

MATHEMATICS Compulsory Part
PAPER 1

Question-Answer Book

8:30 am – 10:45 am (2¼ hours)

This paper must be answered in English

INSTRUCTIONS

- (1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3, 5, 7, 9 and 11.
- (2) This paper consists of THREE sections, A(1), A(2) and B.
- (3) Attempt ALL questions in this paper. Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.
- (4) Graph paper and supplementary answer sheets will be supplied on request. Write your Candidate Number, mark the question number box and stick a barcode label on each sheet, and fasten them with string INSIDE this book.
- (5) Unless otherwise specified, all working must be clearly shown.
- (6) Unless otherwise specified, numerical answers should be either exact or correct to 3 significant figures.
- (7) The diagrams in this paper are not necessarily drawn to scale.
- (8) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

Please stick the barcode label here.

Candidate Number

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* A 0 3 0 E 0 0 1 *

SECTION A(1) (35 marks)

1. Simplify $\frac{(mn^{-2})^5}{m^{-4}}$ and express your answer with positive indices. (3 marks)

2. Factorize

(a) $\alpha^2 + \alpha - 6$,

(b) $\alpha^4 + \alpha^3 - 6\alpha^2$.

(3 marks)

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3. (a) Round up 534.7698 to the nearest hundred.
(b) Round down 534.7698 to 2 decimal places.
(c) Round off 534.7698 to 2 significant figures.

(3 marks)

4. Let a , b and c be non-zero numbers such that $\frac{a}{b} = \frac{6}{7}$ and $3a = 4c$. Find $\frac{b+2c}{a+2b}$. (3 marks)

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5. In a recruitment exercise, the number of male applicants is 28% more than the number of female applicants. The difference of the number of male applicants and the number of female applicants is 91. Find the number of male applicants in the recruitment exercise. (4 marks)

6. Consider the compound inequality

$$3 - x > \frac{7 - x}{2} \quad \text{or} \quad 5 + x > 4 \quad \dots\dots\dots (*)$$

- (a) Solve (*).
- (b) Write down the greatest negative integer satisfying (*).

(4 marks)

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7. Let $p(x) = 4x^2 + 12x + c$, where c is a constant. The equation $p(x) = 0$ has equal roots. Find

(a) c ,

(b) the x -intercept(s) of the graph of $y = p(x) - 169$.

(5 marks)

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8. In Figure 1, B and D are points lying on AC and AE respectively. BE and CD intersect at the point F . It is given that $AB = BE$, $BD \parallel CE$, $\angle CAE = 30^\circ$ and $\angle ADB = 42^\circ$.

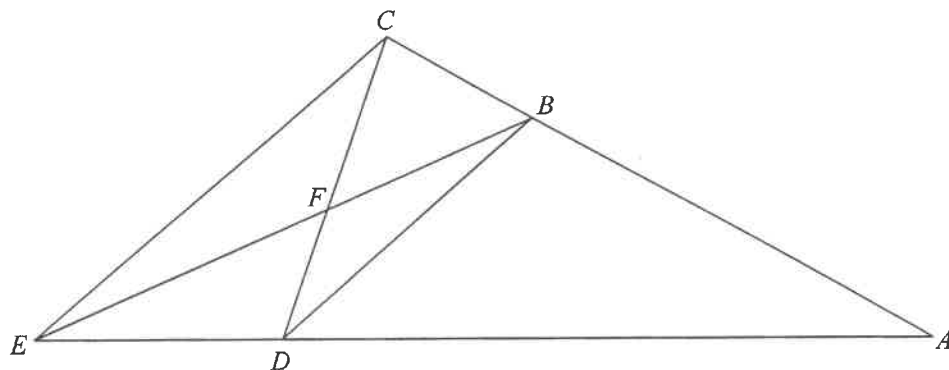


Figure 1

- (a) Find $\angle BEC$.
- (b) Let $\angle BDC = \theta$. Express $\angle CFE$ in terms of θ .

(5 marks)

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9. The table below shows the distribution of the numbers of subjects taken by a class of students.

Number of subjects taken	4	5	6	7
Number of students	8	12	16	4

- (a) Write down the mean, the median and the standard deviation of the above distribution.
- (b) A new student now joins the class. The number of subjects taken by the new student is 5. Find the change in the median of the distribution due to the joining of this student.

(5 marks)

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- (2 marks)

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11. The stem-and-leaf diagram below shows the distribution of the weights (in grams) of the letters in a bag.

Stem (tens)	Leaf (units)						
1	1	2	3	3			
2	3	3	4	5	6	9	9
3	1	6	7	8	8	8	
4	2						
5	0	w					

It is given that the range of the above distribution is the triple of its inter-quartile range.

