2021-2022 S6
MOCK EXAM
MATH CP
PAPER 1

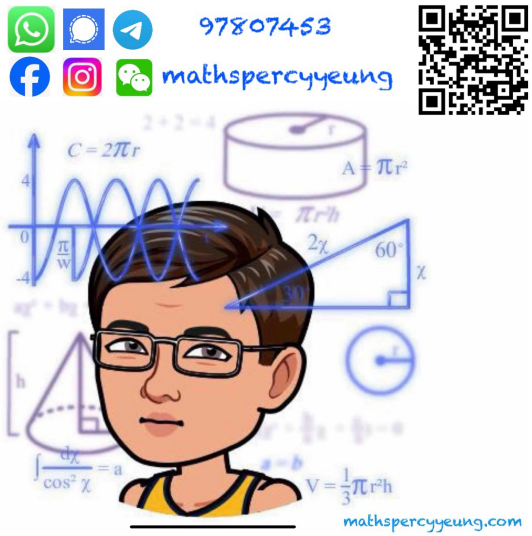
2021 – 2022
S6 Mock Examination

MATHEMATICS Compulsory Part

PAPER 1

Question–Answer Book

10th January, 2022
8:15 am – 10:30 am (2 hours 15 minutes)
This paper must be answered in English



Sections	Marks
A(1)	
A(2)	
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. Simplify $\dfrac{4ab^4}{\left(2a^{-2}b^3\right)^3}$ and express your answer with positive indices. (3 marks)

2. Make a the subject of the formula $\dfrac{5}{a}-\dfrac{b}{2}=3$. (3 marks)

3. Factorize

(a) $9x^2-4y^2$,

(b) $9x^2-4y^2-4y-6x$.

(3 marks)

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4. **(a)** Solve the compound inequality $3(x-13) \geq 5x+9$ or $6-2x<0$.

(b) Write down the least positive integers satisfying the compound inequality in **(a)**.

(4 marks)

5. **(a)** Round off 2021.79 to 1 decimal place.

(b) Round up 2021.79 to 1 significant figures.

(c) Round down 2021.79 to the nearest integer.

(3 marks)

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6. In Figure 1, AC and BD intersect at E. It is given that $AB:BC:CD:DA=3:2:5:8$, find $\angle BEC$. (5 marks)

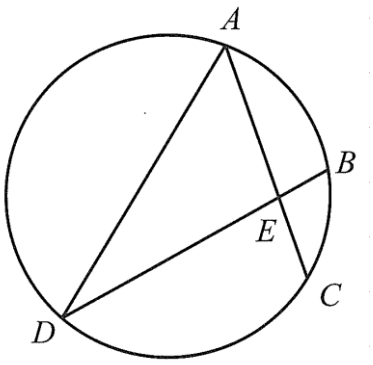

Figure 1

7. In a box, the ratio of the number of apples to that of oranges is $8:7$. 9 apples and 12 oranges in the box are found rotten and thrown away. Then the ratio of the numbers of apples to that of oranges becomes $5:4$. Find the total number of apples and oranges originally in the box. (4 marks)

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8. The coordinates of the points X and Y are (5, –7) and (–2, –6) respectively. X is rotated clockwise about the origin O through 90° to X'. Y' is the reflection image of Y with respect to the y-axis.

(a) Write down the coordinates of X' and Y'.

(b) Is $\angle X'OY'$ an acute angle? Explain your answer.

(5 marks)

9. A pack of Choco Pie is classified as standard if its weight is measured to be 300 g, correct to the nearest g.

(a) Find the upper limit of the weight of a standard pack of Choco Pie.

(b) Is it possible that the total weight of 120 standard packs of Choco Pie is measured as 36.1 kg, correct to the nearest 0.1 kg? Explain your answer.

(5 marks)

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Section A(2) (35 marks)

10. A function $f(x)$ is the sum of two parts, one part varies directly as x^2 and the other part varies directly as x. It is given that $f(-1)=10$ and $f(3)=-6$.

(a) Find $f(-2)$. (4 marks)

(b) $A(-2, m)$ and $B(6, n)$ are two points on the graph of $y=f(x)$ and C is a point on the x-axis. Find the area of ΔABC. (4 marks)

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11. The stem-and-leaf diagram below shows the distribution of the ages of the members in a basketball club.

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

(a) Find the mean and the range of the above distribution. (2 marks)

(b) The club recruits two new members. It is found that the mean of the distribution of the ages is decreased by 1 while the range of the distribution of the ages is increased by 1. Find the ages of these two new members. (4 marks)

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12. An inverted right pyramidal vessel with a square base contains some water. The vessel is placed vertically and the depth of the water in the vessel is 10 cm. Sam then pours 95 cm^3 of water into the vessel without overflowing. He now finds that the depth of water in the vessel is 15 cm.

(a) Find the final volume of water in the vessel. (3 marks)

(b) Sam claims that the final area of the wet surface of the vessel is more than 150 cm^2. Do you agree? Explain your answer. (3 marks)

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13. It is given that L is a straight line passes through the point $Q(-6, 1)$ with the slope $-\frac{1}{2}$.

(a) (i) Find the equation of L.

(ii) Suppose that G is a point lying on L. Denote the y-coordinate of G by k. Let C be the circle which is centred at G passes through the point $P(6, 5)$. Prove that the equation of C is $x^2 + y^2 + 4(k+2)x - 2ky - 14k - 109 = 0$.

(5 marks)

(b) The coordinates of the point R are $(-2, 1)$. Using **(a)(ii)**, or otherwise, find the diameter of the circle centred at G which passes through P and R. (3 marks)

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14. Let $f(x)=(x+h)^2(x-1)+k$, where h and k are constants. When $f(x)$ is divided by $x-1$, the remainder is 6. It is given that $f(x)$ is divisible by $x+5$.

