MOCK SET 1
MATH CP

PAPER 1

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HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

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MATHEMATICS Compulsory Part

PAPER 1

Question-Answer Book

Time allowed: 2¼ hours

This paper must be answered in English

INSTRUCTIONS

(1) This paper consists of THREE sections, A(1), A(2) and B.

(2) 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.

(3) Unless otherwise specified, all working must be clearly shown.

(4) Unless otherwise specified, numerical answers should be either exact or correct to 3 significant figures.

(5) The diagrams in this paper are not necessarily drawn to scale.

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*For candidates who have paid our paper-marking service, please write your **Marking Number** and **E-mail Address** on the right. (The information is used for the marking service only and is not required in the HKDSE.) Please refer to the confirmation email of the marking service, or visit https://dse.pearson.com.hk for details.

Answers:

SECTION A(1) (35 marks)

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

2. (a) Round off 202.1495 to 2 significant figures.

(b) Round down 202.1495 to 2 decimal places.

(c) Round up 202.1495 to the nearest thousand.

(3 marks)

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3. Factorize

(a) $x^2 + 8xy + 16y^2$,

(b) $x^2 + 8xy + 16y^2 - 5x - 20y$.

(3 marks)

4. Let a and b be non-zero numbers such that $a : b = 11 : 7$ and $3a - 4b = 20$.
Find $2a - 3b$. (3 marks)

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5. (a) Find the range of values of x which satisfy both

$$\frac{4x-7}{5} > 2(x-4) \quad \text{and} \quad \frac{56-3x}{7} \geq 8 \ .$$

(b) How many non-negative integers satisfy both inequalities in (a)?

(4 marks)

6. The daily wage of Ada is 25% higher than that of Billy while the daily wage of Carol is 25% lower than that of Ada.

(a) Someone claims that the daily wages of Billy and Carol are the same. Do you agree? Explain your answer.

(b) If the sum of the daily wages of Billy and Carol is \$496 , find the daily wage of Ada.

(4 marks)

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7. In a polar coordinate system, the polar coordinates of the points P and Q are $(5, 52^{\circ})$ and $(10, 112^{\circ})$ respectively.

(a) Let O be the pole. Someone claims that OP is perpendicular to PQ. Do you agree? Explain your answer.

(b) Find PQ.

(5 marks)

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8. In Figure 1, B and D are points lying on CE and AE respectively. It is given that $AB = AC$, $BD \perp AE$, $\angle ACE = 63^\circ$ and $\angle EAB = 26^\circ$.

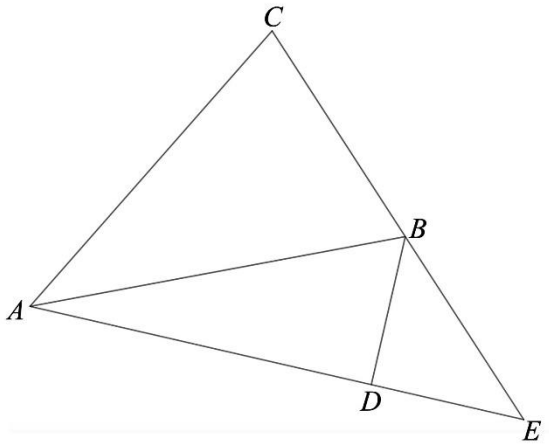

Figure 1

(a) Find $\angle AEC$.

(b) Join CD and let $\angle CDB = \theta$. CD cuts AB at F. Express $\angle AFC$ in terms of θ.

(5 marks)

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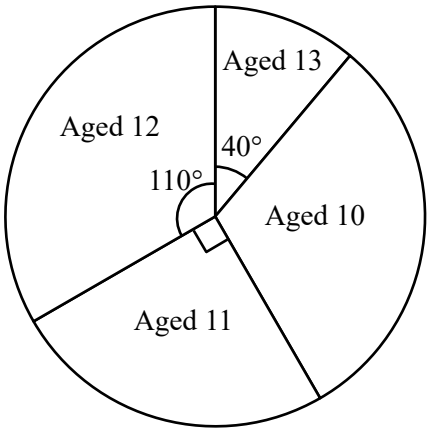
9. The pie chart below shows the distribution of the ages of students in a choir.



