Mock Exam
MATH CP
PAPER 1

Ying Wa Girls' School
Mock Examination 2020-2021

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.

Ying Wa Girls' School

Date: 20 January 2021
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		
Total		

SECTION A(1) (35 marks)

1. Simplify $\dfrac{\left(4m^{-3}n^{3}\right)^{-2}}{2m^{-2}n^{5}}$ and express your answer with positive indices.

(3 marks)

2. Let a, b and c be non-zero numbers such that $\dfrac{a}{b}=\dfrac{3}{4}$ and $5a = 8c$. Find $\dfrac{b-c}{a+3c}$.

(3 marks)

Answers written in the margin will not be marked.

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3. Factorize

(a) $x^2 - 25y^2$,

(b) $x^2 - 4xy - 5y^2$,

(c) $x^2 - 4xy - 5y^2 - x^2 + 25y^2$.

(4 marks)

4. (a) Solve the inequality $x - \frac{2x+1}{3} \geq -2$.

(b) How many negative integers satisfy the following compound inequality?

$$x - \frac{2x+1}{3} \geq -2 \text{ or } 3(x-7) < 5x$$

(4 marks)

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5. In class A, $\frac{1}{3}$ of students take a mathematics tutorial, In class B, $\frac{2}{7}$ of students take the same tutorial. If the numbers of students taking the tutorial in the 2 classes are the same, and the number of students in class B is 5 more than that of class A, find the number of students in class A.

(4 marks)

6. In a polar coordinate system, P is the pole. The polar coordinates of A are $\left(\sqrt{2},\ 310°\right)$. A is rotated clockwise about P through 90° to form B. Denote the axis of reflectional symmetry of ΔPAB by L.

(a) Write down the polar coordinates of B.
(b) Describe the geometric relationship between L and AB.
(c) Find the polar coordinates of the point of intersection of L and AB.

(4 marks)

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7. If a handbag is sold at a 15 % discount on its marked price, then the selling price will be \$2550. If the handbag is sold at a 23% discount on its marked price, then the profit percent is 50%.
   (a) Find the marked price of the handbag.
   (b) Find the cost of the handbag.

(4 marks)

8. In **Figure 1**, PQR is a triangle. Points R and T lie on SU such that $QT = RT$. It is given that $PQ = 26$, $PR = 10$ and $QR = 24$. If $\angle QTU = x$, express $\angle PRS$ in terms of x.

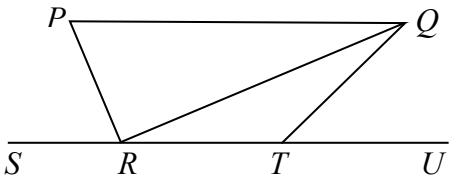

Figure 1

(5 marks)

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9. In **Figure 2**, the histogram shows the weights of a group of participants in a fitness class.

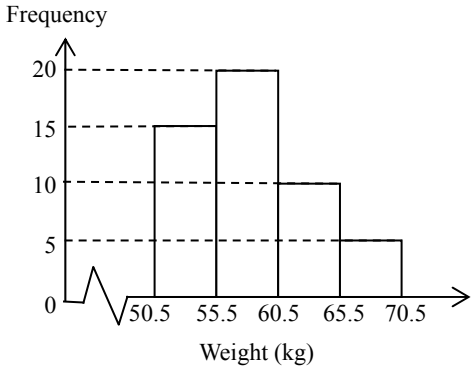

Figure 2

(a) Find the mean weight of the group of participants.

(b) Four new participants join the class and their weights belong to different class intervals. Find the change in the mean weight of all the participants.

(4 marks)

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SECTION A(2) (35 marks)

10. It is given that $f(x)$ is partly constant and partly varies as $2x^2$. Suppose that $f(-2) = 132$ and $f(3) = 172$.
    (a) Find $f(x)$. (3 marks)
    (b) Solve the equation $f(x) = 60x$. (2 marks)

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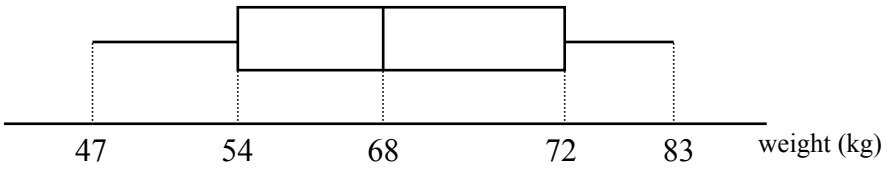
11. 20 people join a fitness training course. The stem-and-leaf diagram below shows the distribution of the weights (in kg) of these 20 people before joining the course.

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

(a) Find the median, the range and the inter-quartile range of the above distribution.
(3 marks)

(b) After completing the course, the weights of these 20 people are measured again. The box-and-whisker diagram below shows the distribution of the weights of these 20 people in the second measurement.



(i) Is the distribution of the weights of these 20 people in the second measurement less dispersed than that in the first measurement? Explain your answer.
(ii) Peter claims that at least 25% of these 20 people reduce weight after completing the course. Do you agree? Explain your answer.
(4 marks)

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12. A right circular cone is divided into two parts by a plane which is parallel to its base. The upper part is a small circular cone and the lower part is a frustum of height 3 cm. The height of the original right circular cone is 12 cm.

