

MUNSANG COLLEGE
2020 – 2021 Mock Examination
F.6 Mathematics Compulsory Part
Paper 1

Class : _____

Name : _____

Class Number : _____

*Please circle the initial of your subject teacher: CHF / CYL / HYC / MKL / WFL

Time allowed : 2 hours 15 minutes

Full mark : 105

This question-answer book consists of 28 printed pages.

INSTRUCTIONS

1. After the announcement of the start of the examination, you should first write your name, class and class number in the space provided on this cover.
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 name, class and class number 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.

	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		
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15		
16		
17		
18		
Total		

Section A(1) (35 marks)

1. Make n the subject of the formula $\frac{5m-n}{2} = \frac{n}{3} + 1$.

(3 marks)

2. Simplify $\frac{(x^5y^{-3})^2}{y^7}$ and express your answer with positive indices.

(3 marks)

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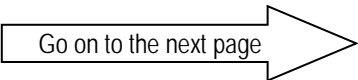
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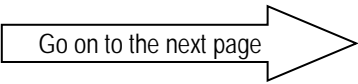
3. Factorize $2x^3 - 8x(y - z)^2$. (3 marks)

4. There are certain numbers of boys and girls in a group. If 4 boys leave the group, then the ratio of the number of boys to the number of girls is 2 : 1. On the other hand, if 1 more boy and 1 more girl join the group, then the ratio of the number of boys to the number of girls is 3 : 1. Find the ratio of the original number of boys to the original number of girls in the group. (4 marks)



7. The coordinates of points P and Q are $(-4, -2)$ and $(1, 3)$ respectively. P is rotated anti-clockwise about the origin through 90° to the point P' . Q is translated rightwards by 8 units to the point Q' .
- (a) Write down the coordinates of P' and Q' .
- (b) Prove that PQ is parallel to $P'Q'$.

(4 marks)



8. In Figure 1, BD is a diameter of the circle $ABCD$. If $\angle ACD = 54^\circ$, find the ratio of the arc lengths $\widehat{AB} : \widehat{AD}$.

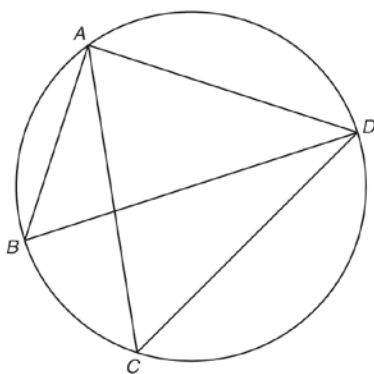


Figure 1

(5 marks)

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9. The following table shows the numbers of books read by 40 students in a certain week.

Number of books read	1	2	3	4
Number of students	x	8	9	y

It is given that x and y are positive integers.

- (a) Find the least possible value and the greatest possible value of the mean of the distribution.
- (b) Leonhard has the following claim.
‘If the mode of the distribution is 4, the median of the distribution must not be less than 3.’
Is his claim correct? Explain your answer.

(5 marks)

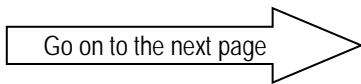
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Section A(2) (35 marks)

10. The stem-and-leaf diagram below shows the test scores of 30 students in a class.

<u>Stem (tens)</u>	<u>Leaf (units)</u>
1	<i>a</i>
2	
3	1 3
4	5 6 9
5	0 1 2 3 7 9 9
6	0 0 3 4 4 6 6 9
7	1 <i>b</i> 3 5 5 5
8	3 6
9	2

- (a) If the range and the inter-quartile range of these scores are 81 and 22 respectively, find the values of *a* and *b*. (3 marks)
- (b) Due to a mistake in recording, the score of a student should be 11 instead of 71.
 - (i) What is the change in the mean of the test scores after 71 is corrected to 11?
 - (ii) Bernhard claims that for the two statistical measures in (a), correcting the score from 71 to 11 will only affect the value of the inter-quartile range. Do you agree? Explain your answer. (5 marks)

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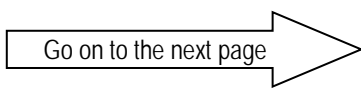
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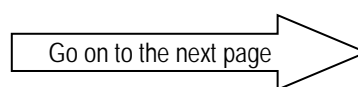
11. The cost of printing n copies of a brochure for a company is $\$C$. It is known that C is partly constant and partly varies as \sqrt{n} .

When $n = 10\ 000$, $C = 212\ 000$ and when $n = 40\ 000$, $C = 224\ 000$.

(a) Find the cost of printing 62 500 copies of that brochure. (4 marks)

(b) After a careful investigation, the company decides to increase the number of copies of brochure printed from 62 500 to 250 000. The company claims that the extra cost of printing the brochures is less than \$50 000. Do you agree? Explain your answer. (2 marks)

A series of horizontal lines provided for the student's answer to the questions.



12. Figure 2(a) shows a right conical vessel of base radius 9 cm. The curved surface area of the vessel is $135\pi \text{ cm}^2$. The vessel is now fully filled with water.

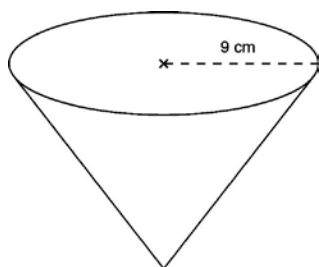


Figure 2(a)

- (a) Find
- (i) the height of the vessel,
 - (ii) the volume of the vessel in terms of π .

(4 marks)

- (b) In Figure 2(b), the water in the vessel is poured into three identical paper cups which are similar in shape to the vessel.

