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TOTAL
MARKS

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INTERNATIONAL SECONDARY CERTIFICATE EXAMINATION
NOVEMBER 2024

MATHEMATICS: PAPER II

EXAMINATION NUMBER

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Time: 3 hours

150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

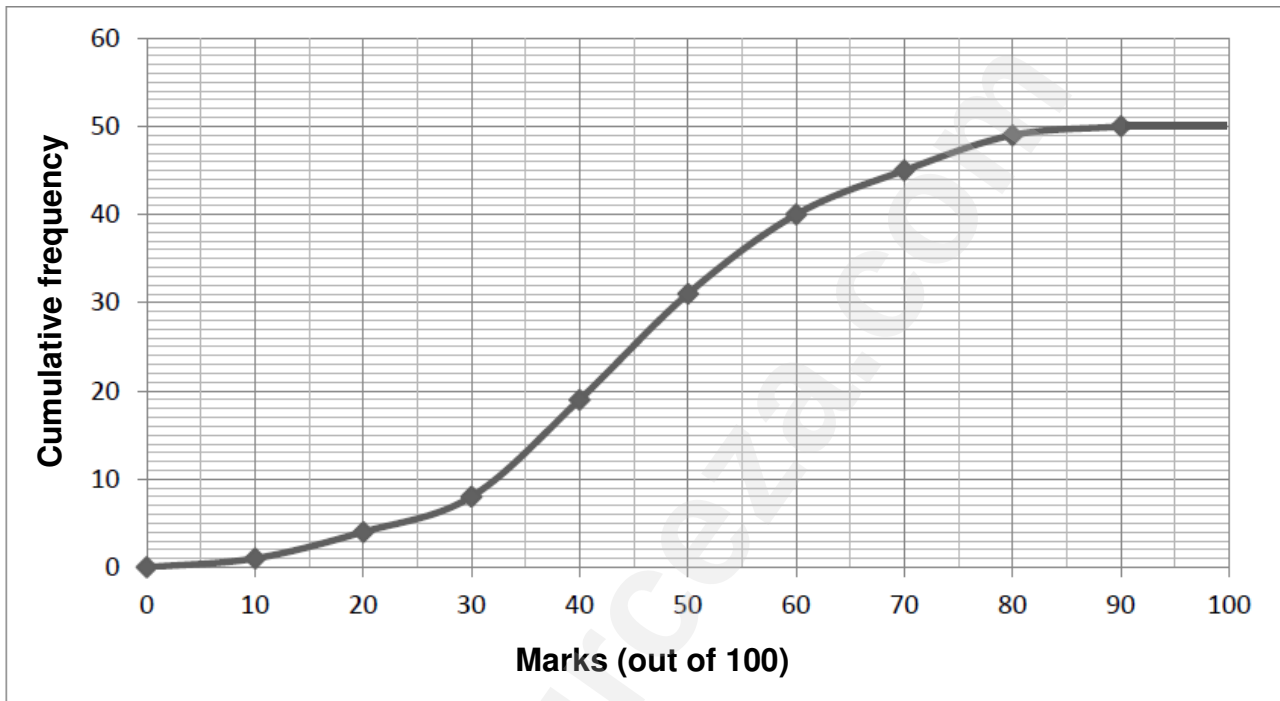
1. This question paper consists of 24 pages, including the Information Sheet of 2 pages (i–ii). Please check that your question paper is complete.
2. Read the questions carefully.
3. **Answer ALL the questions on the question paper and hand it in at the end of the examination. Remember to write your 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. One blank page (page 24) is included at the end of the paper. If you run out of space for a question, use this page. Clearly indicate the number of your answer should you use this extra space.

