2020/21-ME
MATH CP
PAPER 1

HOK YAU CLUB

HONG KONG MOCK EXAMINATION 2020/21

MATHEMATICS Compulsory Part
PAPER 1
Question-Answer Book

9:00 am – 11:15 am (2¼ hours)

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 and stick barcode labels in the spaces provided on Pages 1 and 3.

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. Supplementary answer sheets will be supplied on request. Write your Candidate Number, mark the question number box and stick a barcode label on each sheet, 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.

8. No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

Please stick the barcode label here.

Candidate Number									

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

SECTION A (1) (35 marks)

1. Simplify $\frac{(a^3b^{-2})^4}{a^{-5}}$ and express your answer with positive indices . (3 marks)

2. Factorize

(a) $x^2 - 6xy + 9y^2$,

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

(3 marks)

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Page total

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3. Let a, b and c be non-zero numbers such that $5a = 3b$ and $c = \frac{b}{2}$. If $2a + b - 3c = 14$, find c. (3 marks)

4. The cost of a handbag is $160. A shop sells the handbag at its marked price with 20% off but also wants to make a profit of 10%. Find the marked price. (4 marks)

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5. There are 280 members in a fitness centre . The number of male members is $\frac{1}{3}$ more than the number of female members . Find the difference of the number of male members and the number of female members . (4 marks)

6. Consider the compound inequality

$$6 - x > \frac{3-4x}{2} \quad \text{or} \quad 42 - 7x \le 0 \quad \cdots\cdots (*) \quad .$$

(a) Solve (*) .

(b) Write down the number of non-positive integers satisfying (*) .

(4 marks)

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7. The coordinates of the points A and B are $(-1, 7)$ and $(4, -4)$ respectively. A is rotated clockwise about the origin through $90°$ to A'. B' is the reflection image of B with respect to the y-axis.

(a) Write down the coordinates of A' and B'.

(b) Prove that AB is perpendicular to $A'B'$.

(4 marks)

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8. In figure 1, E is a point lying on AD. AC and BE intersect at the point F. It is given that $AB = AC = AD$, $BE // CD$, $\angle ADC = 62°$ and $\angle ABE = \theta$.

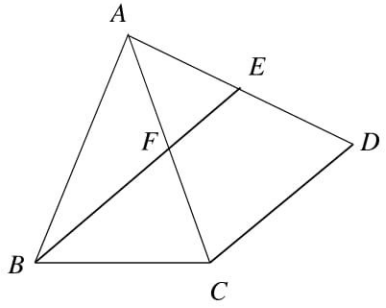

Figure 1

Express $\angle BAC$ and $\angle FBC$ in terms of θ. (5 marks)

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9. The table below shows the distribution of the numbers of subjects taken by a class of students .

Number of subjects taken	5	6	7	8
Number of students	7	a	12	b

It is given that a student is randomly selected from the class . The probability that the student takes 8 subjects is $\frac{1}{8}$ and the median of the above distribution is 6.5 .

(a) Find a and b .

(b) A student taking 8 subjects now withdraws from one subject . Find the change in the mean of the distribution due to the withdrawal from one subject by that student.

(5 marks)

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SECTION A (2) (35 marks)

10. The price of a crystal ornament of area A cm^2 is \$ S . S partly varies as A and partly varies as A^2 . When $A = 4$, $S = 56$ and when $A = 7$, $S = 140$.

(a) Find the price of a crystal ornament of area 6 cm^2 . (4 marks)

(b) Someone claims that the price of a crystal ornament of area 12 cm^2 is 4 times the price of a crystal ornament of area 6 cm^2 . Is the claim correct ? Explain your answer . (2 marks)

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11. The stem-and-leaf diagram below shows the distribution of the results (in seconds) of some girls in a 100 m swimming.

Stem（tens）	Leaf（units）								
10	a								
11	0	1	2	4	4	6	7	9	
12	2	3	5	5	6	8	8	9	9
13	5	b							

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

(b) It is given that the range of the distribution is at least 24 seconds more than the inter-quartile range . Find

(i) a and b ,

(ii) the greatest possible standard deviation of the distribution .

(4 marks)

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12. A vessel in the form of an inverted frustum is made by cutting off the lower part of an inverted right circular conical vessel and then putting on a circular base . The upper base radius, the lower base radius and the height of the vessel are 12 cm , 6 cm and h cm respectively . It is given that the capacity of the vessel is 672π cm^3 .

(a) Find h . (3 marks)

(b) The vessel is now placed on a horizontal table . Some water is poured into the vessel to half of its height . Find the area of the vessel wetted by the water in terms of π . (4 marks)

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13. It is given that $x+1$ is a factor of a cubic polynomial $f(x)$. When $f(x)$ is divided by x^2-1, the remainder is $4x+k$, where k is an integer.

(a) Find k. (3 marks)

(b) It is given that when $f(x)$ is divided by $-x$, the remainder is -4. Someone claims that $f(x)=0$ cannot have the repeated roots different from -1. Is the claim correct ? Explain your answer. (5 marks)

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14. It is given that the equation of the circle C is $x^2 + y^2 + 4x - 6y - 12 = 0$ and passes through the point $H(-2, b)$, where $b > 0$. Denote the centre of C by G.

