

MATHEMATICS PAPER 1
Question-Answer Book

8.30 am – 10.30 am (2 hours)
This paper must be answered in English

INSTRUCTIONS

- Write your Candidate Number in the space provided on Page 1.
- Stick barcode labels in the spaces provided on Pages 1, 3, 5, 7, 9 and 11.
- This paper consists of THREE sections, A(1), A(2) and B. Each section carries 33 marks.
- Attempt ALL questions in Sections A(1) and A(2), and any THREE questions in Section B. Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins.
- Graph paper and supplementary answer sheets will be supplied on request. Write your Candidate Number and stick a barcode label on each sheet, and fasten them with string INSIDE this book.
- Write the question numbers of the questions you have attempted in Section B in the spaces provided on Page 1.
- Unless otherwise specified, all working must be clearly shown.
- Unless otherwise specified, numerical answers should be either exact or correct to 3 significant figures.
- The diagrams in this paper are not necessarily drawn to scale.

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Candidate Number

Marker's
Use Only

Examiner's
Use Only

Marker No.

Examiner No.

Section A Question No.	Marks	Marks
1-3		
4-6		
7-8		
9		
10		
11		
12		
13		
Section A Total		

Checker's
Use Only

Section A Total

Section B Question No.*	Marks	Marks
Section B Total		

**To be filled in by the candidate*

Checker's
Use Only

Section B Total

Checker No.

FORMULAS FOR REFERENCE

SPHERE	Surface area	$= 4\pi r^2$
	Volume	$= \frac{4}{3}\pi r^3$
CYLINDER	Area of curved surface	$= 2\pi rh$
	Volume	$= \pi r^2 h$
CONE	Area of curved surface	$= \pi rl$
	Volume	$= \frac{1}{3}\pi r^2 h$
PRISM	Volume	$= \text{base area} \times \text{height}$
PYRAMID	Volume	$= \frac{1}{3} \times \text{base area} \times \text{height}$

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SECTION A(1) (33 marks)

Answer ALL questions in this section and write your answers in the spaces provided.

1. Make p the subject of the formula $5p - 7 = 3(p + q)$. (3 marks)

2. Simplify $\frac{m^6}{m^9 n^{-5}}$ and express your answer with positive indices. (3 marks)

3. Factorize

(a) $r^2 + 10r + 25$,

(b) $r^2 + 10r + 25 - s^2$.

(3 marks)

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4. The stem-and-leaf diagram below shows the distribution of weights (in kg) of 15 teachers in a school.

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

Find the median, the range and the standard deviation of the distribution. (3 marks)

5. Let k be a constant. If the quadratic equation $x^2 + 14x + k = 0$ has no real roots, find the range of values of k . (4 marks)

6. The marked price of a vase is \$ 400 . The vase is sold at a discount of 20% on its marked price.

- (a) Find the selling price of the vase.
 - (b) A profit of \$ 70 is made by selling the vase. Find the percentage profit.
- (4 marks)

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Page total

7. The consultation fees charged to an elderly patient and a non-elderly patient by a doctor are \$120 and \$160 respectively. On a certain day, there were 67 patients consulted the doctor and the total consultation fee charged was \$9000. How many elderly patients consulted the doctor on that day?

(4 marks)

8. In Figure 1, ABC and DEF are straight lines. It is given that $AC \parallel DF$, $BC = CF$, $\angle EBF = 90^\circ$ and $\angle BED = 110^\circ$. Find x , y and z .

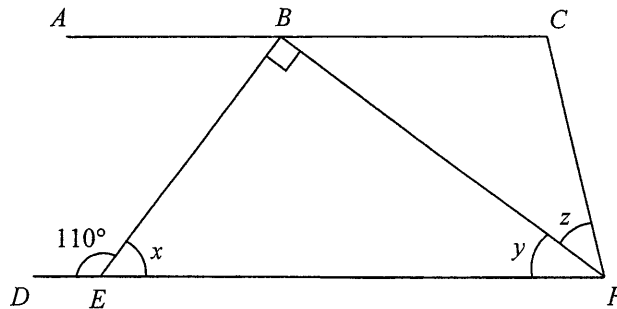


Figure 1

(4 marks)

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9. In Figure 2, the radius of the sector AOB is 40 cm . It is given that $\widehat{AB} = 16\pi$ cm .