FOR OFFICE USE ONLY: MARKER TO ENTER MARKS

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	TOTAL
6	11	4	24	21	16	4	8	10	12	19	5	10	150

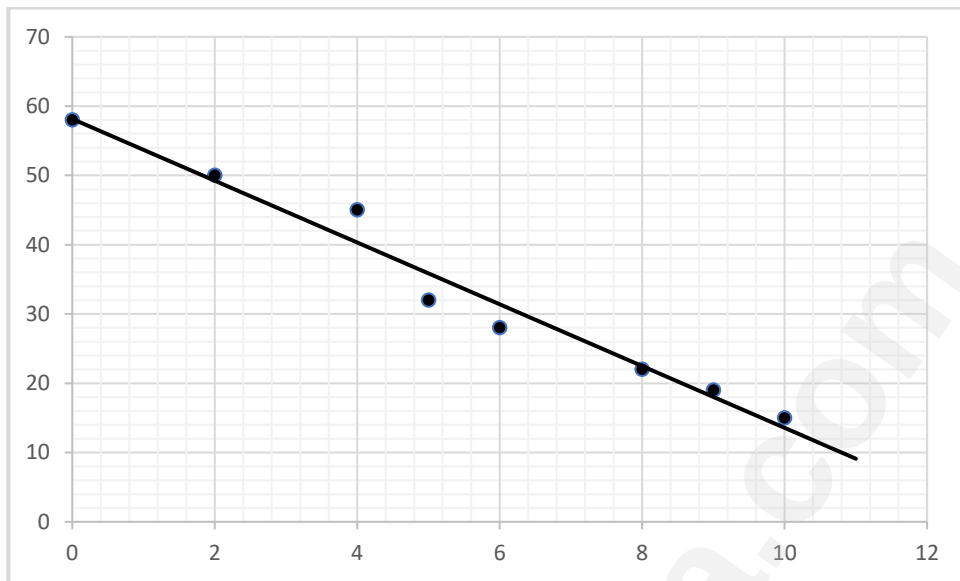
SECTION A**QUESTION 1**

- (a) The ogive (cumulative frequency curve) below shows the performance of students who wrote a basic mathematics skills course. The test had a maximum of 100 marks.



- (i) How many students wrote the test? (1)
- (ii) How many students achieved a mark above 70% for the test? (1)
- (iii) Only the top 25% of the students are allowed to proceed to the advanced mathematics course. What is the minimum mark achievable to still be part of this group? (2)

(b) Below is a scatter plot representing a set of data:



Choose the letter that corresponds to the most correct answer. Circle it.

(i) The equation of the least squares regression line (line of best fit) is:

A $y = 58,28x - 4,48$

B $y = 4,48x + 58,28$

C $y = 58,28 - 4,48x$

(1)

(ii) This plot could be representing the relationship between:

A temperature and thirst

B training and fitness

C late coming and success

(1)

[6]

QUESTION 2

- (a) The letters of the word SISHWALA (a traditional porridge originating from Eswatini) are arranged to form different words. Assume that all the words have meaning and repeated letters are treated as identical.

(i) How many different words can be formed? (3)

(ii) What is the probability that the word will start and end with the same letter? Leave your answer as a fraction. (3)

- (b) A main course and dessert are chosen from the following menu:

Main Course	Desert
Kapanna	Ice Cream
Galjoen	Malva Pudding
Eisbein	Appel Strudel
Mahangu with chicken	Peppermint Crisp Tart

What is the probability that the choice will contain:

(i) Kapanna and Peppermint Crisp Tart? (2)

(ii) Eisbein or Appel Strudel, but not both? (3)

QUESTION 3



A yield sign consists of two **equilateral** triangles.

The length of each side of the inner triangle is 60 cm and the length of each side of the outer triangle is 80 cm.

