HKDSE MOCK EXAM PAPER
MATHEMATICS Compulsory Part
Question-Answer Book
Set 1

Time allowed: 2 hours 15 minutes

Name:_____ Marks:_____/105

Instructions

1. This paper must be answered in English.

2. Unless otherwise specified, all working must be clearly shown.

3. Unless otherwise specified, numerical answers must be exact.

4. This paper is for **internal use** only.

5. All questions are constructed by Mok Owen.

6. The mock paper is composed of 3 parts, including Section A(1), Section A(2) and Section B. Each part consist of 35 marks each.

Section A(1) (35 marks)

1. Simplify $\dfrac{(m^3n^{-2})^3}{(m^{-1}n^7)^{-2}}$ and express your answer with positive indices. (3 marks)

2. Make a the subject of the formula $\dfrac{a+1}{a-1} = \dfrac{b+c}{d-c}$. (3 marks)

3. Factorize

   (a) $4x^2 + 4xy + y^2$,

   (b) $12x^2 + xz + z^2$,

   (c) $(4x^2 + 4xy + y^2) - (12x^2 + xz + z^2)$.

   (3 marks)

4. Given that $a : b = 5 : 6$ and $2b = 3c$.

   (a) Find $a : b : c$.

   (b) Find the value of $\dfrac{9a + 2b + 3c}{a + b + c}$.

   (3 marks)

5. Given a stock X in the market at \$x per unit at instance. It is known that a person could buy a certain amount of stock X at this price level. What is the percentage change in amount affordable for that person if the stock price is increased by 20% ? (4 marks)

6. Consider the compound inequality

$$\begin{cases} \dfrac{x}{x+1} \le 5 \\ 3x + 2 \le 0 \end{cases}$$

   (a) Solve the inequality system.

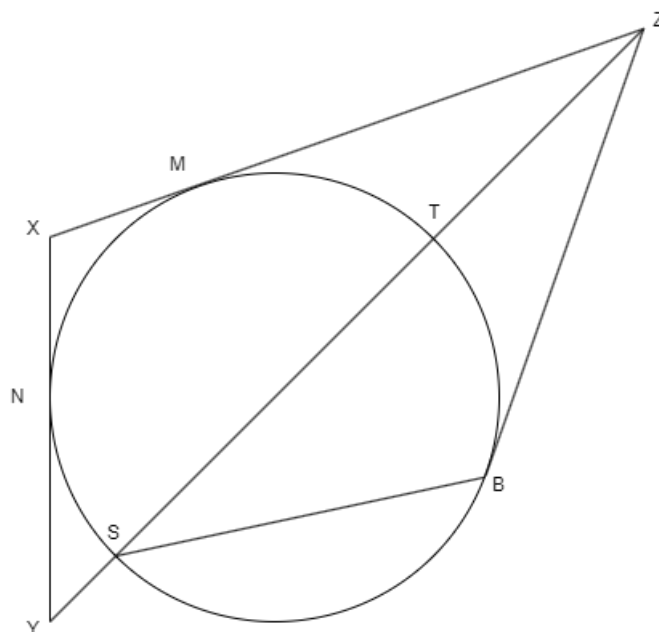   (b) Write down the number of integers satisfying the inequality.

   (4 marks)

7. Let $f(x) = x^2 - kx - (k+1)$ has equal roots. Find

   (a) k,

   (b) the possible y-intercepts of $y = kf(x)$.

8. Given the following figure

Suppose ST is the diameter of the circle passing through S,N,M,T,B. Assume XMZ and XNY are tangent to the circle. Further assume ZB is a tangent to the circle, while $\angle TSB = 30°$ and $\angle NYS = 45°$. Let the center of the circle be O. Find the value of $\angle MON$.   (5 marks)

9. The following stem-and-leaf diagram shows the distribution of the ages of Tommy's girlfriends:

Stem	Leaf
0	6 6 7 8 9 9
1	0 0 1 5 5 5 5 7 8 9
2	2 3 7
3	0 b

It is known that the range of the distribution is over 30.

(a) Is it possible to have mean of the distribution to be less than 15.6? Explain your answer briefly.

(b) Suppose the current mean is maximized. Compute the standard deviation of the distribution.

(5 marks)

Section A(2) (35 marks)

10. It is given that $f(x)$ is composed of 3 parts. The first part varies as constant. The second part and the third part varies directly and inversely with x respectively. Suppose that $f(1) = f(-1)$, $2f(2) = 5$ and $4f(4) = 19$.

    (a) Solve $f(x) = 1$. (3 marks)

    (b) Define $g(x) = xf(x) - 1$ and denote the graph of $y = g(x)$ by G. Denote G's x-intercepts by X and Y, where X is on the left of Y, and the vertex of G by V. Find the area of $\triangle VXY$. (3 marks)

11. The table below shows the distribution of the range of years of sentence of prisoners in a certain jail.

Years of sentence	1 - 10	11 - 20	21 - 30	31 - 40
Number of prisoners	109	75	n	n - 10

    It is given that the expected years of sentence in the jail is 17.5 years if a random prisoner is chosen.

    (a) Find the median group and mode group of the distribution. (4 marks)

    (b) Tommy was one of the prisoners in this jail with less than 10 years of sentence. During period of sentence, he murdered 3 prisoners whose years of sentence are below 10 years. He then received an extension of sentence. The mean of the new distribution is nearly unchanged. In what range of years of sentence should Tommy be extended to? (3 marks)

12. Given that $f(x)$ is a polynomial such that $(x - 1)f(x)$ is divisible by $x^2 + x + 1$.

    (a) Show that $f(x)$ is divisible by $x^2 + x + 1$. (3 marks)

    (b) Consider $g(x)$ is a polynomial such that $f(x)$ is a factor of $g(x)$. Someone claims that if $(x - 1)g(x)$ is divisible by x^3 then $g(x)$ is at least of degree 5. Is the claim correct? Explain your answer. (4 marks)