

HONG KONG DIPLOMA OF SECONDARY  
EDUCATION EXAMINATION MOCK PAPER

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**MATHEMATICS (COMPULSORY PART)**  
**PAPER 1: CONVENTIONAL QUESTIONS**

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**Time Allowed:** 2 hr 15 min

**Total Marks:** 105

**INSTRUCTIONS TO CANDIDATES:**

1. This paper consists of multiple sections.
2. Answer ALL questions in this paper.
3. Write your answers in the spaces provided.
4. Unless otherwise specified, all working must be clearly shown.
5. Unless otherwise specified, numerical answers should be either exact or correct to 3 significant figures.

## SECTION A(1)

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### QUESTION 1

Solve the equation  $2x^2 - 7x + 3 = 0$ .

(3 marks)

### QUESTION 2

Let  $f(x) = 2x^2 - 3x + 1$ .

(a) Find  $f(-2)$ .

(2 marks)

(b) Solve  $f(x) = 0$ .

(2 marks)

### QUESTION 3

Answer the following questions.

(a) Solve  $3^{x+1} = 81$ .

(2 marks)

(b) Evaluate  $\log_2 32$ .

(2 marks)

#### QUESTION 4

The polynomial  $p(x) = x^3 + ax^2 - 4x + 6$  leaves a remainder of 4 when divided by  $x - 1$ .

(a) Find the value of  $a$ . (2 marks)

(b) Hence find the remainder when  $p(x)$  is divided by  $x + 2$ . (2 marks)

#### QUESTION 5

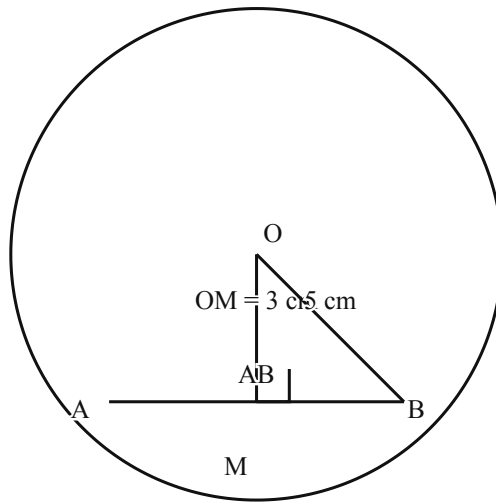
A straight line passes through  $A(2, -1)$  and  $B(6, 7)$ .

(a) Find the gradient of  $AB$ . (2 marks)

(b) Find the equation of  $AB$  in the form  $y = mx + c$ . (2 marks)

### QUESTION 6

In the circle with centre  $O$ ,  $AB$  is a chord and  $OM$  is perpendicular to  $AB$  at  $M$ . The radius of the circle is 5 cm and  $OM = 3$  cm.



(a) Find the length of  $AM$ .

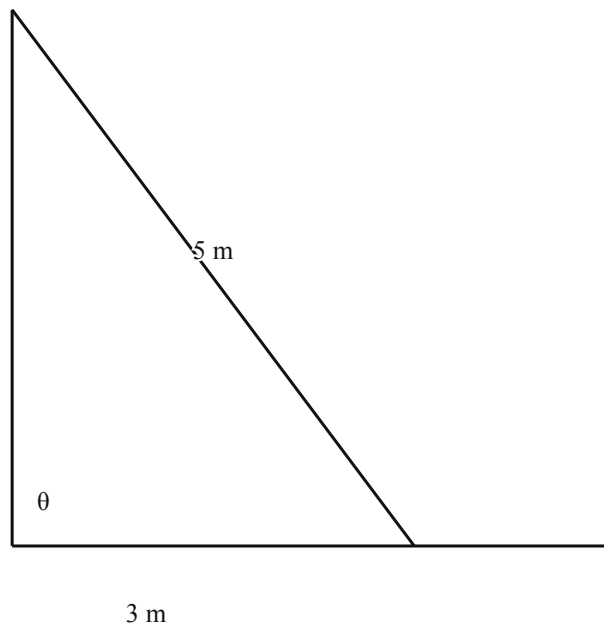
(2 marks)

(b) Find the length of chord  $AB$ .

(2 marks)

### QUESTION 7

A ladder of length 5 m rests against a vertical wall. Its foot is 3 m from the wall.



- (a) Find the height reached by the ladder on the wall. (2 marks)
- (b) Find the angle  $\theta$  between the ladder and the ground, to the nearest degree. (2 marks)

### QUESTION 8

An arithmetic sequence has first term 7 and common difference 3.

- (a) Find its 20th term. (2 marks)
- (b) Find the sum of its first 20 terms. (2 marks)

### QUESTION 9

The table shows the scores of a group of students.

| Score     | 2 | 4 | 6 | 8 |
|-----------|---|---|---|---|
| Frequency | 1 | 3 | 4 | 2 |

(a) Find the mean score.

(2 marks)

(b) Find the range of the scores.