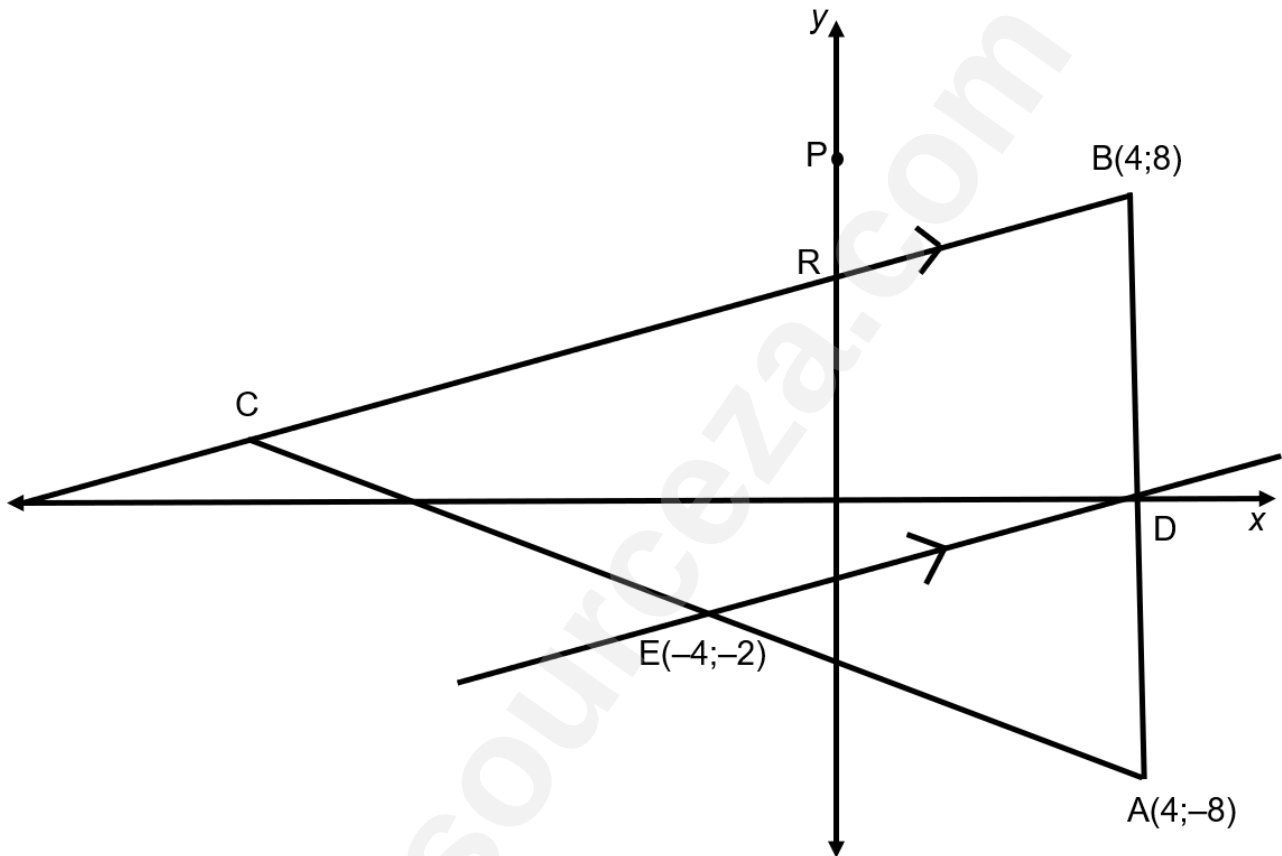
- (a) What is the value of each angle of the triangle? (1)
- (b) Calculate the area of the shaded part of the yield sign. (3)

[4]

QUESTION 4

- (a) In the diagram below, $\triangle ABC$ is shown with coordinates $A(4;-8)$ and $B(4;8)$ given. AB intersects the x -axis at D and AC intersects the line DE at $E(-4;-2)$.

BC intersects the y -axis at R .
 P is a point on the y -axis. $DE \parallel BC$.



