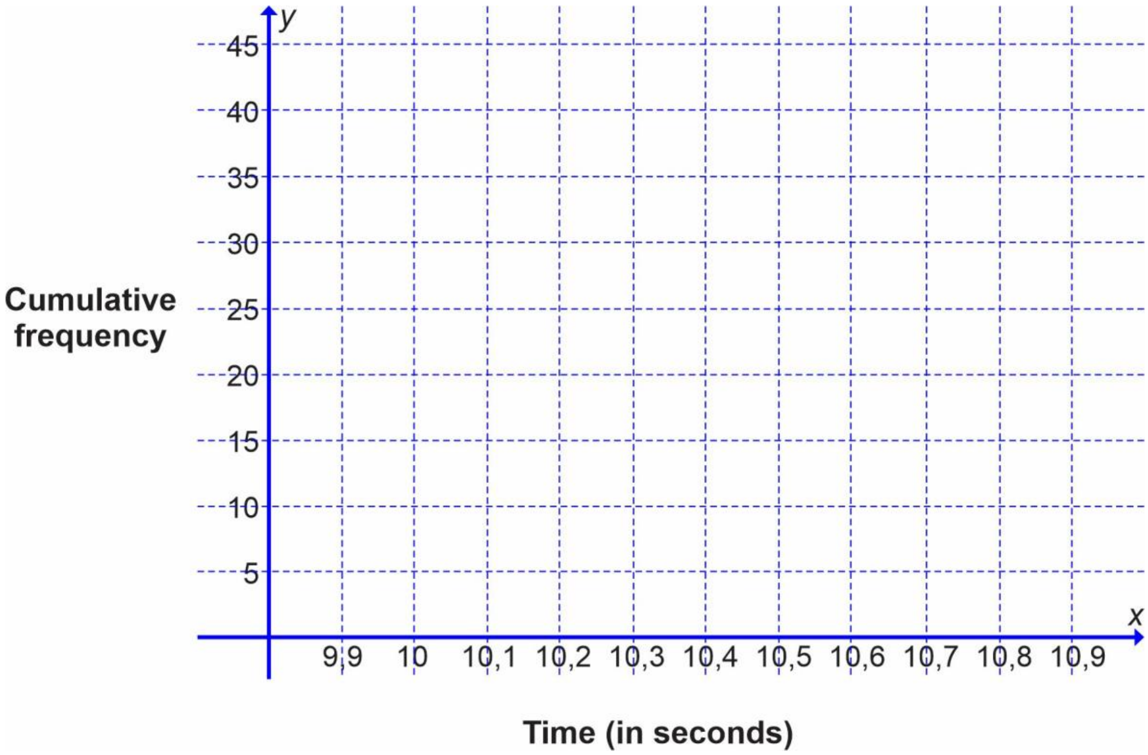
The speeds of all 44 runners are represented in the histogram below.



(a) Describe the skewness of the distribution. (1)

(b) Using the frequency table below to assist you, sketch an ogive (cumulative frequency curve) of the data, on the grid provided below. (4)

Time (seconds)	Frequency	Cumulative frequency
$9,9 < x \leq 10,1$	9	
$10,1 < x \leq 10,3$	21	
$10,3 < x \leq 10,5$	10	
$10,5 < x \leq 10,7$	2	
$10,7 < x \leq 10,9$	2	



(c) Eighteen runners ran times of less than x seconds. Estimate x. (2)

(d) Calculate an estimate of the mean. (2)

(e) After the race, it is discovered that the timing equipment was faulty.
It added 0,1 seconds to each runner's time. How does this error influence:

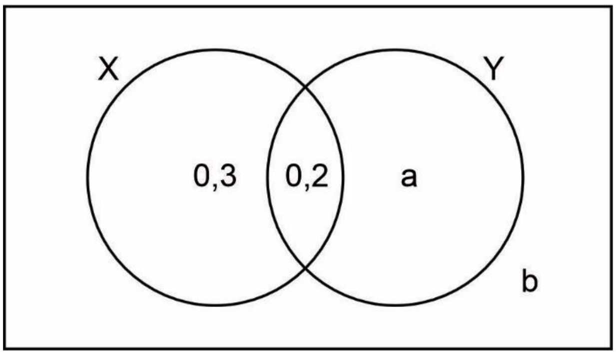
(i) the range of the data set? (1)

(ii) the mean of the data set? (1)

[11]