- (a) Find $\angle AOB$.
(b) Find the area of the sector AOB in terms of π .

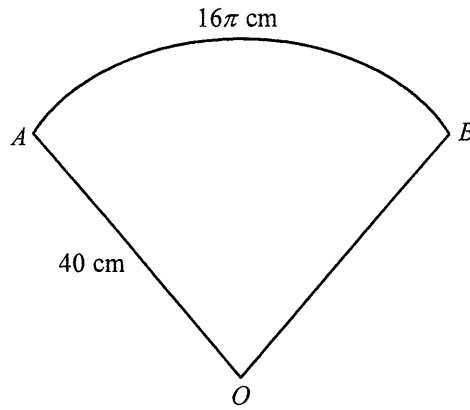


Figure 2

(5 marks)

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Section A(2) (33 marks)

Answer ALL questions in this section and write your answers in the spaces provided.

10. (a) If the length of a piece of thin metal wire is measured as 5 cm correct to the nearest cm, find the least possible length of the metal wire. (2 marks)

- (b) The length of a piece of thin metal wire is measured as 2.0 m correct to the nearest 0.1 m .
- (i) Is it possible that the actual length of this metal wire exceeds 206 cm? Explain your answer.
- (ii) Is it possible to cut this metal wire into 46 pieces of shorter metal wires, with each length measured as 5 cm correct to the nearest cm? Explain your answer.

(5 marks)

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11. Figure 3 shows an inverted right circular conical vessel which is held vertically. The height and the base radius of the vessel are 24 cm and 18 cm respectively. The vessel contains some water and the depth of the water is 8 cm .

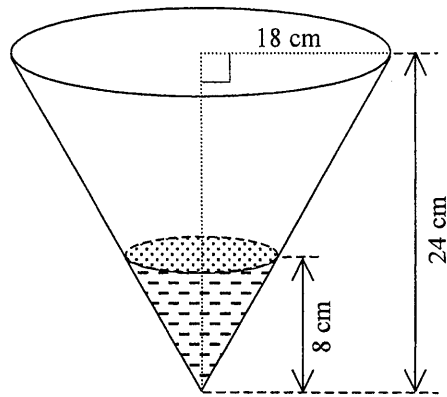


Figure 3

- (a) Find the volume of water contained in the vessel in terms of π . (4 marks)

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12. The bar chart and pie chart in Figure 4 show the distribution of the numbers of keys owned by the students in class A . The numbers of students having 2 keys, 3 keys and 4 keys are 12, 17 and k respectively.

Distribution of the numbers of keys owned by the students in class A

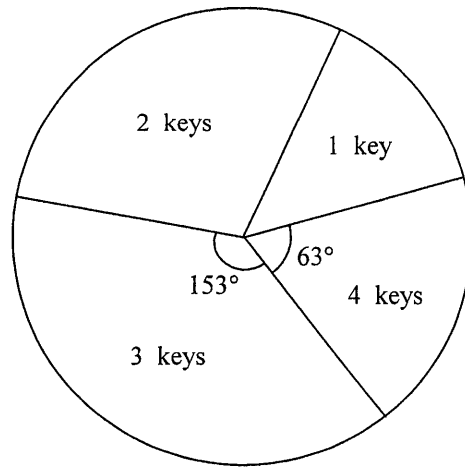
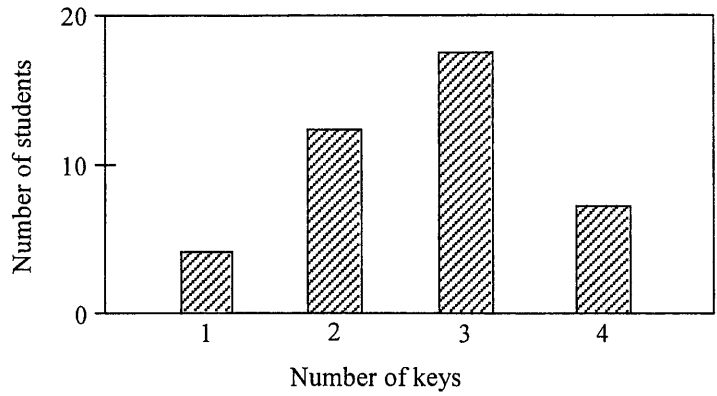