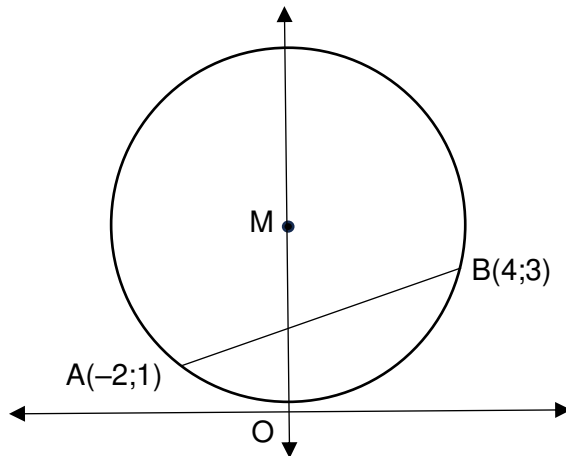
- (i) Write down the coordinates of D . (1)
- (ii) Determine the gradient of line DE . (2)

(iii) Determine the equation of line BC. (3)

(iv) Calculate $\hat{P}RB$. (3)

(v) Determine the point Q such that BDEQ is a parallelogram. (2)

- (b) In the accompanying figure AB is a chord of a circle whose centre, M, lies on the y -axis. The co-ordinates of A and B are $(-2;1)$ and $(4;3)$ respectively.



Find the following:

- (i) The co-ordinates of the midpoint of AB. (2)

- (ii) The gradient of AB. (2)

- (iii) Show that the equation of the perpendicular bisector of AB is $y = -3x + 5$. (3)

- (iv) Show that the co-ordinates of M are (0;5). (2)

- (v) Find the equation of the circle in the form $x^2 + ax + y^2 + by + c = 0$. (4)

[24]

QUESTION 5

- (a) Simplify to one trigonometric ratio:

$$\frac{2\cos(90^\circ + \theta)\sin 216^\circ \cos 396^\circ}{\sin 72^\circ} \quad (5)$$

- (b) Determine the general solution of the following equation:

$$\sin 2\theta - 4\sin^2 \theta = 0 \quad (6)$$

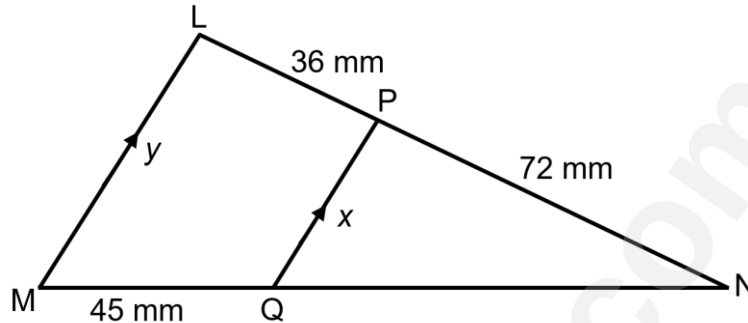
(c) (i) Prove that $\frac{1 - \sin 2x}{\cos 2x} = \frac{\cos x - \sin x}{\cos x + \sin x}$ (5)

(ii) Hence, determine the value of $\frac{\cos 15^\circ - \sin 15^\circ}{\cos 15^\circ + \sin 15^\circ}$ without using a calculator. (5)

[21]

QUESTION 6**Give reasons for all statements.**

- (a) In $\triangle LMN$, $PQ \parallel LM$ with $PN = 72$ mm, $LP = 36$ mm and $MQ = 45$ mm.

