

MATHEMATICS Compulsory Part
PAPER 1
Question-Answer Book

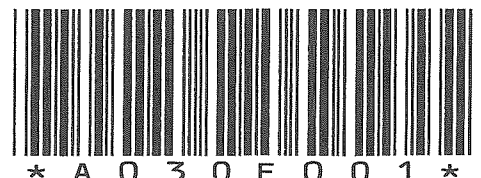
8:30 am – 10:45 am (2¼ hours)
This paper must be answered in English

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.

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Candidate Number



SECTION A(1) (35 marks)

1. Simplify $\frac{(a^3b^{-2})^4}{a^{-5}b^6}$ and express your answer with positive indices. (3 marks)

2. Let x and y be two numbers. The sum of x and y is 456 while the product of 7 and x is y . Find x . (3 marks)

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3. Simplify $\frac{3}{k-9} + \frac{2}{5k+6}$. (3 marks)

4. Factorize
(a) $9c^2 - 6c + 1$,
(b) $(4c + d)^2 - 9c^2 + 6c - 1$. (4 marks)

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5. A fan is sold at a discount of 30% on its marked price. After selling the fan, the profit is \$78 and the percentage profit is 26%. Find the marked price of the fan. (4 marks)

6. Consider the compound inequality
 $-2(3x+2) > x+10$ or $2x \leq -8$ (*) .
- (a) Solve (*) .
- (b) Write down the greatest integer satisfying (*) . (4 marks)

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7. The coordinates of the points S and T are $(12, -5)$ and $(-3, -7)$ respectively. S is rotated anticlockwise about O through 90° to S' , where O is the origin. T' is the reflection image of T with respect to the x -axis.

(a) Write down the coordinates of S' and T' .

(b) Find the slope of $S'T'$.

(4 marks)

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8. In Figure 1, A is a point lying inside the quadrilateral $BCDE$ such that $AC \parallel ED$ and $AD \parallel BC$. It is given that $\angle ABC = \angle AED$ and $AB = AE$.

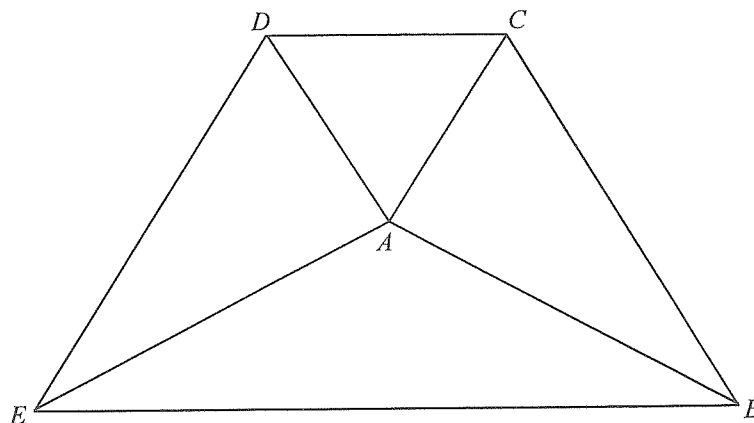


Figure 1

- (a) Prove that $\triangle ABC \cong \triangle AED$.
- (b) If $\angle ABC = 39^\circ$ and $\angle DAE = 87^\circ$, find $\angle ACD$.

(5 marks)

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9. The frequency distribution table and the cumulative frequency distribution table below show the distribution of the times taken to complete a 3 km race by a group of students.

Time taken (minutes)	Frequency
10 – 14	a
15 – 19	9
20 – 24	b
25 – 29	3

Time taken less than (minutes)	Cumulative frequency
14.5	3
19.5	x
24.5	y
29.5	20

- (a) Write down the value of x .
- (b) Find the mean of the distribution.
- (c) Find the probability that the time taken to complete the 3 km race by a randomly selected student from the group is less than 19.5 minutes.

(5 marks)

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11. The stem-and-leaf diagram below shows the distribution of the ages of the players of a football team.

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

The inter-quartile range and the median of the distribution are 14 and 31 respectively.

- (a) Find a and b . (3 marks)
- (b) A player now leaves the football team.
- (i) Is there any change in the mode of the distribution due to the leaving of the player? Explain your answer.
- (ii) If the range of the distribution is decreased, find the greatest possible standard deviation of the distribution. (4 marks)

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12. The equation of the circle C is $x^2 + y^2 - 154x - 128y + 224 = 0$. Denote the centre of C by G . The coordinates of the point H are $(65, 48)$.