(a) Find the ratio of the volume of the small circular cone to that of the original circular cone.

(2 marks)

(b) The base radius of the small circular cone is 18 cm.

(i) Find the volume of the frustum in terms of π.

(ii) A hemisphere and the original right circular cone with same radius are attached together to form a round bottom container. If 10000π cm^3 water is poured into the empty container, find the depth of the water in the container.

(6 marks)

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13. In **Figure 3**, $PQRS$ is a circle. PR and QS intersect at T, and $\angle PTQ = 64°$. It is given that $PR = PS$ and $\overset{\frown}{PQ} : \overset{\frown}{RS} = 3:5$.

(a) Find $\angle QPS$.

(4 marks)

(b) If $\overset{\frown}{RS} = 10\pi$ cm, find the area of the shaded region.

(3 marks)

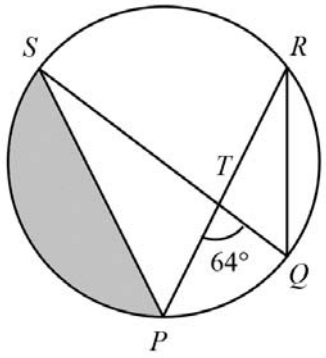

Figure 3

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14. Let $f(x) = 2x(x + 3)^2 + hx + k$, where h and k are constants. When $f(x)$ is divided by $x^2 - 4$, the remainder is $mx + 20$, where m is a constant. It is given that $f(x)$ is divisible by $x - 2$.

(a) Find h, k and m.

(4 marks)

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

(4 marks)

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SECTION B (35 marks)

15. Suppose 30% of all new drug formulae are active. Out of the active formulae, 60% show side effects. Out of the formulae which are proved to be inactive, 30% can be recomposed to become active, and among these recomposed formulae, 75% show side effect.

(a) (i) What is the probability that a new drug formula will show side effects?

(ii) Given an active drug formula, what is the probability that it will not show side effects?

(5 marks)

(b) Given that a drug formula is active and shows no side effects, the probability that it will be approved by a government is 0.8. Of drug formulae that are active but show side effects, 3% will be approved.

(i) What is the probability that a new drug formula will be approved?

(ii) If 10 independent drug formulae are seeking for approval from the government, what is the probability that exactly half of them will be approved?

(3 marks)

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16. Mr. Wong opens a savings account in a bank. At the beginning of the first year, he deposits \$$x$ in his bank account. In subsequent years, he deposits 8% more than he did in the previous year. The interest rate offered by the bank is 2% p.a., compounded yearly. It is given that the balance in his savings account is \$3 374 568 at the end of the 3rd year.

(a) (i) Express, in terms of x, the amount in his savings account at the end of the 2nd year.

(ii) Find x.

(3 marks)

(b) Express, in terms of n, the amount in his savings account at the end of nth year.

(3 marks)

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17. In **Figure 4(a)**, *ABCDEF* is a regular hexagonal paper card. It is given that $AB = 20$ cm.

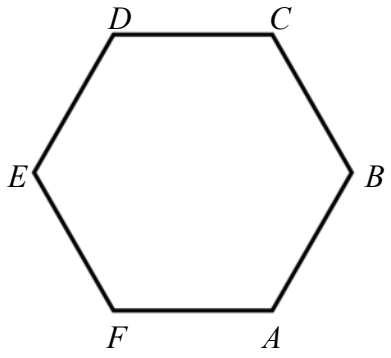

Figure 4(a)

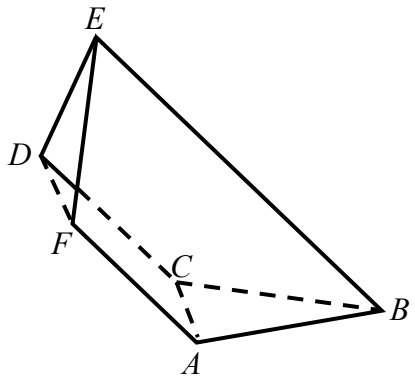

Figure 4(b)

Refer to **Figure 4(b)**, the paper card in **Figure 4(a)** is folded along *EB* such that $AC = DF = 15$ cm.

(a) Find $\angle ABC$. (2 marks)

(b) Find the angle between the planes *ABEF* and *CBED*. (3 marks)

(c) A craftsman built a metal solid statue which is exactly the same as the paper model outlined in **Figure 4(b)**. He claims that the volume of metal used is less than 3100 cm^3. Do you agree? Explain your answer. (4 marks)

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18. Let $f(x)=\frac{1}{6k-6}\left(x^2-2kx+4k^2+6k-9\right)$, where $k > 1$. Denote the vertex of the graph of $y=f(x)$ by V.

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

(3 marks)

(b) Let F and P be a fixed point and a moving point respectively, in the same coordinate system, such that P maintains an equal distance from F and a straight line L: $y = 3 - k$. The locus of P is the graph of $y=f(x)$, which intersects with a straight line $y = x$ at points B and C. Denote the mid-point of BC by M.

(i) Express the coordinates of F, in terms of k.

(ii) Find the range of values of k.

(iii) Express the coordinates of M, in terms of k.

(iv) Does the perpendicular bisector of FV pass through M? Explain your answer.

(9 marks)

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