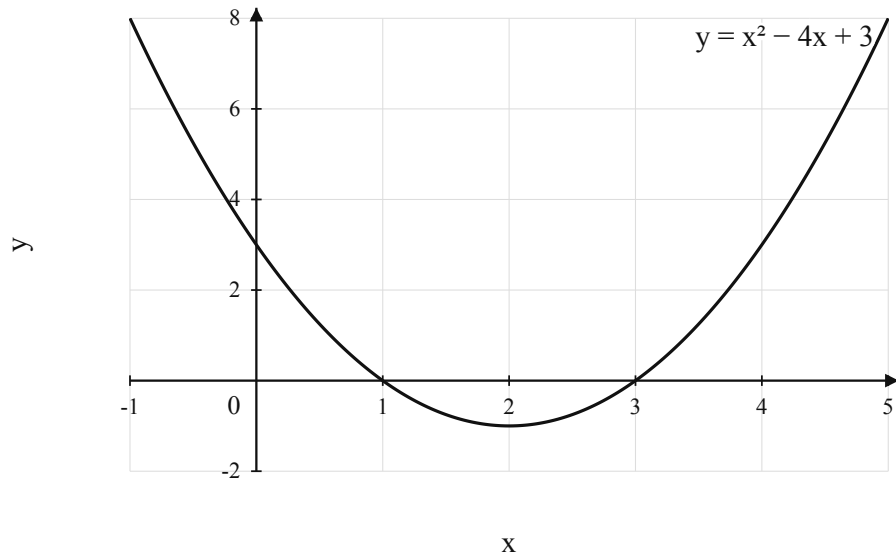
(2 marks)

## SECTION A(2)

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### QUESTION 10

The graph of  $y = x^2 - 4x + 3$  is considered.



(a) Find the coordinates of the vertex of the graph.

(2 marks)

(b) Find the  $x$ -intercepts of the graph.

(2 marks)

(c) Find the range of  $y = x^2 - 4x + 3$  for  $-1 \leq x \leq 5$ .

(3 marks)

### QUESTION 11

A positive quantity  $y$  varies inversely as the square of  $x$ . When  $x = 2$ ,  $y = 18$ .

(a) Express  $y$  in terms of  $x$ . (2 marks)

(b) Find  $y$  when  $x = 3$ . (2 marks)

(c) Find the positive value of  $x$  when  $y = 2$ . (3 marks)

### QUESTION 12

A geometric sequence has first term 5 and common ratio 2.

(a) Find the 8th term. (2 marks)

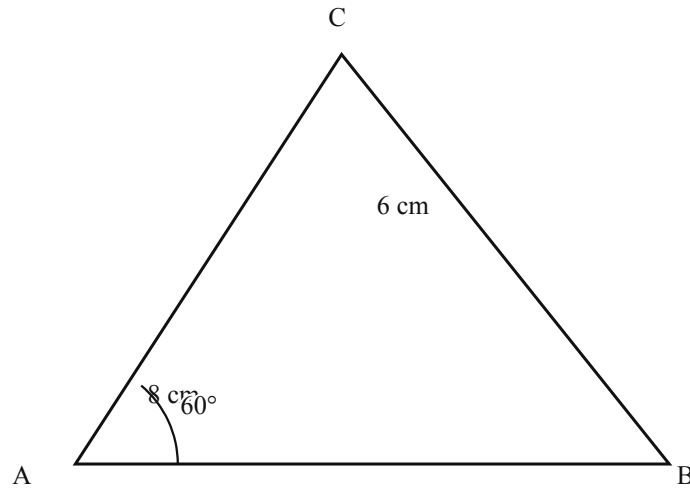
(b) Find the sum of the first 8 terms. (3 marks)

(c) Find the least positive integer  $n$  such that the  $n$ th term is greater than 1000. (2 marks)

### QUESTION 13

In triangle  $ABC$ ,  $AB = 8$  cm,  $AC = 6$  cm and  $\angle BAC = 60^\circ$ .

Not drawn to scale

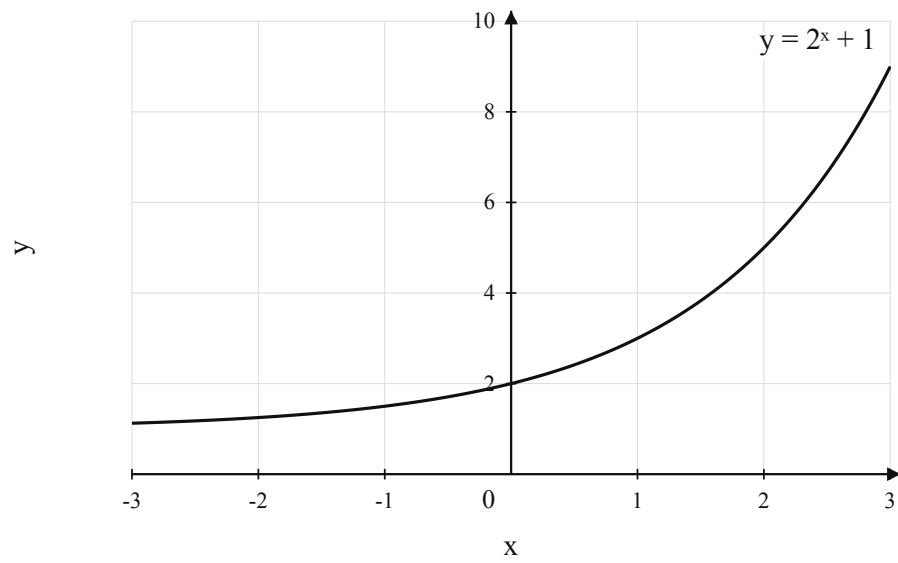


(a) Find the length of  $BC$ . (3 marks)