(a) Find the distance between G and H . (3 marks)

(b) Let P be a moving point on C . When the area of $\triangle GHP$ is the greatest,

(i) describe the geometric relationship between GH and GP ;

(ii) find the perimeter of $\triangle GHP$.

(4 marks)

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14. Let $p(x) = 2x^3 + ax^2 + bx - 20$, where a and b are constants. When $p(x)$ is divided by $x^2 - 2x + 3$, the remainder is $x + 13$.
- (a) Find a and b . (3 marks)
 - (b) Is $x - 5$ a factor of $p(x)$? Explain your answer. (2 marks)
 - (c) Someone claims that the equation $p(x) = 0$ has two irrational roots. Do you agree? Explain your answer. (3 marks)

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SECTION B (35 marks)

15. There are 10 boys and 12 girls in a class. If 4 students are randomly selected from the class to form a committee,
- (a) find the probability that there are 2 boys and 2 girls in the committee; (2 marks)
- (b) find the probability that the number of boys and the number of girls in the committee are different. (2 marks)

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16. Let $g(x) = 3x^2 + 12kx + 16k^2 + 8$, where k is a non-zero real constant.

- (a) Using the method of completing the square, express, in terms of k , the coordinates of the vertex of the graph of $y = g(x)$. (2 marks)
- (b) On the same rectangular coordinate system, denote the vertex of the graph of $y = g(x)$ and the vertex of the graph of $y = 2g(-x)$ by A and B respectively. Let M be a point lying on AB such that the area of $\triangle OBM$ is the triple of the area of $\triangle OAM$, where O is the origin. Express, in terms of k , the coordinates of M . (3 marks)

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18. In Figure 2, the triangular paper card PQR is held such that PQ lies on the horizontal ground. It is given that $PQ = 30$ cm, $PR = 25$ cm and $\angle QPR = 95^\circ$.

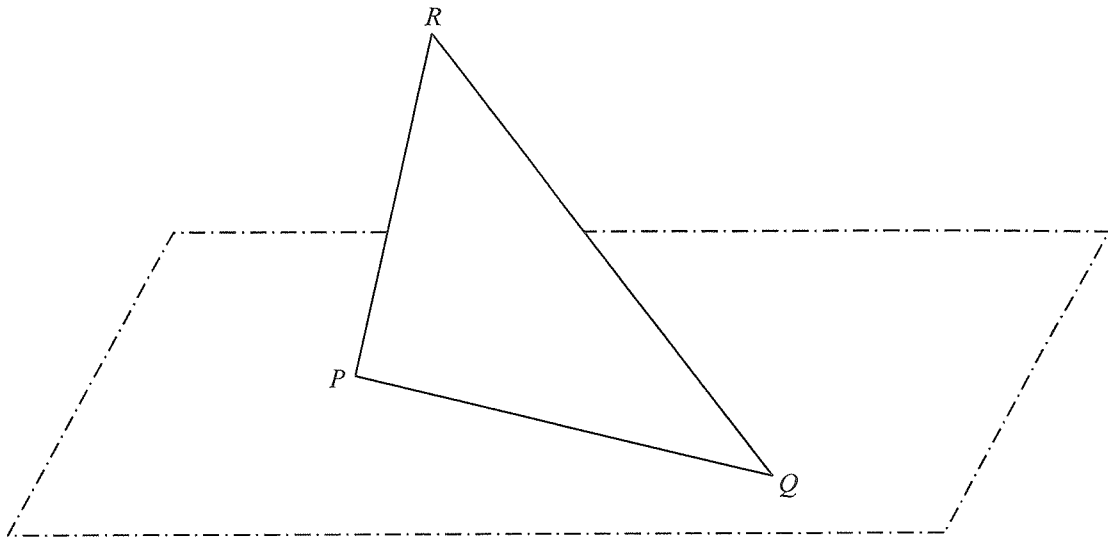


Figure 2

- (a) Find
- (i) the length of QR ,
 - (ii) $\angle PQR$.
- (4 marks)
- (b) Let M be the mid-point of QR . A craftsman finds that the angle between PR and the horizontal ground is 70° . The craftsman claims that the angle between PM and the horizontal ground exceeds 40° . Is the claim correct? Explain your answer. (3 marks)

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END OF PAPER

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