



STUDENT HOUSE

HONG KONG DIPLOMA OF SECONDARY EDUCATION  
MOCK EXAMINATION

# **MATHEMATICS Compulsory Part PAPER 1**

## **Question-Answer Book**

Time allowed: 2 hours 15 minutes

This paper must be answered in English

### **INSTRUCTIONS**

1. Write your Candidate Number in the space provided on Page 1.
2. Stick barcode labels in the spaces provided on Pages 1, 3, 5, 7 and 9.
3. This paper consists of THREE sections, A(1), A(2) and B. Each section carries 35 marks.
4. 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.
5. Graph paper and supplementary 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.
6. Unless otherwise specified, all working must be clearly shown.
7. Unless otherwise specified, numerical answers should be either exact or correct to 3 significant figures.
8. The diagrams in this paper are not necessarily drawn to scale.

Please stick your barcode label here

Candidate Number

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	Marker's Use only	Examiner's Use only
	Marker No.	Examiner No.
Question No.	Marks	Marks
1 – 2		
3 – 4		
5 – 6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
<b>Total</b>		

**SECTION A(1) (35 marks)**

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

(3 marks)

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2. Let  $f(x) = x^2 - 4x + 3$ . If  $f(0) = f(k)$ , find the possible values of  $k$ .

(3 marks)

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3. Factorize

(a)  $x^4 + 4x^2 + 4$ ,

(b)  $x^4 + 4$ .

(3 marks)

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4. Consider the formula  $C = \frac{5}{9}(F - 32)$ .

(a) Make  $F$  the subject of the formula.

(b) Find the value of  $F$  when  $C = 40$ .

(4 marks)

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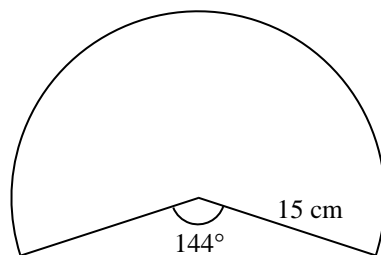
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5.



Find the volume of the cone whose curved surface is formed by the sector shown in the figure. Express your answer in terms of  $\pi$ .

(4 marks)

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6. With a 10% discount, the selling price of an article is reduced by \$12.

(a) Find the marked price of the article.

(b) If the article is sold at discount, the profit percentage to the seller is 35%. Find the cost of the article.

(4 marks)

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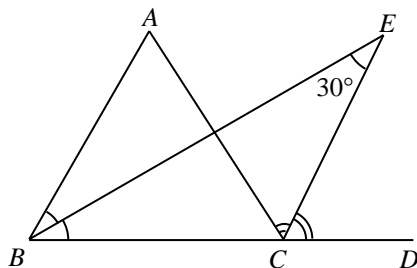
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- [illegible]



- Find  $\angle BAC$ .
- If  $AB = AC$ , show that  $\triangle ABC$  is equilateral.

(4 marks)

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- [illegible]

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9. The following stem-and-leaf diagrams show the distribution of the scores of students from two different classes in the same test:

Stem (10 marks)	Class 1A Leaf (1 mark)
3	1 3
4	0 $x$ 9
5	2 2 3 5 6
6	4 5 7 8 8 9
7	0 2 3
8	1

Stem (10 marks)	Class 1B Leaf (1 mark)
5	1 1 2 3 5 8
6	2 3 4 $y$ 6 6 7 8
7	0 1 3 4 4 9

It is known that the mean score of Class 1A is 58 marks, and the median score of Class 1B is 65 marks.

- (a) Find the values of  $x$  and  $y$ .
- (b) If  $v_A$  and  $v_B$  are the variances of the scores of Classes 1A and 1B respectively, which one,  $v_A$  or  $v_B$ , is smaller? Explain your answer.

(6 marks)

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- (a) Express  $x$  in terms of  $y$  and  $z$ .