QUESTION 3

(a) The following Venn diagram refers to probabilities. If X and Y are independent events, find the values of *a* and *b*. Show all calculations. (5)



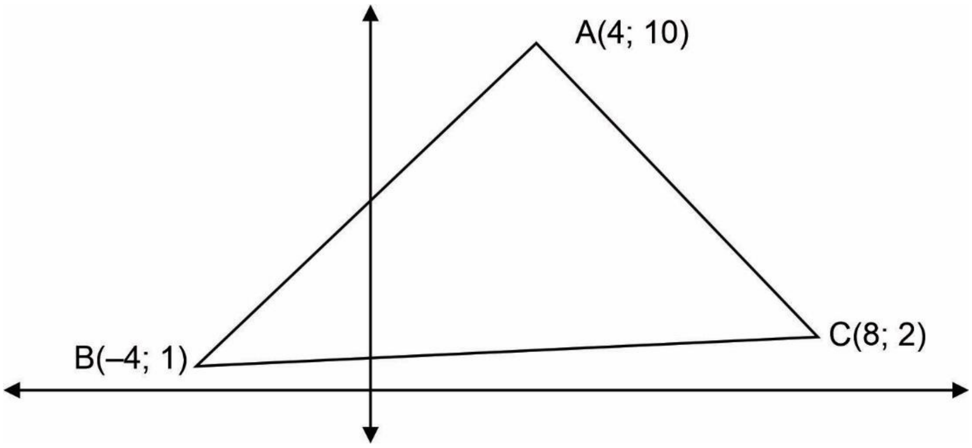
(b) The probability that the Brave Warriors has all its players fit to play in the COSAFA cup is 65%. The probability that they will win a game if all their players are fit is 80%. When they are not all fit, the probability of them winning becomes 45%.
Calculate the probability of them not winning their next game.

(4)

[9]

QUESTION 4

In the diagram below, the points A(4; 10), B(–4; 1) and C(8; 2) are shown.



(a) Prove that ΔABC is an isosceles triangle. (4)

(b) What are the coordinates of point D such that ABCD is a rhombus? (2)

(c) Calculate the perimeter of ABCD. (2)

(d) Calculate the size of $A\hat{B}C$. (5)

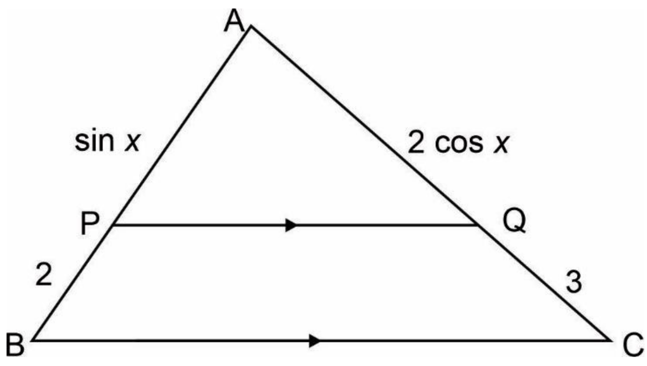
[13]

QUESTION 5

(a) Simplify as fully as possible, without the use of a calculator:

$$\frac{\sin 170^\circ.\cos 10^\circ}{\sin(20^\circ - x)\cos x + \cos(20^\circ - x).\sin x}$$ (4)

(b) In the triangle below, PQ//BC.
AP = sin x, PB = 2 units, AQ = 2 cos x and QC = 3 units.



Determine the values of x for which the diagram is valid, where $x \in [0°; 360°]$. (6)

(c) If sin 36º = p, express each of the following in terms of p:

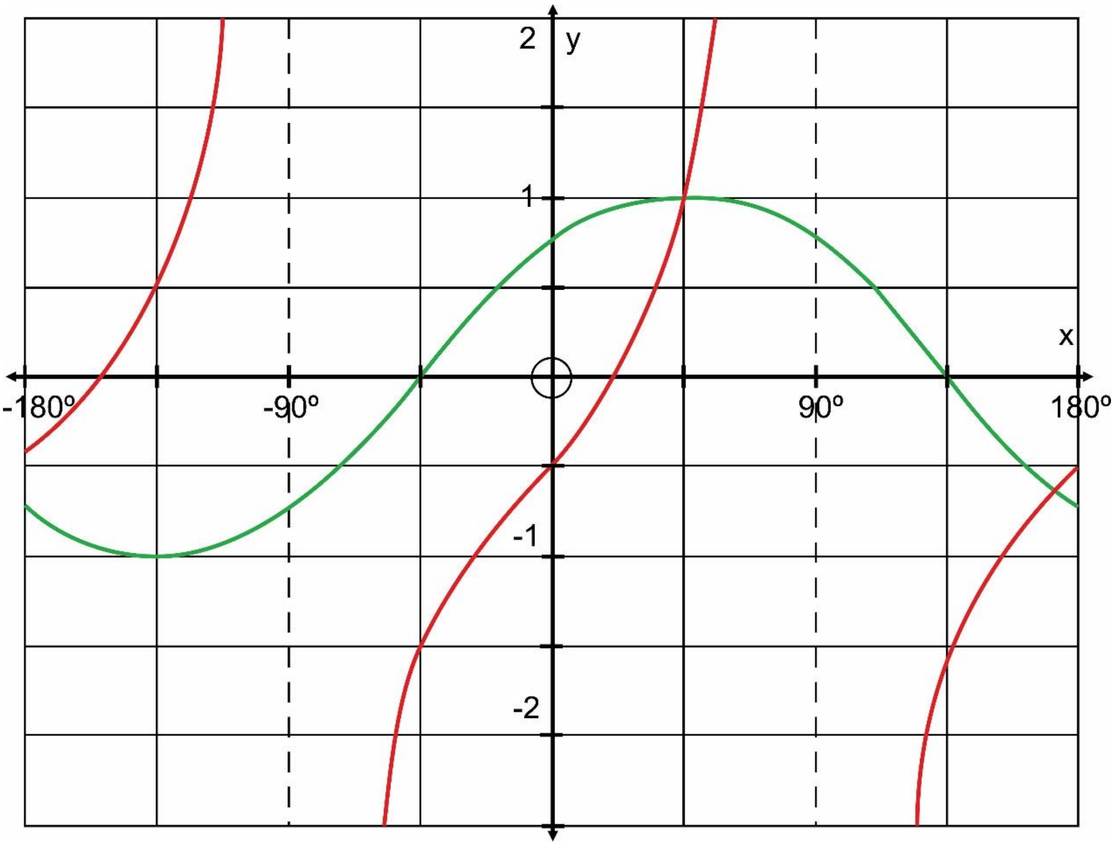
(i) cos 234º (3)

(ii) sin 40º cos 32º + sin 32º cos 40º (4)

[17]

QUESTION 6

In the diagram, the graphs of $f(x) = \cos(x - p)$ and $g(x) = \tan x + q$ are drawn for the interval $x \in [-180°; 180°]$.



(a) Determine the values of p and q. (2)

(b) Determine the new equation of g if the:

(i) graph is translated 25° to the left. (1)

(ii) period of the graph is doubled. (1)

(c) For what values of k will $f(x) = k$ have real solutions? (2)

(d) If $r = 3 - f(x)$, determine the:

(i) maximum value of r. (1)

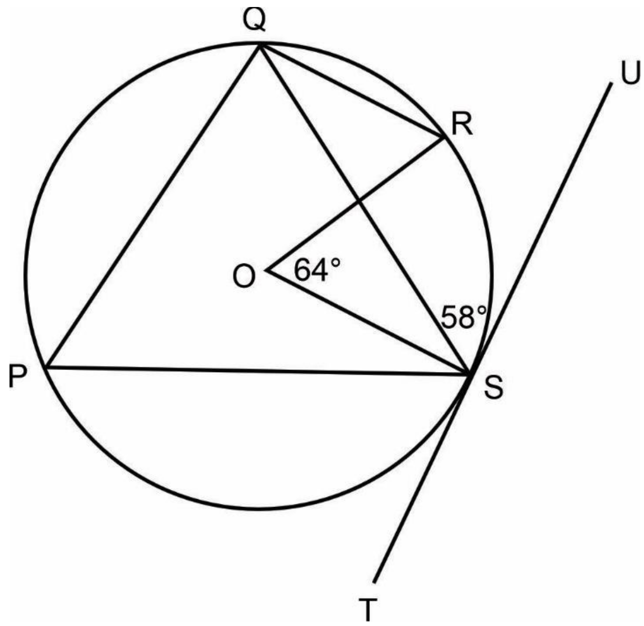
(ii) value of x that will give the maximum value for r. (1)

[8]

QUESTION 7

P, Q, R, and S are points on the circumference of a circle, center O.

TU is a tangent to the circle at S. $R\hat{O}S = 64°$ and $Q\hat{S}U = 58°$.

