2024-2025 S6
MOCK EXAM
MATH CP
PAPER 1

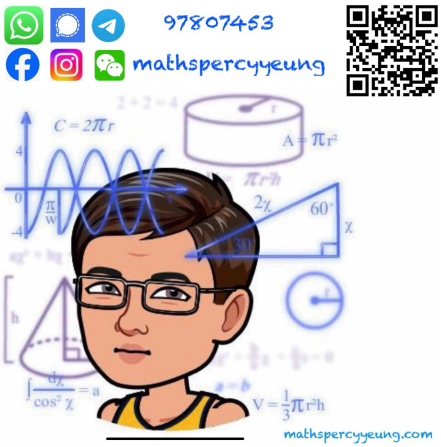
2024 – 2025
S6 Mock Examination

MATHEMATICS Compulsory Part

PAPER 1

Question–Answer Book

22nd January, 2025
8:15 am – 10:30 am (2 hours 15 minutes)
This paper must be answered in English



Section	Marks
A(1)	/ 35
A(2)	/ 35
A Total	**/70**
B Total	**/35**
TOTAL	**/105**

INSTRUCTIONS

1. Write your name, class and class number in the spaces provided on this cover.

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. 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.

6. The diagrams in this paper are not necessarily drawn to scale.

Section A(1) (35 marks)

1. Make b the subject of the formula $\frac{b}{b+1}=\frac{2}{a+1}$. (3 marks)

2. Factorize
   (a) x^2-25y^2,
   (b) $x^2-25y^2-xz-5yz$.

   (3 marks)

3. Simplify $\frac{\left(2m^3n^{-2}\right)^{-4}}{m^{-3}n^{10}}$ and express your answer with positive indices. (3 marks)

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4. Consider the compound inequality

$$2-6(y+2)>4 \quad \text{or} \quad -2y-10 \geq \frac{y}{2} \quad \ldots\ldots\ldots(*).$$

(a) Solve (*) .

(b) Write down the greatest negative integer satisfy (*).

(4 marks)

5. A piece of ribbon is measured as 2.6 m, correct to the nearest 0.1 m.

(a) Find the range of the actual length of the ribbon.

(b) Penny claims that if the ribbon is evenly divided into 180 short ribbons, the length of each piece of short ribbon can be measured as 1.50 cm, correct to 3 significant figures. Do you agree? Explain your answer.

(4 marks)

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6. A toy company sells its toys at a percentage profit of 20%. If the cost price of a toy is increased by 25%, its selling price has to be increased by \$36 in order to keep the same percentage profit. Find the original cost price of the toy. (4 marks)

7. In a polar coordinate system, O is the pole. The polar coordinates of the points P and Q are $(20, 80°)$ and $(k, 110°)$ respectively, where k is a positive constant. It is given that $\angle OPQ = 60°$.
   (a) Is ΔOPQ a right-angled triangle? Explain your answer.
   (b) Find the area of ΔOPQ.

(4 marks)

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8. In Figure 1, $ABCD$ is a circle. AC and BD intersect at E. F is a point lying on BD such that $AD = AF$. It is given that $AB = BC$, $\angle ACB = 62°$ and $\angle DAC = 23°$.

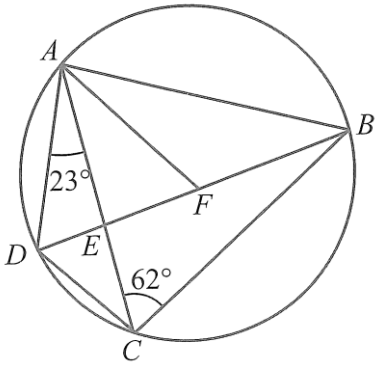

Figure 1

Find $\angle BAF$ and $\angle ACD$. (5 marks)

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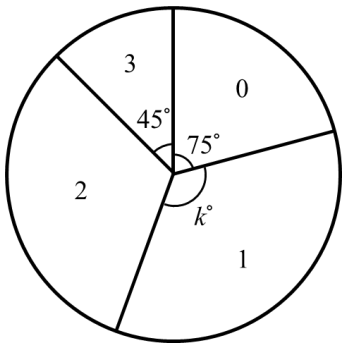
9. The pie chart below shows the distribution of the numbers of siblings of a group of students. It is known that the probability of a randomly selected student from the group has less than 2 siblings is equal to $\frac{7}{12}$.