Figure 4

- (a) Find the value of k . (2 marks)

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(b) Find the number of students in class A .

(2 marks)

(c) Find the probability that a randomly selected student in class A has only 1 key.

(3 marks)

(d) It is given that the numbers of students in class A and class B are the same. The distributions of the numbers of keys owned by the students in class A and class B are also the same. The two classes are now combined to form a group. On each of the bar chart and the pie chart in Figure 4, is there a modification needed in order that the statistical chart can show the distribution of the numbers of keys owned by the students in this group? If your answer is 'yes', write down the modification needed.

(2 marks)

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13. In Figure 5, the perpendicular from B to AC meets AC at D . It is given that $AB = AC$ and the slope of AB is $\frac{-4}{3}$.

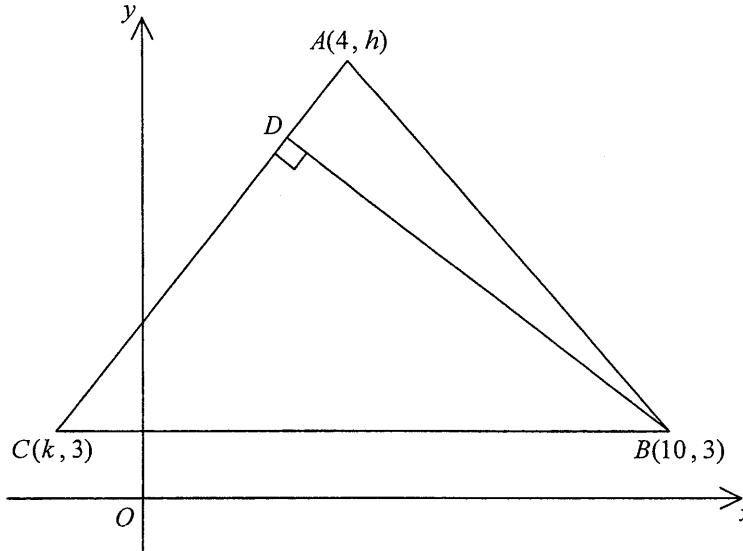


Figure 5

- (a) Find the equation of AB . (2 marks)

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- (b) Find the value of h . (2 marks)

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SECTION B (33 marks)

Answer any **THREE** questions in this section and write your answers in the spaces provided.

Each question carries 11 marks.

14. (a) Let $f(x) = 4x^3 + kx^2 - 243$, where k is a constant. It is given that $x + 3$ is a factor of $f(x)$.

(i) Find the value of k .

(ii) Factorize $f(x)$.

(5 marks)

(b) Let C be the cost of making a cubical handicraft with a side of length x cm. It is given that C is the sum of two parts, one part varies as x^3 and the other part varies as x^2 .
When $x = 5.5$, $C = 7\,381$ and when $x = 6$, $C = 9\,072$.

(i) Express C in terms of x .

(ii) If the cost of making a cubical handicraft is \$ 972, find the length of a side of the handicraft.

(6 marks)

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15. The following table shows the results of a survey about the sizes of shirts dressed by 80 students on a certain school day.

