Ying Wa Girls' School
Mock Examination 2021-2022

MATHEMATICS

Compulsory Part

PAPER 1

Question-Answer Book

Time allowed: 2 hours 15 minutes
This paper must be answered in English.

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.
2. This paper consists of THREE sections: A(1), A(2) and B. Each section carries 35 marks.
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, 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.

Date: 16 February 2022
Period: 1

Name: _____

Class Number: _____

Class: S6 _____

Candidate Number				

	Marker's Use Only	**Examiner's Use Only**
Question No.	Marks	Marks
1 – 2		
3 – 4		
5 – 6		
7 – 8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
Total		

SECTION A(1) (35 marks)

1. Simplify $\dfrac{\left(a^3b^2\right)^4}{a^{-2}b^{12}}$ and express your answer with positive indices.

(3 marks)

2. If $h+\dfrac{3}{x-4}=2h-3$, express x in terms of h.

(3 marks)

Answers written in the margin will not be marked.

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3. Factorize

(a) $9m^2 - 16$,

(b) $3m^2n - 11mn - 20n$,

(c) $9m^2 - 16 - 3m^2n + 11mn + 20n$.

(4 marks)

4. (a) Find the range of values of x which satisfy both $\frac{4x-3}{5} \geq 2x-3$ and $3-2x<1$.

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

(4 marks)

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5. A table is sold at a discount of 20% on its marked price. The selling price of the table is \$2780.

(a) Find the marked price of the table.

(b) After selling the table, the percentage profit is 25%. Find the cost of the table.

(4 marks)

6. In a playgroup, the ratio of the number of baby boys to the number of baby girls is $11:7$. If 8 baby boys and 6 baby girls join the playgroup, then the ratio of the number of baby boys to the number of baby girls is $3:2$. Find the original number of baby boys in the playgroup.

(4 marks)

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7. ABC is a triangle with $\angle B = 90°$. It is given that $AB = (3k - 2)$ cm, $AC = (7k - 2)$ cm and $BC = (5k + 4)$ cm, where k is a constant. Find k.

(3 marks)

8. L is a straight line which is perpendicular to a straight line L_1: $3x + 4y + 8 = 0$. It is given that the x-intercept of L is –3.

(a) Find the equation of L.

(b) L_1 and L intersect at P. L_1 and L cut the y-axis at A and B respectively. Find the ratio of the area of ΔOPA to that of ΔOPB.

(5 marks)

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9. In Figure 1, the pie chart shows the distribution of the number of pairs of shoes owned by the students in a group.

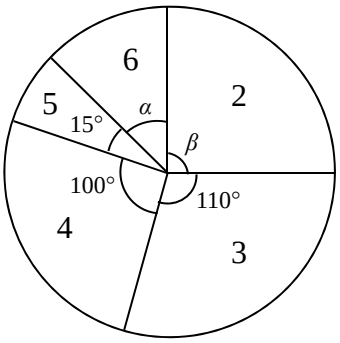

Figure 1

If a student is randomly selected from the group, the probability that the selected student has more than 5 pairs of shoes is $\frac{1}{8}$.

(a) Find the values of α and β.

(b) Find 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 weights (in kg) of the players in a volleyball team.

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

It is given that the range of the above distribution is twice of its inter-quartile range.

(a) Find k. (4 marks)

(b) If a player is randomly selected from the team, find the probability that the weight of the selected player is greater than the mode of the distribution. (1 mark)

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11. Figure 2 shows the graphs for car *A* and car *B* travelling on the same straight road between town *P* and town *Q* during the period 7:30 to 10:00 in a morning. Car *B* travels at a constant speed during the period. It is given that town *P* and town *Q* are 240 km apart.