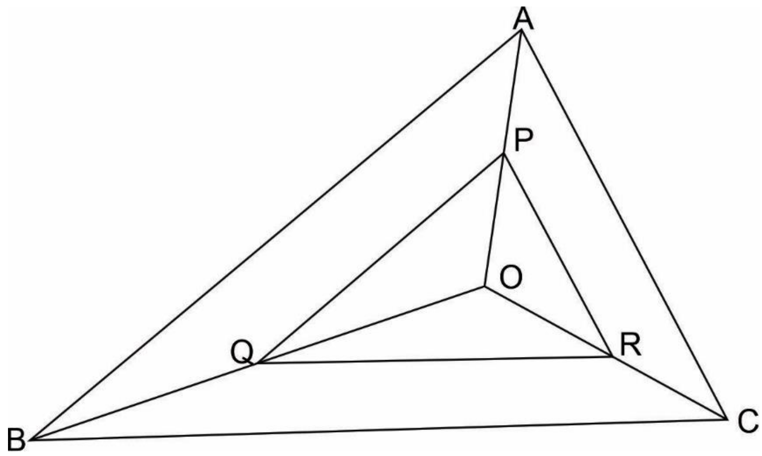


(a) Complete the following statements and reasons:

Statement	Reason
$O\hat{S}Q = 32°$	
$S\hat{Q}R =$	
$Q\hat{P}S = 58°$	
$Q\hat{R}S =$	
QR//OS	
$Q\hat{R}O = 64°$	

(8)

(b) In the figure, AO, BO and CO meet at point O. Points P, Q, and R are on AO, BO, and CO, respectively, such that PQ//AB and QR//BC.
Prove that PR//AC. (4)

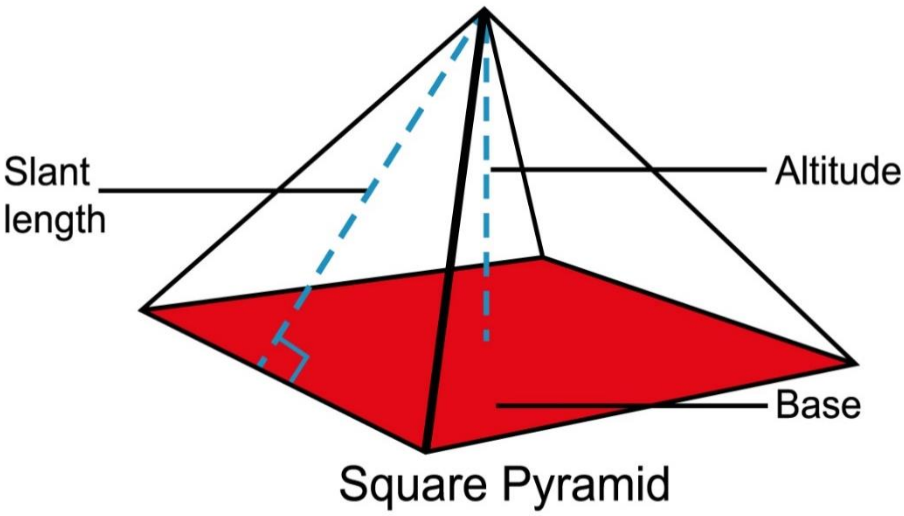


[12]

79 marks

SECTION B

QUESTION 8



The base of a pyramid is a square of side *s.* The slant height is *h*, and the altitude *a*.

(a) Express the surface area, *SA*, in terms of *s* and *h*. (2)

(b) Suppose that the dimensions of both *s* and *h* are tripled. How does the surface area of the pyramid change in terms of the original surface area? (2)

(c) If the volume of the original pyramid is $V = \frac{1}{3}s^2a$, and the sides of the square as well as the altitude of the pyramid are multiplied by scale factor *k*, what is the ratio of the volume of the new pyramid to the volume of the original pyramid? (2)

[6]

QUESTION 9

You have a bench that seats six people. In how many ways can the six be seated if two of them, Eduan and Monica, do not want to sit next to each other?

