2025-DSE
MATH CP
PAPER 1

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2025

MATHEMATICS Compulsory Part

PAPER 1

Question-Answer Book

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

Please stick the barcode label here.

Candidate Number									

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.

SECTION A(1) (35 marks)

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

2. Simplify $\frac{1}{3d-4}-\frac{2}{6d+5}$. **(3 marks)**

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3. Let m and n be two numbers. The sum of $2m$ and $3n$ is 999 while the ratio of m to n is $8:7$. Find n. (3 marks)

4. The coordinates of the point A are $(4,-2)$. A is rotated clockwise about the origin O through $90°$ to B.

(a) Write down the coordinates of B.

(b) Suppose that B is translated upwards by t units to the point C. If A, O and C are collinear, find t. (3 marks)

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5. Factorize

(a) $10pr-6qr$,

(b) $25p^2-9q^2$,

(c) $25p^2-9q^2-10pr+6qr$. (4 marks)

6. Consider the compound inequality

$$\frac{6x+1}{2} < x-8 \quad \text{or} \quad 3x \leq -21 \quad \ldots\ldots\ldots\ldots (*) .$$

(a) Solve (*) .

(b) Write down the greatest integer satisfying (*) . (4 marks)

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7. The selling price of a souvenir is $378. The souvenir is sold at a discount of 60% on its marked price. The marked price of the souvenir is 75% above its cost.

(a) Find the marked price of the souvenir.

(b) Find the cost of the souvenir.

(c) Determine whether there is a gain or a loss after selling the souvenir. Explain your answer.

(5 marks)

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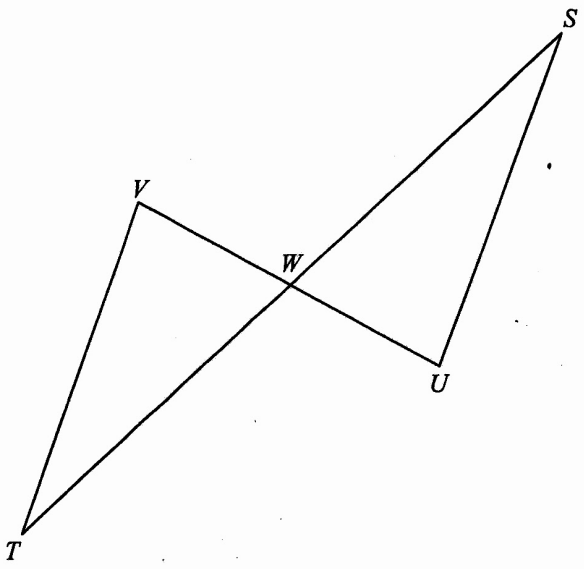
8. In the figure, ST and UV intersect at the point W. It is given that $SU // VT$ and W is the mid-point of ST.



(a) Prove that $\Delta SUW \cong \Delta TVW$.

(b) Let X be a point lying on TW such that $\Delta SUW \sim \Delta VXW$. If $SU = 57$ cm, $SW = 63$ cm and $WX = 7$ cm, find the perimeter of ΔTVX.

(5 marks)

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9. The table below shows the distribution of the numbers of pens owned by some students.

Number of pens	5	6	7	8	9
Number of students	9	13	2	s	11

The median of the distribution is 7 .

(a) Find the least possible value of s .

(b) Write down the greatest possible value of s .

(c) Find the greatest possible standard deviation of the distribution.

(5 marks)

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SECTION A(2) (35 marks)

10. Let $f(x)=2x^3+hx^2+kx+15$, where h and k are constants. When $f(x)$ is divided by $x+2$, the remainder is -45. It is given that $f(x)$ is divisible by $2x-5$.

(a) Find h and k. (3 marks)

(b) Someone claims that all the roots of the equation $f(x)=0$ are rational numbers. Do you agree? Explain your answer. (3 marks)

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11. It is given that $p(x)$ partly varies as x and partly varies as x^2. Suppose that $p(7) = 56$ and $p(9) = 216$.

(a) Find $p(x)$. (3 marks)

(b) Let c be a real constant. Find the range of values of c such that the equation $p(x) = c$ has two distinct real roots. (3 marks)

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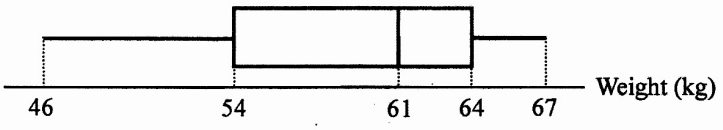
12. The stem-and-leaf diagram below shows the distribution of the weights (in kg) of some athletes before training.