(a) Find h and k. (4 marks)

(b) Suppose h is equal to the smaller value found in **(a)**. A student claims that all the roots of the equation $f(x)=0$ are integers. Do you agree? Explain your answer. (3 marks)

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Section B (35 marks)

15. An ice-cream manufacturer released 10 new flavours. 5 of them are fruit types, 2 of them are chocolate types and the remaining are nut types. John is going to buy ice-cream with 3 different new flavours randomly.

(a) Find the number of combinations of the ice-cream that he can buy. (2 marks)

(b) Find the probability that 2 out of 3 ice-cream flavours that he can buy are of the same types. (2 marks)

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16. Let $A(n) = 6n + 2$ and $B(n) = 10^{6n+2}$, where n is a positive integer.

(a) Express $A(1) + A(2) + A(3) + ... + A(n)$ in terms of n. (2 marks)

(b) Find the greatest value of n such that $\log[B(1)B(2)B(3)...B(n)] \leq 2000$. (4 marks)

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17. Let $f(x) = -\frac{1}{4}x^2 - 6x - 45$.

(a) Using the method of completing the square, find the equation of the axis of symmetry of the graph of $y = f(x)$. (2 marks)

(b) The graph of $y = g(x)$ is obtained by translating the graph of $y = f(x)$ horizontally. If the axis of symmetry of the graph of $y = g(x)$ lies on the y-axis, find $g(x)$. (2 marks)

(c) Under a transformation, $f(x)$ is changed to $y = -x^2 - 12x - 45$. Describe the geometric meaning of the transformation. (2 marks)

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18. In Figure 2, OC is a building with height h m. O, A and B are on the same horizontal ground. The true bearings of A and B from O are 205º and 080º respectively. The angles of elevation of C from A and B are 30º and 46º respectively.

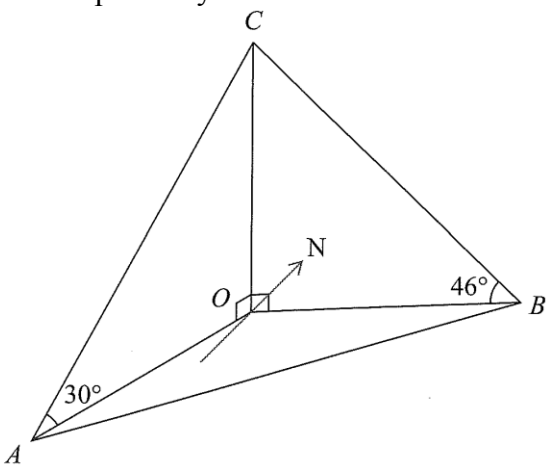

Figure 2

(a) Express OA and OB in terms of h. (2 marks)

Given the distance between A and B is 230 m.

(b) Amy claims that h is greater than 70. Do you agree? Explain your answer. (4 marks)

(c) Find the compass bearing of A from B. (3 marks)

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19. (a) In Figure 3, the equations of L_1 and L_2 are $x = 60$ and $y = 10$ respectively. The straight line L_3 passes through the origin. The straight line L_4 intersects L_2 and L_3 at (380, 10) and (240, 80) respectively.

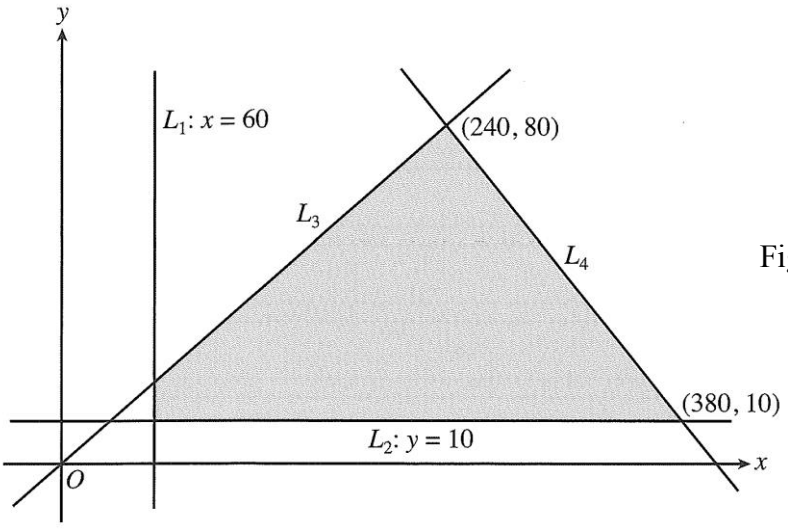

Figure 3

(i) Find the equations of L_3 and L_4 .

(ii) In Figure 3, the shaded region (including the boundary) represents the solution of a system of inequalities. Write down the system of inequalities.

(5 marks)

(b) An engineer wants to build an aeroplane which consists of two classes: economy class and first class. It is given that the aeroplane must have at least 60 economy class seats and 10 first class seats. Moreover, the number of economy class seats in the aeroplane must not less than 3 times that of the first class seats. Each economy class seat occupies a floor area of 10 m^2 and each first class seat occupies a floor area of 20 m^2. The floor area occupied by the seats in the aeroplane is at most 4000 m^2. The aeroplane is used to fly a certain flight. On that flight, the profits of selling an economy class ticket and a first class ticket are \$4000 and \$15 000 respectively. The manager of the airline claims that if all the tickets of the flight are sold, the total profit is not more than \$2 160 000. Do you agree? Explain your answer.

(5 marks)

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