(3 marks)

- (3 marks)

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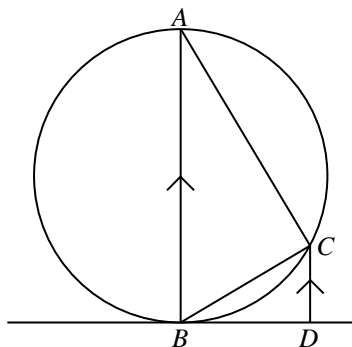
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- [illegible]



- (a) Prove that  $\triangle ABC \sim \triangle BCD$ . (3 marks)
- (b) If  $AB = 8$  and  $CD = 2$ , find the area of  $\triangle ABC$ . (3 marks)

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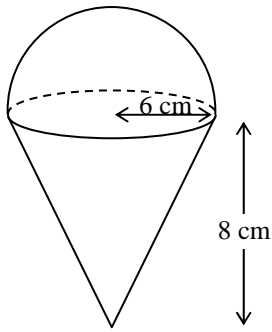
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13. In the figure, a solid in the form of an ice-cream cone is made up of a hemisphere of radius 6 cm and a cone with base radius 6 cm and height 8 cm.



- (a) Find the curved surface area of its

- (i) hemispherical part,
- (ii) conical part,

and express your answer in terms of  $\pi$ .

(5 marks)

- (b) If the cost of painting the spherical part is \$1 per  $\text{cm}^2$  and the cost of painting the conical part is \$1.5 per  $\text{cm}^2$ , find, correct to the nearest dollar, the total cost of painting the entire solid.

(2 marks)

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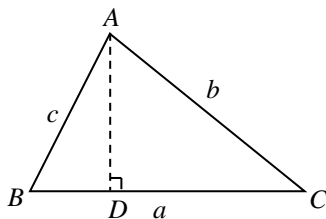
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14. In acute-angled  $\triangle ABC$ , denote the length of the sides opposite to  $A, B, C$  by  $a, b, c$  respectively.  $D$  is the foot of the perpendicular from  $A$  to  $BC$ .



- (a) (i) Express  $AD$  in terms of  $B$  and  $c$ .

- (ii) Show that  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ .

(3 marks)

- (b) (i) Express  $BD$  in terms of  $B$  and  $c$ .

- (ii) By using  $DC = BC - BD$ , deduce  $b^2 = a^2 + c^2 - 2ac \cos B$ .

(3 marks)

- (c) Using (a) and (b), or otherwise, show that  $\sin A + \sin C > \sin(A + C)$ .

(3 marks)

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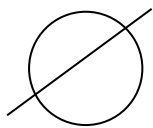
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(3 marks)

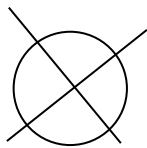
(2 marks)

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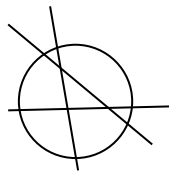
16. For a positive integer  $n$ , let  $a_n$  denote the maximum number of regions obtained when a circle is cut by  $n$  straight lines. The figures below illustrate the cases for  $n = 1, 2$  and 3.



$$a_1 = 2$$



$$a_2 = 4$$



$$a_3 = 7$$



$$a_4 = ?$$

- (a) Write down the value of  $a_4$ . (1 mark)

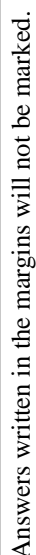
- (b) By observing the value of  $a_{n+1} - a_n$  for  $n = 1, 2, 3$ , deduce that  $a_n = \frac{n^2 + n + 2}{2}$ . (4 marks)

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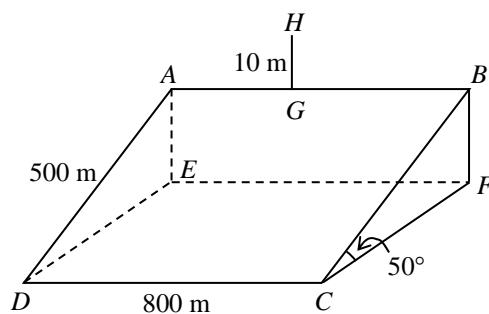


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18. In the figure,  $ABCD$  is a rectangular plane with  $AD = 500$  m and  $DC = 800$  m. It is inclined at an angle of  $50^\circ$  to the horizontal.  $E$  and  $F$  are the projections of  $A$  and  $B$  to the ground.  $G$  is a point on  $AB$  such that  $AG : GB = 2 : 3$ .  $GH$  is a vertical flagpole with height 10 m.



(a) Explain, without direct calculation, why  $\angle DGC$  is acute.

(3 marks)

(b) Find

- (i) the length of  $AE$ ;
- (ii) the angle of elevation of  $H$  from  $D$ .

(7 marks)

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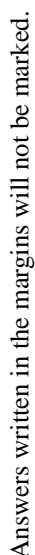
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