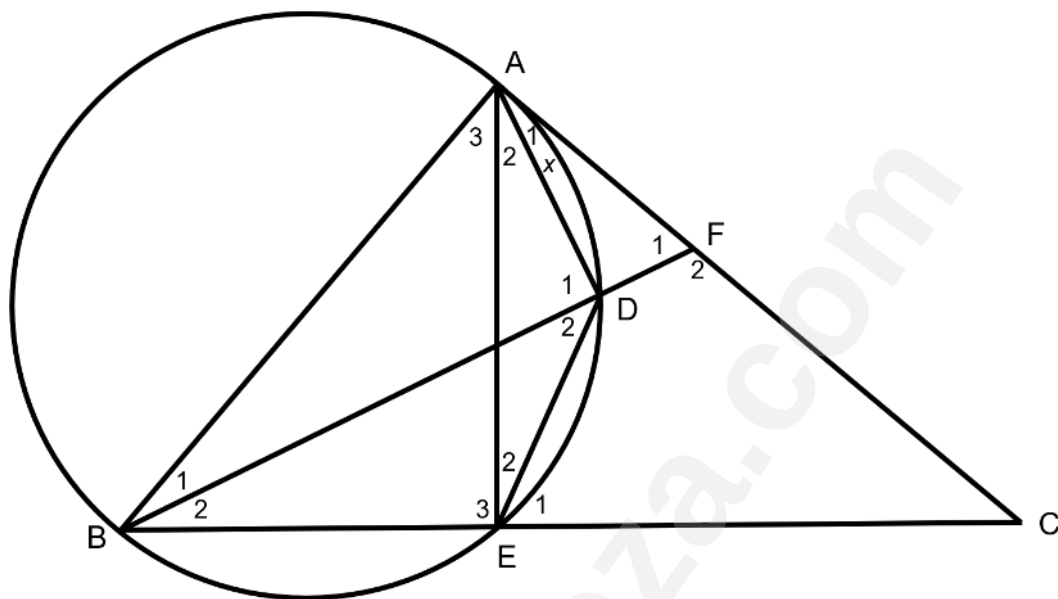


- (i) Calculate the length of MN. Leave your answer as fraction in simplest form. (3)

- (ii) Prove that $\frac{y}{x} = \frac{3}{2}$. (5)

- (b) In the figure, AB is a diameter of the circle ABED and AC is a tangent to the circle at A. BDF and BEC are straight lines.

$$\hat{A}_1 = x$$



- (i) Give a reason why $\hat{B}_1 = x$. (1)

- (ii) Express $\hat{E}_1$ in terms of x . (4)

- (iii) Prove that CFDE is a cyclic quadrilateral. (3)

[16]

82 marks

SECTION B**QUESTION 7**

Given that A and B are independent events.

Calculate the value of x and y correct to two decimal places, if:

- $P(B \text{ and } A') = 0,3$
- $P(A \text{ and } B) = 0,2$
- $P(A \text{ and } B') = x$
- $P(A' \text{ and } B') = y$

[4]