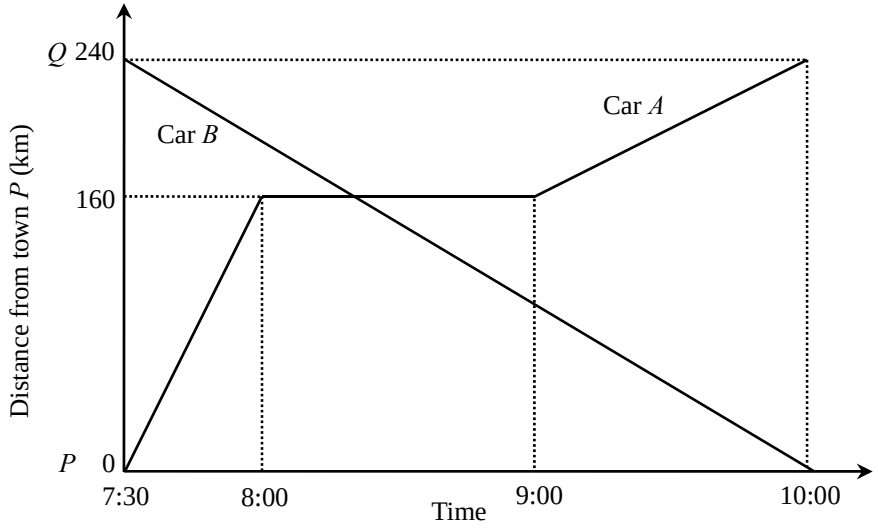

Figure 2

(a) Find the distance of car *B* from town *Q* at 8:00 in the morning. (2 marks)

(b) At what time do car *A* and car *B* meet? (2 marks)

(c) The driver of car *A* claims that, after 2 cars meet each other, the average speed of car *A* is less than that of car *B* until 10:00. Do you agree? Explain your answer. (2 marks)

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12. In Figure 3, the solid consists of a right circular cone and a hemisphere with a common base. The base radius and the height of the circular cone are r cm and 16 cm respectively. It is given that the ratio of the curved surface area of the circular cone to that of the hemisphere is 5 : 6.

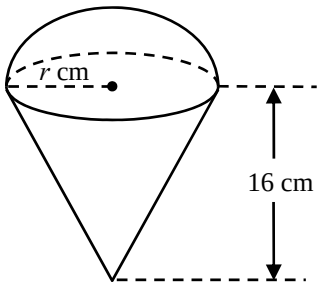

Figure 3

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

(b) Express the volume of the solid in terms of π. (2 marks)

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13. The cost of a wardrobe of weight w kg is \$$C$. C is partly constant and partly varies as $\sqrt{w}$. When $w=16$, $C=1520$ and when $w=25$, $C=1650$.

(a) Find the cost of a wardrobe of weight 36 kg. (4 marks)

(b) Someone claims that the cost of a wardrobe of weight 121 kg is higher than the total cost of two wardrobes of weight 36 kg. Is the claim correct? Explain your answer. (2 marks)

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14. The cubic polynomial f (x) is divisible by $x - 2$. When f (x) is divided by $x^2 - 4$, the remainder is $kx - 8$, where k is a constant.

(a) Find k. (3 marks)

(b) It is given that when f (x) is divided by x, the remainder is 16. When f (x) is divided by $x + 3$, the remainder is –65. Someone claims that all the roots of the equation f (x) = 0 are integers. Is the claim correct? Explain your answer.

(5 marks)

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15. The coordinates of the points A and B are $(0, 5)$ and $(3, 1)$ respectively. Let P be a moving point in the rectangular coordinate plane such that $AP \perp PB$. The locus of P lies on a circle Γ.

(a) Find the equation of Γ. (2 marks)

(b) Q is a moving point on Γ. C (0,1) is a point in the same plane.

(i) Does Γ pass through C? Explain your answer.

(ii) When the slope of CQ is $\sqrt{3}$, someone claims that $\angle CAQ$ is greater than 100°. Do you agree? Explain your answer. (4 marks)

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SECTION B (35 marks)

16. A queue is randomly formed by 6 boys and 3 girls.

(a) How many different queues can be formed? (1 mark)

(b) Find the probability that all the boys are next to each other in the queue. (3 marks)

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17. In an examination, the mean of the scores of a class of students is 70. The range of the scores of these students is at most 70. Johnny scored the lowest in the examination. His score is 25 and his standard score is –3. Can the standard score of any student exceed 2? Explain your answer.