Distribution of the ages of students in a choir

(a) Find the mean of the distribution.

(b) Someone claims that the median of the distribution cannot be found due to insufficient information. Do you agree? If yes, briefly explain. Otherwise, find the median of the distribution.

(5 marks)

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SECTION A(2) (35 marks)

10. Let $\$C$ be the cost of making a carpet of area A m^2. It is given that C is the sum of two parts, one part is a constant and the other part varies as the square root of A. When $A = 4$, $C = 78$; when $A = 9$, $C = 94$.

(a) Find the cost of making a carpet of area 25 m^2. (4 marks)

(b) There is a larger carpet which is similar to the carpet described in (a). If the perimeter of the larger carpet is 4 times that of the carpet described in (a), find the cost of making the larger carpet. (2 marks)

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11. The stem-and-leaf diagram below shows the distribution of the weights (in kg) of the students in class 5B.

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

(a) Find the inter-quartile range of the distribution. (2 marks)

(b) It is known that the standard weight of a Secondary five student is 68 kg . If a student is randomly selected from the class, find the probability that the weight of the student is greater than this standard. (2 marks)

(c) If 3 more students weigh less than 59 kg are included in the distribution, will the median of the distribution increase, decrease or remain unchanged? Explain your answer. (2 marks)

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12. Let $f(x) = 6x^3 + 7x^2 - kx - 10$, where k is a constant. It is given that $f(x) \equiv (x + 2)(ax^2 + bx + c)$, where a, b and c are constants.

(a) Find a, b and c. (4 marks)

(b) Someone claims that all the roots of $f(x) = 0$ are rational numbers. Do you agree? Explain your answer. (2 marks)

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13. Figure 2 shows a water tank $ABCDEF$, which is in the shape of a right triangular prism. It is given that the plane $BCDF$ is on the top and parallel to the horizontal and the edge AE touches the horizontal ground. ABC and EFD are two identical triangles while $ACDE$, $ABFE$ and $BCDF$ are rectangles. $AE = 10$ m, $AB = 8$ m, $AC = 15$ m and $BC = 17$ m. Initially, the tank is full of water.

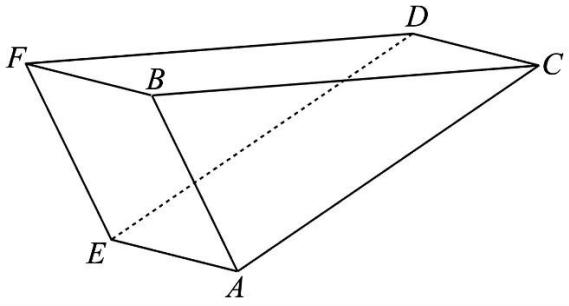

Figure 2

(a) Find the initial volume of the water in the tank. (3 marks)

(b) Water is pumped out by a pipe at a rate of 25 Litres per second constantly for 5 hours. Find

(i) the volume of water pumped out,

(ii) the wet area on the plate $ACDE$ after pumping out the water.

(5 marks)

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14. L is a straight line passing through $A(4, 3)$ and perpendicular to OA, where O is the origin.

(a) B is a point lying on L such that $AB = 2$. Find the coordinates of B. (3 marks)

(b) P is a moving point in the rectangular coordinate plane such that area of ΔPOA is always equal to 5 square units. Denote the locus of P by Γ.

(i) Describe the geometric relationship between Γ and OA.

(ii) Find the equation(s) of Γ.

(iii) The equation of a circle C is $x^2 + y^2 - 8x - 6y = 0$. C cuts Γ at two distinct points S and Q. Find the area of ΔASQ.

(6 marks)

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Section B (35 marks)

15. In a conference room, there are 6 financial consultants, 5 accountants, 4 lawyers and 3 secretaries. If 6 people are selected randomly, find the probabilities that

(a) there are only 3 professions and 2 people of each kind; (3 marks)

(b) at least one secretary is selected. (2 marks)

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16. The seats in a cinema are numbered in numerical order from the first row to the last row, and from left to right. The first row has 15 seats in total. Each succeeding row has 4 seats more than its preceding row. If the seat numbered with 598 is located in the mth row, find

(a) the value of m ; (3 marks)

(b) the total number of seats in the mth row. (2 marks)

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17. In Figure 3, CB is a diameter of the circle. OA is the tangent to the circle at O such that ABC is a straight line. It is given that $\angle ODA = 45°$ and $\angle CAD = \theta$.