QUESTION 8

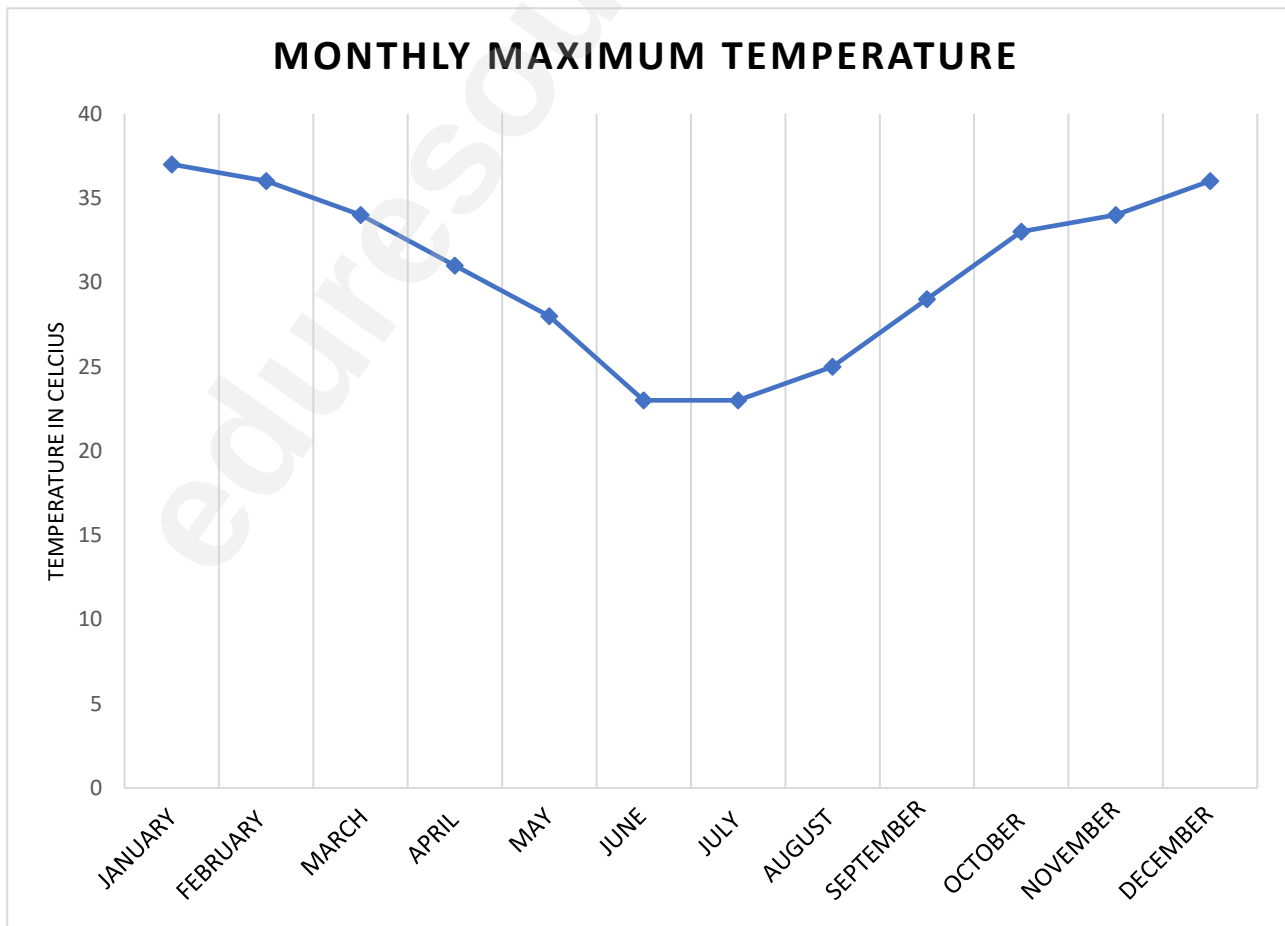
The graph below shows the monthly maximum temperatures of Keetmanshoop over a 1-year period.

Here are the average temperatures of Keetmanshoop, located in the South, at 1 000 meters (3 300 feet) of altitude.

Keetmanshoop – average temperatures (1991–2020)						
Month	Min (°C)	Max (°C)	Mean (°C)	Min (°F)	Max (°F)	Mean (°F)
January	19,6	36,6	28,1	67	98	82,6
February	19,6	35,9	27,7	67	97	81,9
March	18,6	34,4	26,5	65	94	79,7
April	15,2	30,7	23	59	87	73,4
May	11,8	27,5	19,6	53	82	67,4
June	7,6	23,3	15,4	46	74	59,8
July	7	23,1	15	45	74	59,1
August	8,2	25,3	16,8	47	78	62,2
September	11,6	29,4	20,5	53	85	68,9
October	14,4	32,5	23,4	58	90	74,2
November	16,1	34,3	25,2	61	94	77,4
December	18,6	36,3	27,4	65	97	81,4



[<<https://www.climatestotravel.com/climate/namibia>>]