Distribution of the numbers of siblings of a group of students

(a) Find k.

(b) Find the minimum number of students in the group.

(c) Write down the mean of the distribution.

(5 marks)

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Section A(2) (35 marks)

10. The stem-and-leaf diagram below shows the distribution of the time (in minutes) spent on lunch by 6E students on a specific day.

Stem (10 minutes)	Leaf (1 minute)
0	8 9
1	2 *a* *a* *a* 7
2	0 1 3 5 6 8
3	0 2 *b* 8
4	3 8 9

It is given that the median of the above distribution is greater than the mode by 9 minutes.

(a) Find a. (2 marks)

(b) It is given that the difference between the range and the inter-quartile range of the distribution is less than 22 minutes. Find

(i) the possible value(s) of b,

(ii) the greatest possible variance of the distribution.

(5 marks)

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11. The cubic polynomial $f(x)$ is divisible by x^2+x-1. When $f(x)$ is divided by $x+7$, the remainder is -123. When $f(x)$ is divided by $x-3$, the remainder is 297.

(a) Find the quotient when $f(x)$ is divided by x^2+x-1. (3 marks)

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

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12. It is given that $f(x)$ is the sum of two parts, one part varies as x^2 and the other part varies as $(2x+3)$. Suppose that $f(-1)=5$ and $f(2)=32$.

(a) Find $f(3)$. (4 marks)

(b) The graph of $y=f(x)$ passes through the points $A(a, b)$ and $B(3, b)$, and cuts the x-axis at C and D, where x-coordinate of C < x-coordinate of D. Someone claims that the perimeter of ΔABC is 10 greater than the perimeter of ΔBCD. Do you agree? Explain your answer. (3 marks)

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13. A circle C passes through the points $P(2, 1)$ and $Q(-2, -3)$. The centre of C lies on the straight line $x-7y+25=0$.

(a) (i) Find the coordinates of the centre of C.

(ii) Hence, find the equation of C.

(4 marks)

(b) A straight line $L_1 : x-2y-10=0$ intersects with a straight line L_2 which is perpendicular to L_1 and passes through the centre of C. Denote the point of intersection of L_1 and L_2 by R.

(i) Find the coordinates of R.

(ii) Someone claims that the shortest distance between C and R is less than 3. Do you agree? Explain your answer.

(5 marks)

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14. The base of a solid right pyramid is a square of side 32 cm. The height of the pyramid is 12 cm. The pyramid is divided into a frustum X and a pyramid Y by a plane which is parallel to its base. It is given that the side of the square base of Y is 24 cm.

(a) Find the volume of X. (3 marks)

(b) The base of another solid right pyramid is a square. This pyramid is divided into a frustum Z and a pyramid by a plane which is parallel to its base. The side of the square and the total surface area of Z is 8 cm and 135 cm^2 respectively. Are X and Z similar? Explain your answer. (4 marks)

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Section B (35 marks)

15. In a box, there are 14 white balls and 6 black balls. From the box, 5 balls are randomly drawn at the same time.

(a) Find the probability that exactly 2 black balls are drawn. (2 marks)

(b) Find the probability that at most 2 black balls are drawn. (2 marks)

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16. Let $f(x) = x^2 - (2k+4)x + 2k^2 + 2k + 10$, where k is a constant and $k \neq 2$. Denote the vertex of the graph of $y = f(x)$ by U.

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

(b) On the same rectangular coordinate system, the coordinates of the point P are (0, 20). Denote the vertex of the graph of $y = 4f(-x)$ and the origin by V and O respectively. Is it possible that $OUPV$ is a parallelogram? Explain your answer. (3 marks)

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17. Let $G(n)$ be the nth term of a geometric sequence. The sum of the first 3 terms of the sequence is 1701 and the sum of the first 6 terms of the sequence is 1638.

(a) Find the first term of the sequence. (3 marks)

(b) Suppose that $P(n) = G(2n-1)$ for any positive integer n. Find the least value of m such that $\log_9(P(1)P(2)...P(m)) < -100$. (4 marks)

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18. Figure 2(a) shows a chocolate cake $VABCD$ placed on a horizontal table. The cake is in the shape of a regular square pyramid and all its lateral faces are uniformly covered with cream. It is given that $VA = 8$ cm and $AB = 10$ cm.