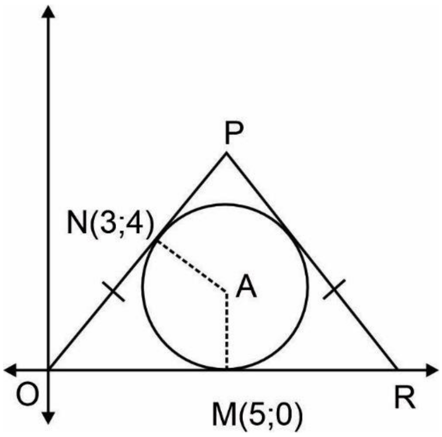
[4]

QUESTION 10

A circle with centre A is inscribed in the isosceles triangle OPR, with OP = PR.

AM is a vertical line.

OP, OR, and PR are all tangents to the circle.



(a) Determine the equation of line OP. (2)

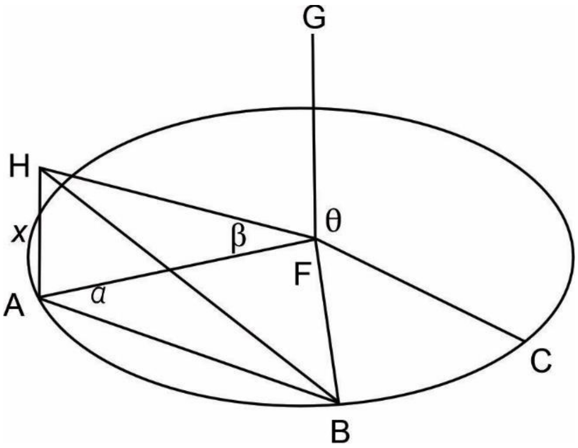
(b) Determine the co-ordinates of A. (7)

(c) Given that the equation of the inscribed circle with centre A is $(x-5)^2+\left(y-\frac{5}{2}\right)=\frac{37}{4}$, determine whether the circle $x^2 - 10x + y^2 + 4y - 20 = 0$ touches (internally or externally) the inscribed circle with centre A. (5)

[14]

QUESTION 11

Ann and Fiona are playing on a merry-go-round. F is the centre of the merry-go-round and FG is the pole in the centre. Ann is leaning against pole AH which is x metres tall and Fiona is standing at B. $A\hat{F}H = \beta$, $F\hat{A}B = \alpha$, and reflex angle $A\hat{F}C = \theta$.



(a) Determine the radius of the merry-go-round in terms of x and β. (2)

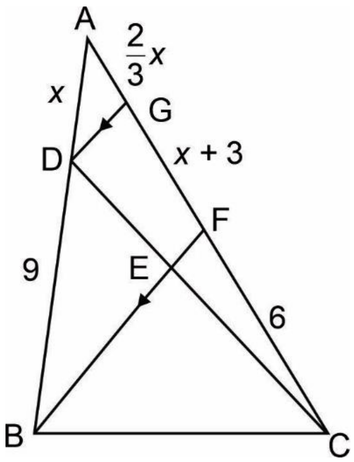
(b) Prove that $AB = \dfrac{2x\cos\alpha}{\tan\beta}$ (4)

(c) If $x = 0,7$ m, $\alpha = 50°$, and $\beta = 25°$ determine the length AB correct to two decimal places. (2)

(d) A third friend, Abiola gets on at point C. Fiona and Abiola are 0,85 metres apart and $\theta = 247°$ (reflex angle $A\hat{F}C$). How far apart are Ann and Abiola? (4)

[12]

QUESTION 12



FC = 6 units; AD = x units; AG = $\frac{2}{3}x$ units; DB = 9 units; GF = $x + 3$ units.

E is a point on BF and DG//BF.