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

The difference of the range and the inter-quartile range of the above distribution is 25 kg .

(a) Write down the range of the above distribution. Hence, find w. (3 marks)

(b) The box-and-whisker diagram below shows the distribution of the weights (in kg) of the athletes after the training.



(i) Find the change in the upper quartile of the distribution due to the training.

(ii) Is the distribution of the weights of the athletes after the training less dispersed than that before the training? Explain your answer.

(4 marks)

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13. The straight line L cuts the positive x-axis and the positive y-axis at the points M and N respectively. Let P be a moving point in the rectangular coordinate plane such that $MP = NP$. Denote the locus of P by Γ. It is given that the equation of Γ is $3x - 2y - 30 = 0$.

(a) Describe the geometric relationship between Γ and MN. (1 mark)

(b) Find the equation of L. (3 marks)

(c) Suppose that Γ cuts L and the x-axis at the points Q and R respectively. Find the area of the quadrilateral $ONQR$, where O is the origin. (3 marks)

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14. The height and the base radius of a solid metal right circular cone are 45 cm and 24 cm respectively. The circular cone is divided into a circular cone and a frustum X by a plane parallel to its base. It is given that the height of X is 30 cm .

(a) Express the volume of X in terms of π. (3 marks)

(b) Express the total surface area of X in terms of π. (3 marks)

(c) X is melted and recast into a solid cube. Does the total surface area of the cube exceed the total surface area of X? Explain your answer. (3 marks)

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SECTION B (35 marks)

15. There are 8 white plates, 4 red plates and 1 black plate in a box. If 3 plates are randomly drawn from the box at the same time, find

(a) the probability that the colours of the 3 plates drawn are the same; (2 marks)

(b) the probability that the colours of the 3 plates drawn are all different. (2 marks)

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16. It is given that $\begin{cases} \log_3 x + \log_3 y = 9 \\ \log_x 81 - \log_y 9 = 1 \end{cases}$, where $0 < x < y$.

(a) Let $u = \log_3 y$. Prove that $u^2 - 3u - 18 = 0$. (2 marks)

(b) Find x. (2 marks)

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17. Let $T(n)$ be the nth term of an arithmetic sequence such that $T(1) \neq T(2)$ and $T(47) = 456$. It is given that $T(9), T(47), T(199)$ is a geometric sequence.

(a) Find $T(1)$. (3 marks)

(b) Find the least value of n such that the sum of the first n terms of the arithmetic sequence is greater than 10^6. (3 marks)

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18. Let $g(x) = 3x^2 - 6kx + 24x + 3k^2 - 24k + 55$, where k is a positive constant. Denote the vertex of the graph of $y = g(x)$ by R.

(a) Using the method of completing the square, express the coordinates of R in terms of k.
(2 marks)

(b) The graph of $y = h(x)$ is obtained by translating the graph of $y = g(x)$ rightwards by 6 units and then downwards by 10 units. Denote the vertex of the graph of $y = h(x)$ by S. Let T be a point such that the orthocentre of ΔRST is the origin.

(i) Express the coordinates of T in terms of k.

(ii) The coordinates of the point U are $(-5, 5)$. Let V be a point lying on RS such that TV is perpendicular to RS. It is given that S, T, U and V are concyclic. Find k.
(7 marks)

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19. The equation of the straight line L is $4x-3y+83=0$. The equation of the circle C is $x^2+y^2+ax-2y+b=0$, where a and b are positive constants. It is given that C passes through the point $(-10,9)$ and L is a tangent to C.

(a) Prove that the equation $25x^2+(9a+640)x+(90a+4\,924)=0$ has equal roots. Hence, find a and b. (4 marks)

(b) The coordinates of the point P are $(-20,1)$. Let Q be a point lying below L such that PQ is tangent to C and $PQ=25$. Denote the centre of C by I.

(i) Find $\cos\angle IPQ$.

(ii) Find, in surd form, the distance between I and Q.

(iii) Let R be a point lying on L such that C is the inscribed circle of ΔPQR. Denote the radius of the circumcircle of ΔPQR by r. Someone claims that $r>PQ$. Is the claim correct? Explain your answer.

(8 marks)

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