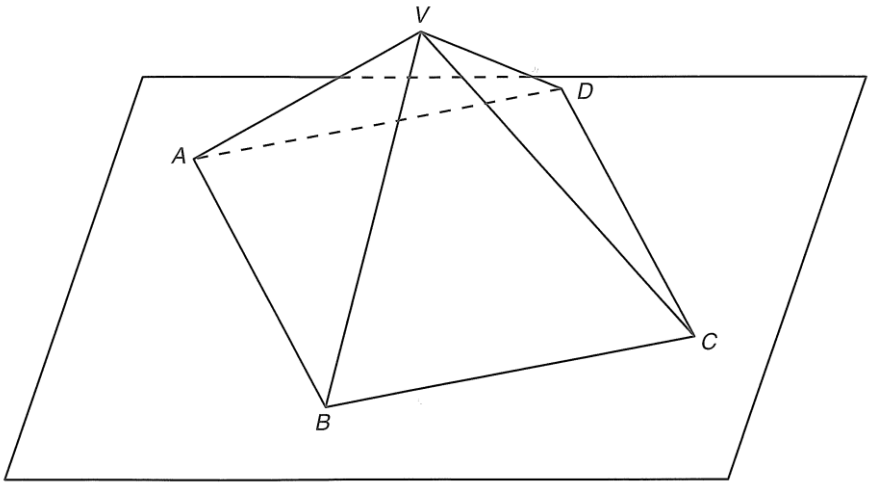

Figure 2(a)

(a) Find

(i) $\angle VAB$,

(ii) the angle between the plane VAB and $ABCD$.

(3 marks)

(b) As shown in Figure 2(b), the cake is then cut into two parts along the plane $EFCD$, where E and F are points on VA and VB respectively such that EF // AB. The part $VEFCD$ is removed. It is known that the angle between the planes $EFCD$ and $ABCD$ is 30°.

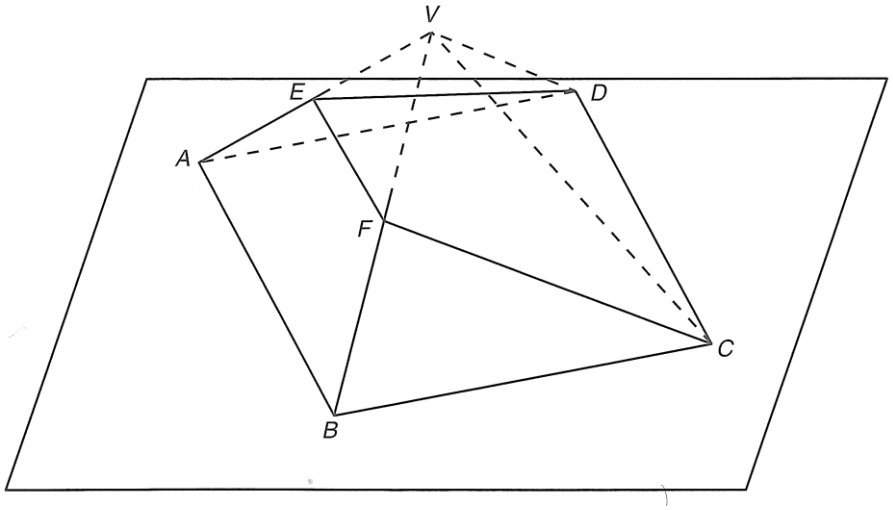

Figure 2(b)

(i) Find AE.

(ii) Stephen claims that more than 30% of the cream is removed. Do you agree? Explain your answer.

(5 marks)

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19. ΔOAB is a right-angled triangle, where $\angle OAB = 90°$. Denote the incentre and the circumcentre of ΔOAB by I and J respectively. It is given that A, I and J are collinear.

(a) Prove that ΔOAB is an isosceles triangle. (3 marks)

(b) A rectangular coordinate system is introduced such that O is the origin, the coordinates of A are $(-50, 120)$, and B lies in quadrant I. It is given that the y-coordinates of B is 170. Let C be the circle which passes through O, A and B.

(i) Find the equation of C.

(ii) Suppose P is a point on C and L is the tangent to C at P. It is given that the slope of L is 1 and the y-intercept of L is negative. Amy claims that the x-intercept of L is greater than 85. Is the claim correct? Explain your answer.

(8 marks)

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