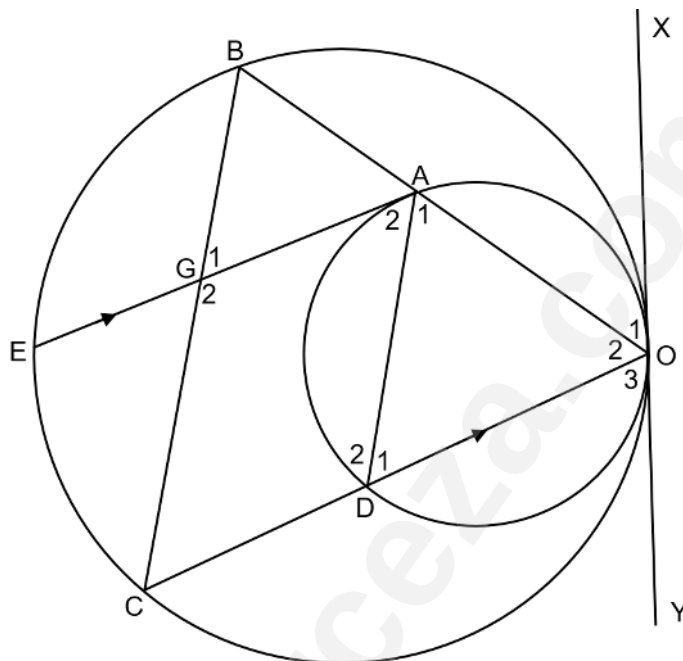
- (a) Calculate the mean monthly maximum temperature in $^{\circ}\text{C}$. (2)
- (b) Calculate the standard deviation of the monthly maximum temperature in $^{\circ}\text{C}$. (2)
- (c) It is predicted that one hundred years from now, global warming is likely to increase the city's monthly maximum temperature by 5°C in June, July and August. It will also result in an increase of 1°C in the other months of the year.
- (i) By how much will the mean increase? (2)
- (ii) Without calculating the new standard deviation, describe the effect that the predicted increases in temperature will have on the standard deviation and range. (2)

[8]

QUESTION 9

In the diagram, two circles OBC and OAD touch each other internally at point O.

Line EA is a tangent to the smaller circle and is parallel to chord CO of the larger circle. XOY is the common tangent at point O.

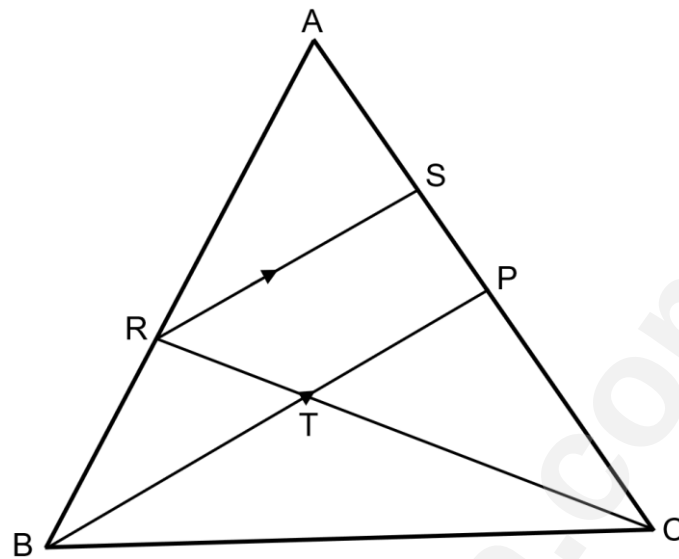


Prove:

(a) AGCD is a parallelogram. (5)

(b) GAOC is a cyclic quadrilateral. (5)

QUESTION 10



In $\triangle ABC$, P is the midpoint of AC. $RS \parallel BP$ and $\frac{AR}{AB} = \frac{4}{7}$.
CR and BP intersect at T.

Determine, with reasons, the following ratios:

(a) $\frac{AS}{SP}$ (2)

(b) $\frac{AS}{SC}$ (3)

(c) $\frac{RT}{TC}$ (3)

(d) $\frac{\text{Area } \triangle TPC}{\text{Area } \triangle RSC}$ (4)

[12]

QUESTION 11

- (a) In $\triangle DEF$, $\hat{D} = 30^\circ$ and $e = 20$ units. If $d = 8$ units, show by calculation that $\triangle DEF$ does NOT exist and hence write down the minimum value of d for $\triangle DEF$ to exist. (4)

(b) $f = \left\{ (x; y) : y = \frac{v^2}{10} \sin 2x \right\}$

The defining equation of f gives an approximation for the distance (y), in metres, that an athlete will achieve in a shotput event, if he throws the weight with an initial speed of v metres per second at an angle of x degrees to the horizontal plane.