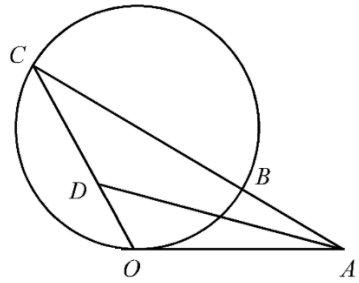

Figure 3

(a) Express $\angle ACO$ and $\angle CBO$ in terms of θ. (2 marks)

(b) Someone claims that AD bisects $\angle OAC$. Do you agree? Explain your answer. (3 marks)

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18. Let $f(x) = x^2 - 2kx - (3k^2 - 4k + 1)$, where k is a real constant.

(a) Using the method of completing the square, find the coordinates of the vertex of the graph of $y = f(x)$ in terms of k. (2 marks)

(b) Someone claims that the graph of $y = f(x)$ must cut the x-axis at two distinct points for any real values of k. Do you agree? Explain your answer. (2 marks)

(c) Suppose $k < \frac{1}{2}$.

(i) It is given that the graph of $y = f(x)$ cuts the x-axis at two distinct points P and Q. Find the length of PQ in terms of k.

(ii) Under a transformation, $f(x)$ is changed to $g(x) = x^2 + 4kx + 4k - 1$. The graph of $y = g(x)$ cuts the x-axis at two distinct points P' and Q'.

(1) Describe the geometric meaning of the transformation.

(2) Write down the length of $P'Q'$ in terms of k.

(5 marks)

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19. $PQRS$ is a quadrilateral metal sheet, where $PS = 40$ cm, $SR = 60$ cm, $\angle QPS = 120°$, $\angle QRS = 35°$ and $\angle PQS = 20°$. The metal sheet is held with PQ lying on the horizontal ground as shown in Figure 4.

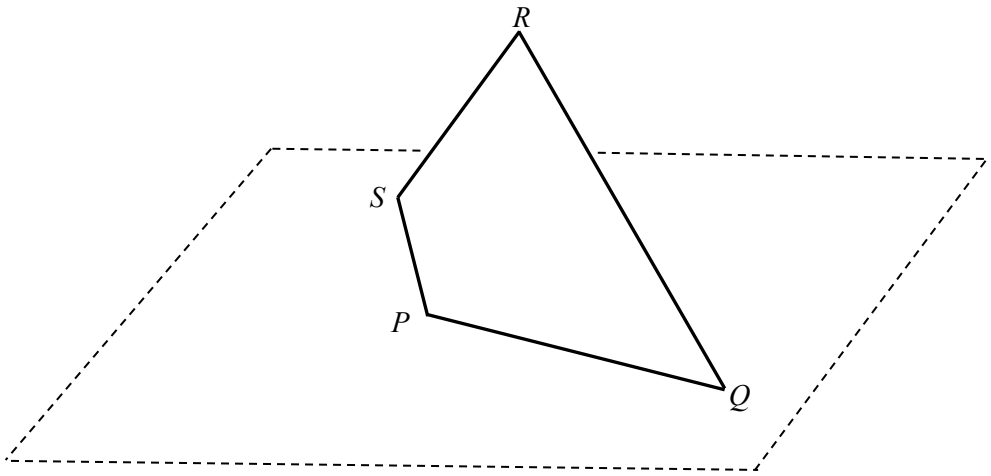

Figure 4

(a) Find the length of QR. (3 marks)

(b) Find the area of the metal sheet. (2 marks)

(c) It is given that the angle between the metal sheet and the horizontal ground is $34°$.

(i) Find the shortest distance from S to the horizontal ground.

(ii) A student claims that the angle between QR and the horizontal ground is less than $20°$. Do you agree? Explain your answer.

(6 marks)

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END OF PAPER

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