Student \ Size	Small	Medium	Large	Total
Boy	8	28	12	48
Girl	20	8	4	32

- (a) On that school day, a student is randomly selected from the 80 students.
- Find the probability that the selected student is a boy.
 - Find the probability that the selected student is a boy and he dresses a shirt of large size.
 - Find the probability that the selected student is a boy or the selected student dresses a shirt of large size.
 - Given that the selected student is a boy, find the probability that he dresses a shirt of large size.
- (6 marks)
- (b) On that school day, two students are randomly selected from the 80 students.
- Find the probability that the two selected students both dress shirts of large size.
 - Is the probability of dressing shirts of the same size by the two selected students greater than that of dressing different sizes? Explain your answer.
- (5 marks)

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16. Figure 6 shows a solid wooden souvenir $ABCDEF$ with the triangular base ABC lying on the horizontal ground. A , B and C are vertically below E , F and D respectively. DEF is an inclined triangular plane. It is given that $AB = 9$ cm, $BC = 5$ cm, $AC = 6$ cm, $AE = BF = 20$ cm and $CD = 23$ cm.

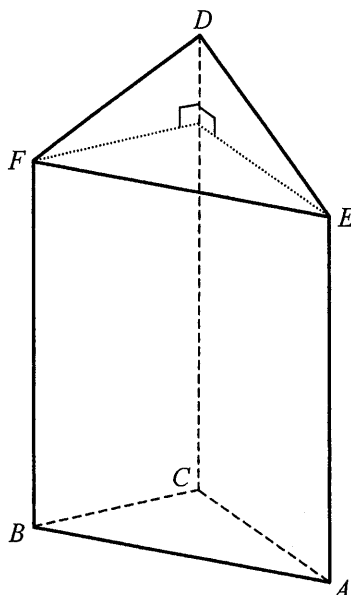


Figure 6

- (a) Find the area of the triangular base ABC and the volume of the souvenir $ABCDEF$. (4 marks)
- (b) Find $\angle DFE$ and the shortest distance from D to EF . (5 marks)
- (c) Can a piece of thin rectangular metal plate of dimensions 5 cm \times 4 cm be fixed onto the triangular surface DEF so that the thin metal plate completely lies in the triangle DEF ? Explain your answer. (2 marks)

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17.

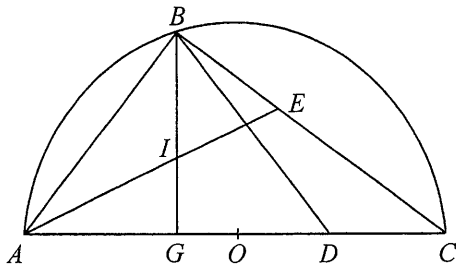


Figure 7(a)

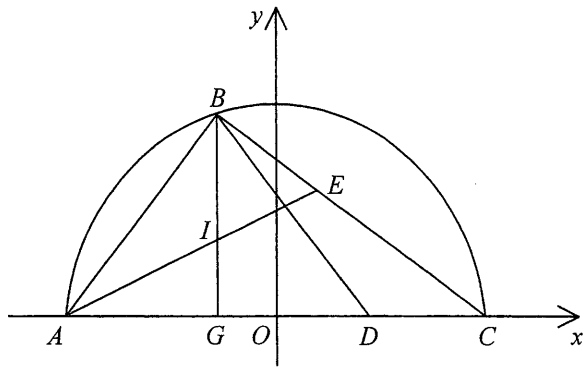


Figure 7(b)

(a) In Figure 7(a), AC is the diameter of the semi-circle ABC with centre O . D is a point lying on AC such that $AB = BD$. I is the in-centre of $\triangle ABD$. AI is produced to meet BC at E . BI is produced to meet AC at G .

(i) Prove that $\triangle ABG \cong \triangle DBG$.

(ii) By considering the triangles AGI and ABE , prove that $\frac{GI}{AG} = \frac{BE}{AB}$.

(6 marks)

(b) A rectangular coordinate system, with O as the origin, is introduced to Figure 7(a) so that the coordinates of C and D are $(25, 0)$ and $(11, 0)$ respectively and B lies in the second quadrant (see Figure 7(b)). It is found that $BE : AB = 1 : 2$.

(i) Find the coordinates of G .

(ii) Find the equation of the inscribed circle of $\triangle ABD$.

(5 marks)

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