- (i) If $v = 12$ m/s, sketch the graph of f for $0^\circ \leq x \leq 90^\circ$. (3)

From this graph, determine:

(ii) the range of f in the given interval. (2)

(iii) the maximum distance that the athlete can achieve. (1)

(iv) the angle at which the weight must be thrown to achieve this distance. (2)

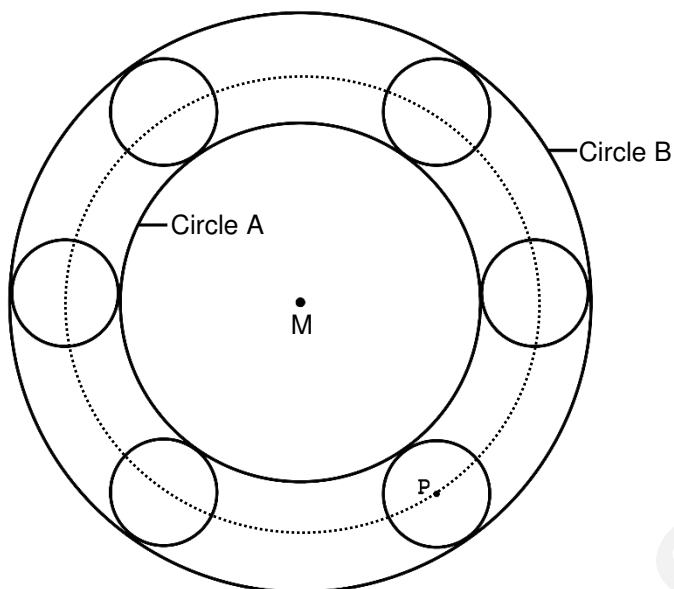
(v) Calculate the angle(s) at which the weight can be thrown to achieve half the maximum distance. (The initial speed remains 12 m/s.) (3)

(vi) If the weight is thrown at an angle of 48° , calculate, using a calculator, the initial speed required to equal the world record of 23,37 m. (4)

[19]

QUESTION 12

The figure below shows the cross-section of a wheel bearing. The smaller circles represent ball-bearings which roll between two larger concentric circles, A and B, which both have centre M.



The equation of Circle A is:

$$x^2 + y^2 + 3x - 6y = 9$$

P is the centre of one of the small ball-bearings, each of which has a diameter of 2 units.

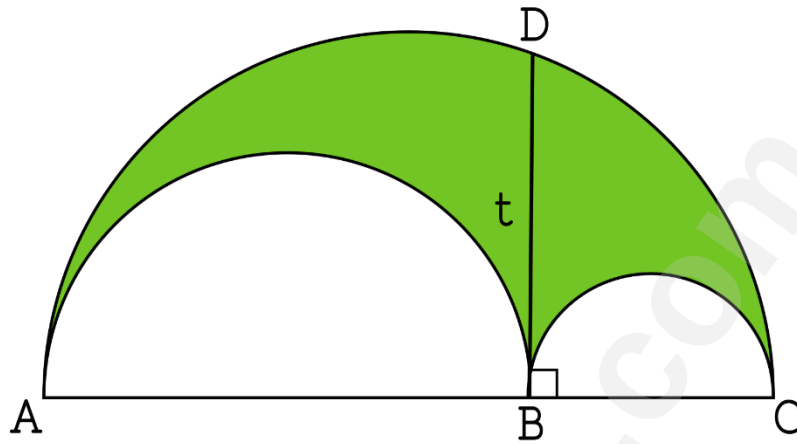
Find the equation which best describes the path of P as it rolls between the two larger circles.

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

[5]

QUESTION 13

AB, BC and AC are diameters of semi-circles. $DB \perp AC$ and $DB = t$. Find a formula, in terms of t , which will enable you to find the area of the shaded part.

**[10]****68 marks**

ADDITIONAL SPACE (ALL QUESTIONS)

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

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