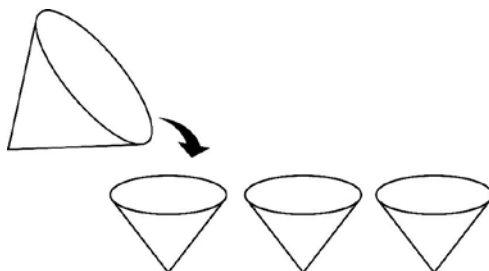


Figure 2(b)

If the water just fills up the three cups without overflow, find the base radius of the paper cup.

(2 marks)

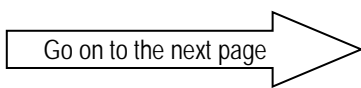
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13. The cubic polynomial $f(x)$ is divisible by $x - 2$. When $f(x)$ is divided by $x^2 - 4$, the remainder is $4x + k$, where k is a constant.

(a) Find the value of k . (3 marks)

(b) It is given that $f(x)$ is also divisible by $x + 4$. When $f(x)$ is divided by x , the remainder is 40. Georg claims that all the roots of the equation $f(x) = 0$ are integers. Do you agree? Explain your answer. (4 marks)

14. In Figure 3, the straight line $L: 3x - 5y + 15 = 0$ cuts the x -axis and the y -axis at A and B respectively.

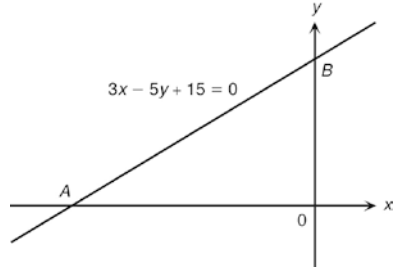


Figure 3

- (a) Find the coordinates of A and B . (2 marks)
- (b) P is a moving point on the coordinate plane such that $AP \perp BP$. Denote the locus of P by Γ .
- (i) Does the origin O lie on Γ ? Explain your answer.
- (ii) Describe the locus of Γ .
- What is the geometric relation between the line segment AB and Γ ?
- (iii) Find the equation of Γ .

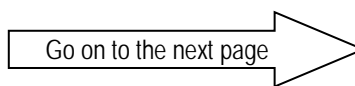
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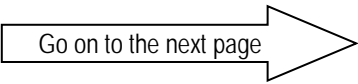


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17. Let $f(x) = \frac{1}{k} [x^2 + (2k - 6)x - 5k + 9]$, where k is a constant with $\frac{1}{2} \leq k \leq \frac{3}{2}$, and the point $(3, 1)$ be A .

(a) Prove that A lies on the graph of $y = f(x)$. (1 mark)

(b) The graph of $y = g(x)$ is obtained by reflecting the graph of $y = f(x)$ about the y -axis and then translating the resulting graph downwards by 2 units.

Let M be the vertex of the graph of $y = g(x)$. Denote the point $(1, -9)$ by N .

(i) By the method of completing the square, express the coordinates of M in terms of k .

(ii) Find k , in surd form, such that the circumcentre of $\triangle ANM$ lies on AN .

(iii) It is known that the graph of $y = g(x)$ passes through the same point P for all positive constant k . Let Q be the vertex of the graph of $y = g(x)$ such that the circumcentre C of $\triangle ANQ$ lies on AN . Henri claims that P , Q and C are collinear.

Do you agree? Explain your answer. (10 marks)

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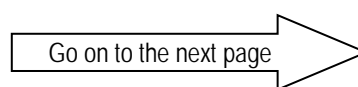
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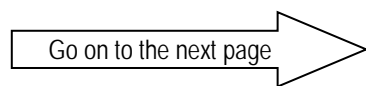
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18. In Figure 4(a), $PTQSR$ is a paper card in the shape of a concave pentagon. It is given that $PT = 10$ cm, $TQ = SQ = 8$ cm, $\angle TPR = 96^\circ$ and $\angle PTQ = 38^\circ$. PS and TR are straight lines intersecting at Q .

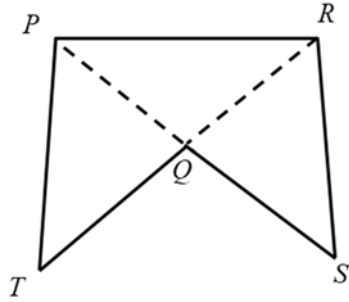


Figure 4(a)

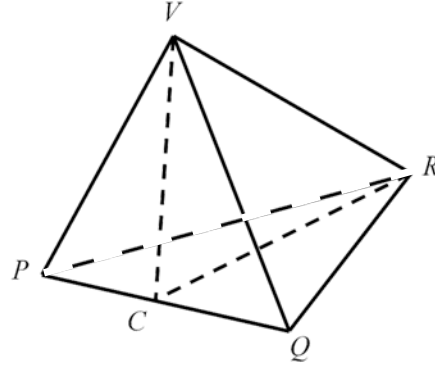


Figure 4(b)

- (a) (i) Find the lengths of PR and QR .
 (ii) Find $\angle QPR$.
 (5 marks)

- (b) The paper card in Figure 4(a) is folded along PQ and QR such that T and S meet at a point V as shown in Figure 4(b). Let C be a point lying on PQ such that VC is perpendicular to PQ .

- (i) Find the length of CR .
 (ii) David claims that $\angle VCR$ is the angle between the face VPQ and the face PQR .
 Do you agree? Explain your answer.

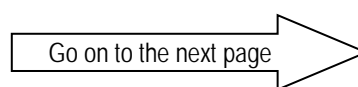
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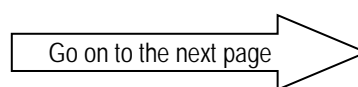
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