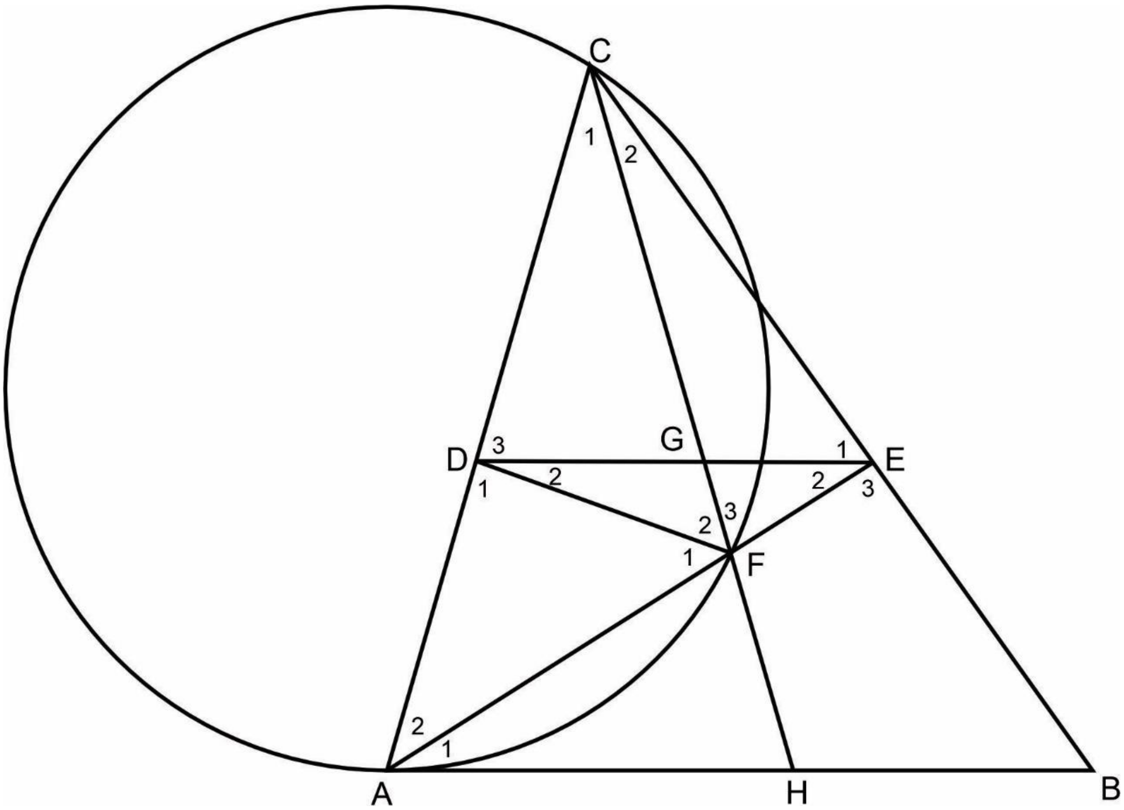
(a) Show that F is the midpoint of GC by first solving for x (giving reasons). (4)

(b) If EF = 1,4 units, write down the length of DG. (3)

(c) If the area of ΔADG = 2,7 units^2, determine the area of ΔACD. (4)

[11]

QUESTION 13



In the given diagram AB is a tangent to the circle. AC, CF, and AF are chords. AC and AF are produced to intersect AB and CB at H and E, respectively.
DE//AB and cuts CH at G. DF is drawn.

Prove that:

(a) CDFE is a cyclic quadrilateral. (4)

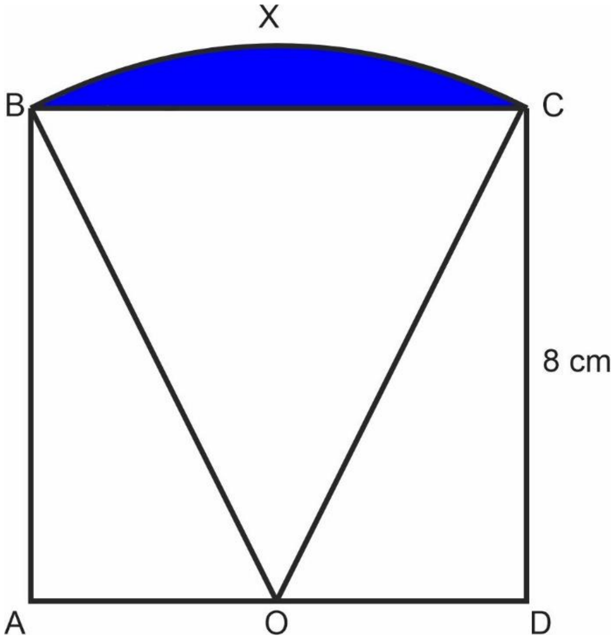
(b) $\Delta CDF /// \Delta AEB$ (5)

(c) $\dfrac{DA.CG}{GH} = \dfrac{AE.DF}{EB}$ (6)

[15]

QUESTION 14

The diagram shows a square ABCD of side 8 cm. The midpoint of AD is O and BXC is an arc of a circle with centre O.



Find the area of the shaded region. (9)

[9]

71 marks

Total: 150 marks

ADDITIONAL SPACE (ALL QUESTIONS)

REMEMBER TO CLEARLY INDICATE AT THE QUESTION THAT YOU HAVE USED THE ADDITIONAL SPACE TO ENSURE THAT ALL ANSWERS ARE MARKED.