(4 marks)

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18. Let $G(n)$ be the nth term of a geometric sequence. It is given that $G(3)=256$ and $G(6)=\frac{1}{16}$.

(a) Find $G(1)$. (2 marks)

(b) Suppose $G(n)=2^{A(n)}$, for all positive integers n.

(i) Express $A(n)$ in terms of n.

(ii) Hence, or otherwise, find the greatest value of k such that $G(1)G(2)G(3)\cdots G(k)>2022$.

(5 marks)

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19. (a) In Figure 4(a), $ABCD$ is a paper card in the form of a quadrilateral. It is given that $\angle ABC = 120°$, $AB = AD = 9$ cm and $BC = CD = 15$ cm. Find AC and $\angle CAB$.

(4 marks)

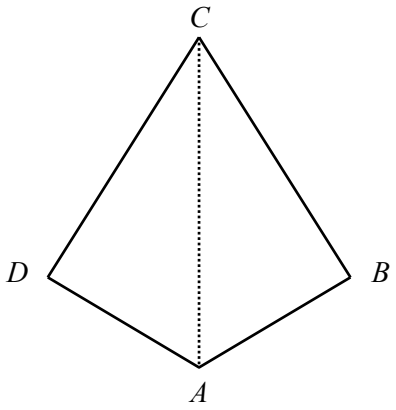

Figure 4(a)

(b) The paper card in Figure 4(a) is folded along AC such that AB and AD lie on the horizontal ground as shown in Figure 4(b). It is given that the angle between the plane ABC and the horizontal ground is 40°. Someone claims that the shortest distance from C to the horizontal ground is less than 8.5 cm. Do you agree? Explain your answer.

(4 marks)

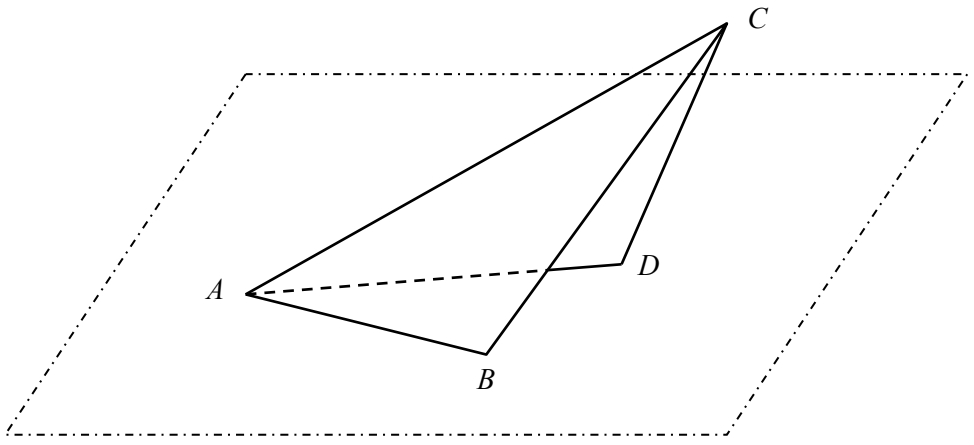

Figure 4(b)

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20. Let $\mathrm{f}(x) = x^2 - (4k+2)x + 4k^2 + 7k - 4$, where k is a constant and $k \neq -1$. Let U be the vertex of the graph of $y = \mathrm{f}(x)$.

(a) By the method of completing the square, find the coordinates of U in terms of k.
(3 marks)

(b) Let $\mathrm{g}(x)$ be a function. It is known that the graph of $y = \mathrm{g}(x)$ can be obtained by translating the graph of $y = \mathrm{f}(x)$ 5 units downwards and $(k+1)$ units leftwards. Let V be the vertex of the graph of $y = \mathrm{g}(x)$.

(i) Find $\mathrm{g}(x)$ in terms of k.
Hence, or otherwise, write down the coordinates of V in terms of k.

(ii) Let W be the point $(2k+6,\ 2k-6)$.
(1) Find the equation of the circle passing through U, V and W in terms of k.
(2) Someone claims that as k varies, the locus of the circumcentre of ΔUVW is a straight line. Do you agree? Explain your answer.
(9 marks)

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