(b) Find  $\angle ABC$ , to the nearest degree. (4 marks)

### QUESTION 14

The function  $f$  is defined by  $f(x) = 2^x + 1$ .



(a) Find  $f(0)$  and  $f(2)$ .

(2 marks)

(b) State the horizontal asymptote of the graph of  $y = f(x)$ .

(2 marks)

(c) Solve  $f(x) = 5$ .

(3 marks)

## SECTION B

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### QUESTION 15

A workshop makes two products,  $X$  and  $Y$ . Let  $x$  and  $y$  be the numbers of units made per day. Each unit of  $X$  requires 2 machine-hours and 1 labour-hour. Each unit of  $Y$  requires 1 machine-hour and 2 labour-hours. At most 100 machine-hours and 80 labour-hours are available. The workshop makes at most 50 units in total. The profit on each unit of  $X$  is \$30 and on each unit of  $Y$  is 40.

- (a) Write down all the inequalities, including the non-negativity conditions, that describe the feasible production plans. (3 marks)
  
  
  
  
  
  
  
  
  
  
- (b) Write the profit function  $P$ . (1 mark)
  
  
  
  
  
  
  
  
  
  
- (c) Find the production plan that gives the maximum profit, and state that maximum profit. (3 marks)

### QUESTION 16

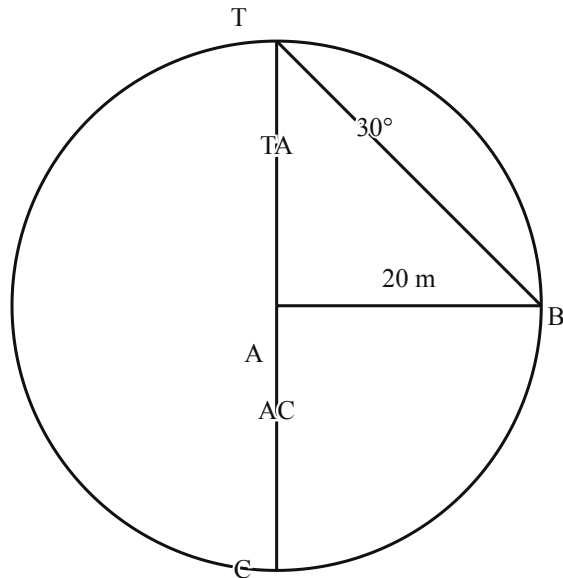
A committee of 3 people is to be selected from 5 women and 4 men. Assume that every selection is equally likely.

- (a) Find the number of different committees that can be formed. (2 marks)
  
  
  
  
  
  
  
  
  
  
- (b) Find the probability that a randomly selected committee consists of exactly 2 women. (2 marks)
  
  
  
  
  
  
  
  
  
  
- (c) Given that the committee contains at least one man, find the probability that it contains exactly 2 women. (3 marks)

### QUESTION 17

A vertical tower  $TA$  stands at the centre  $A$  of a horizontal circular field of radius  $AB = 20$  m. From a point  $B$  on the boundary, the angle of elevation of the top  $T$  of the tower is  $30^\circ$ . Point  $C$  is another point on the boundary such that  $\angle BAC = 90^\circ$ .

Not drawn to scale



- (a) Find the height of the tower. (2 marks)
- (b) Find the length of  $BC$ . (2 marks)
- (c) Find the angle of elevation of  $T$  from  $C$ , to the nearest degree. (3 marks)

### QUESTION 18

A circular sign has centre  $C$  and radius 5 cm. Its centre is at  $(2, -1)$  in a Cartesian coordinate plane. A point  $P$  moves so that its distance from  $(2, -1)$  is always 5.

(a) Write down the equation of the locus of  $P$ . (2 marks)

(b) Find the coordinates of the points where this locus meets the  $x$ -axis. (2 marks)

(c) The line  $y = x - 1$  intersects the circle at  $C$  and another point  $Q$ . Find the coordinates of  $Q$ . (3 marks)

### QUESTION 19

The following are the test scores of two classes. Treat each class as the whole population for its calculations.

| Class | Scores         |
|-------|----------------|
| A     | 4, 5, 5, 6, 10 |
| B     | 3, 6, 6, 7, 8  |

(a) Find the mean score of each class. (2 marks)

(b) Find the population standard deviation of each class, to 2 decimal places. (3 marks)

(c) A report states, 'Class A performed better because its highest score was greater.' Explain why this conclusion is not justified by the information given. (2 marks)