- (a) Find w . (4 marks)
- (b) If a letter is randomly chosen from the bag, find the probability that the weight of the chosen letter is not less than the mode of the distribution. (2 marks)

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12. The height and the base radius of a solid right circular cone are 36 cm and 15 cm respectively. The circular cone is divided into three parts by two planes which are parallel to its base. The heights of the three parts are equal. Express, in terms of π ,

1. **Introduction**
 This document provides a comprehensive overview of the project's objectives, scope, and deliverables. It serves as a guide for all stakeholders involved in the project.
2. **Project Objectives**
 The primary goal of this project is to develop a robust system that meets the following objectives:
- Enhance system performance and scalability.
 - Ensure data security and integrity.
 - Provide a user-friendly interface for end-users.
3. **Scope of Work**
 The project will cover the following areas:
- System architecture design.
 - Database development and optimization.
 - Front-end and back-end development.
 - Testing and deployment.
4. **Deliverables**
 The project will produce the following deliverables:
- Detailed system architecture diagram.
 - Functional system prototype.
 - Final system code and documentation.
 - User training materials.
5. **Timeline**
 The project is scheduled to be completed within a timeline of 12 weeks, starting from the initiation phase.
6. **Conclusion**
 This project is a critical component of our organization's strategic goals. We are committed to ensuring its successful completion.

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 The primary goal of this project is to develop a robust system that meets the following criteria:
- **Performance:** The system must handle up to 10,000 concurrent users.
 - **Scalability:** The system should be able to scale horizontally to accommodate future growth.
 - **Security:** All data must be encrypted, and access must be controlled via role-based permissions.
 - **Reliability:** The system must have a 99.9% uptime guarantee.
3. **Scope**
 The project scope includes the development, testing, and deployment of the system. It also includes the documentation of the system architecture and the user manual.
4. **Deliverables**
 The project will deliver the following items:
- **System Architecture Diagrams:** A detailed diagram showing the components and their interactions.
 - **Source Code:** The complete source code for the system, including all dependencies.
 - **Test Plans and Results:** A set of test plans and their corresponding results to ensure the system's quality.
 - **User Manual:** A comprehensive guide for users to interact with the system.
5. **Conclusion**
 This project is a critical component of our organization's strategy. It is essential that all team members understand the goals and deliverables to ensure a successful outcome.

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14. The coordinates of the points A and B are $(-10, 0)$ and $(30, 0)$ respectively. The circle C passes through A and B . Denote the centre of C by G . It is given that the y -coordinate of G is -15 .

(b) The straight line L passes through B and G . Another straight line ℓ is parallel to L . Let P be a moving point in the rectangular coordinate plane such that the perpendicular distance from P to L is equal to the perpendicular distance from P to ℓ . Denote the locus of P by Γ . It is given that Γ passes through A .

(ii) Find the equation of Γ .

(iii) Suppose that Γ cuts C at another point H . Someone claims that $\angle GAH < 70^\circ$. Do you agree? Explain your answer.

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16. The 3rd term and the 6th term of a geometric sequence are 144 and 486 respectively.

(a) Find the 1st term of the sequence. (2 marks)

(b) Find the least value of n such that the sum of the first n terms of the sequence is greater than 8×10^{18} . (3 marks)

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18. In Figure 2, U , V and W are points lying on a circle. Denote the circle by C . TU is the tangent to C at U such that TVW is a straight line.

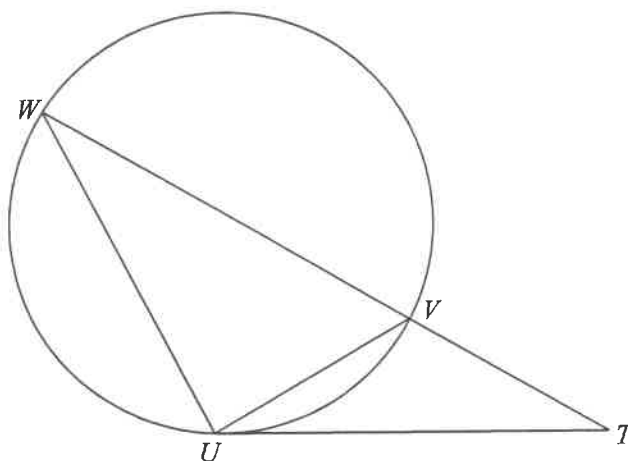


Figure 2

- (a) Prove that $\Delta UTV \sim \Delta WTU$. (2 marks)
- (b) It is given that VW is a diameter of C . Suppose that $TU = 780$ cm and $TV = 325$ cm.
- (i) Express the circumference of C in terms of π .
- (ii) Someone claims that the perimeter of ΔUVW exceeds 35 m. Do you agree? Explain your answer. (5 marks)

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19. $PQRS$ is a quadrilateral paper card, where $PQ = 60$ cm, $PS = 40$ cm, $\angle PQR = 30^\circ$, $\angle PRQ = 55^\circ$ and $\angle QPS = 120^\circ$. The paper card is held with QR lying on the horizontal ground as shown in Figure 3.