(a) Find b. (1 mark)

(b) The coordinates of the point Q are $(-6, 11)$. Let P be a moving point in the rectangular coordinate plane such that $PQ = PG$. Denote the locus of P by Γ.

(i) Find the equation of Γ and prove that Γ passes through H.

(ii) Suppose that Γ cuts C at another point K and Γ cuts the x-axis at the point R. Someone claims that $\angle KGR > \angle KRG$. Do you agree ? Explain your answer .

(7 marks)

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SECTION B (35 marks)

15. 6 people are randomly selected from a group of 7 boys and 5 girls to form a committee .

(a) Find the probability that there are more boys than girls in the committee . (2 marks)

(b) It is given that there are 3 boys and 3 girls in the committee . They are now arranged randomly in a row for a photograph . Find the probability that no girls are arranged next to each other . (3 marks)

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16. The 2nd term of a geometric sequence is 200, the sum to infinity is 800.

(a) Find the first term and the common ratio of the sequence. (2 marks)

(b) Find the least value of n such that the sum of the first n terms of the sequence is greater than $800\,(1-10^{-10})$. (3 marks)

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17. In figure 2 , AP and CP are the tangents to the circle ABC at the points A and C respectively . CBD is a straight line and $AB // DP$.

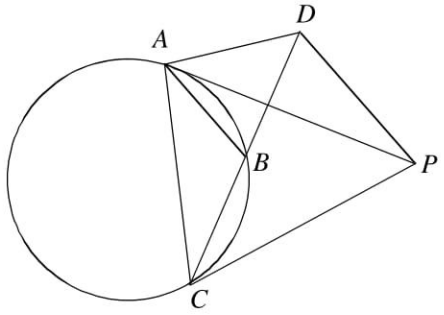

Figure 2

(a) Prove that A , C , P , D are concyclic . (3 marks)

(b) Someone claims that $\Delta PAC \sim \Delta DBA$. Do you agree ? Explain your answer . (3 marks)

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18. Figure 3(a) shows a pentagonal paper card $ABCDE$. It is made by cutting off the right-angled triangle CFD from the square paper card $ABFE$. It is given that $FC : CB = 2 : 3$, $FC = FD = x$ cm and the area of the quadrilateral $BCDE$ is $42\ \text{cm}^2$.

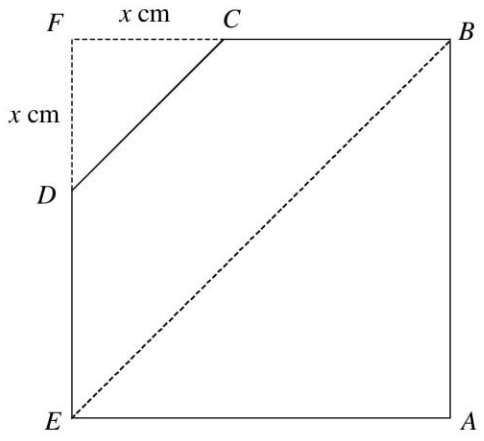

Figure 3 (a)

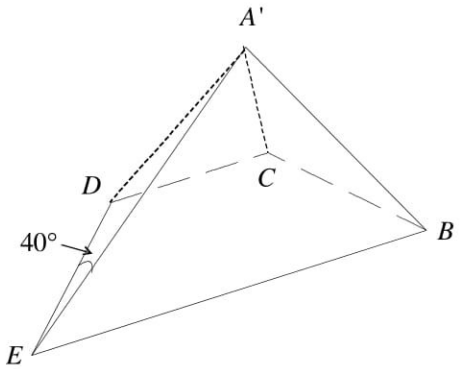

Figure 3 (b)

(a) Find x. (2 marks)

(b) The triangular part ABE of the pentagonal paper card in Figure 3(a) is folded along EB until the vertex A reaches the position A' (see Figure 3(b)) such that $\angle A'ED = 40°$.

(i) Find the length of $A'D$.

(ii) Someone claims that the angle between the planes $A'EB$ and $DEBC$ exceeds $40°$. Is the claim correct ? Explain your answer .

(5 marks)

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19. Let $g(x) = \frac{1}{k}x^2 - 2x + 3k - 1$, where k is a positive integer . The coordinates of the point R are $(-2, 2)$.

(a) Using the method of completing the square , express , in terms of k , the coordinates of the vertex of the graph of $y = g(x)$. (3 marks)

(b) On the same rectangular coordinate system , let P and Q be the vertex of the graph of $y = -g(x+2)$ and the vertex of the graph of $y = g(8-x)$ respectively . It is given that the coordinates of the circumcentre of ΔPQR are $(3, 0)$.

(i) Find k .

(ii) Find the coordinates of the orthocentre of ΔPQR .

(iii) A student claims that the radius of the circumcircle of ΔPQR is $(1+\sqrt{2})$ times the radius of the inscribed circle of ΔPQR . Do you agree ? Explain your answer .

(9 marks)

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