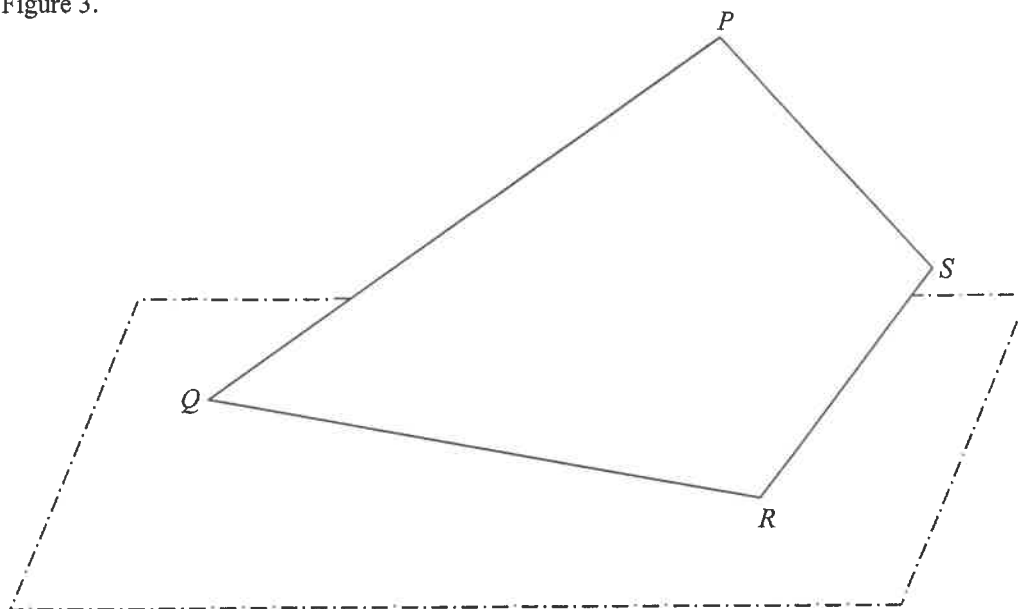


Figure 3

- (a) Find the length of RS . (3 marks)
- (b) Find the area of the paper card. (2 marks)
- (c) It is given that the angle between the paper card and the horizontal ground is 32° .
 - (i) Find the shortest distance from P to the horizontal ground.
 - (ii) A student claims that the angle between RS and the horizontal ground is at most 20° . Is the claim correct? Explain your answer.

(7 marks)

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2. **Project Objectives**
 The primary goal of this project is to develop a robust system that meets the following criteria:

- **Performance:** The system must handle up to 10,000 concurrent users.
- **Scalability:** The system should be able to scale horizontally to accommodate future growth.
- **Security:** All data must be encrypted, and access must be controlled via role-based permissions.
- **Reliability:** The system must have a 99.9% uptime guarantee.

3. **Scope of Work**
 The project will cover the following areas:

- **Requirement Gathering:** Conducting interviews with stakeholders to define functional and non-functional requirements.
- **System Design:** Creating a detailed architecture and database schema.
- **Development:** Writing the core application code and integrating third-party services.
- **Testing:** Performing unit, integration, and user acceptance testing.
- **Deployment:** Deploying the system to a production environment.
- **Monitoring:** Implementing logging and monitoring tools to track system performance.

4. **Deliverables**
 The project will produce the following deliverables:

- **Project Charter:** A document defining the project's purpose, goals, and stakeholders.
- **Requirements Document:** A detailed specification of the system's requirements.
- **System Architecture:** A high-level design of the system's components and their interactions.
- **Source Code:** The complete codebase for the application.
- **Test Plans and Results:** Documents detailing the testing strategy and outcomes.
- **Deployment Plan:** A step-by-step guide for deploying the system.
- **Final Report:** A summary of the project's progress, challenges, and lessons learned.

5. **Conclusion**
 This project is a critical initiative for our organization, and we are committed to ensuring its success. We will maintain regular communication with all stakeholders and provide transparent reporting on the project's progress.

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