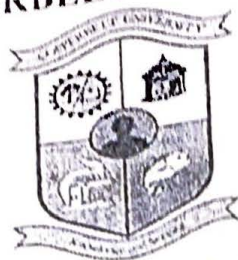


17KHU20

COPPERBELT UNIVERSITY



SCHOOL OF MATHEMATICS AND NATURAL SCIENCES DEPT OF PURE & APPLIED MATHEMATICS MA 110 - MATHEMATICAL METHODS I | TEST 1

INSTRUCTIONS; 1. Attempt all Questions in this Paper without Using a Calculator.
2. Indicate clearly your Names, SIN and the Group you belong to.
3. Duration is 3 Hours Only.

1.
 - a. i.) Let $A = \{1, 2, 3\}$ and $B = \{2, 4\}$, Find $A \times B$. 1 Mk
 - ii.) Prove that $(A^c)^c = A$ by Arbitrary Elementary Method. 4 Mks
 - b. If the Operation $*$ is defined as, "add the first number to 8 times the second number"
Find $(2 * 3) * 5$ 2 Mks
 - c. Find the value of k given that when $2x^3 - 2kx^2 - 3x - 2$ is divided by $x - 2$,
the Remainder is 40. 3 Mks
 - d. If $g \circ f(x) = x$ and $g(x) = \frac{x+1}{x-1}$,
 - i.) Find $f(x)$ ii.) Sketch the Graph of $f(x)$ and Find the Range of $f(x)$ 3 Mks, 4 Mks
2.
 - a. Prove the De Morgan's Law: $A^c \cup B^c = (A \cap B)^c$ 5 Mks
 - b. Solve the following Equations involving the Absolute value functions:

$$|8x + 3| = |2x - 21|$$
3 Mks

c. Solve the following inequation:

5 Mks

$$\frac{x-2}{x+1} \geq \frac{x-6}{x-2}$$

d. Using Synthetic Division, show that both $x-2$ and $x+3$ are Factors of:

$$f(x) = 2x^4 + 7x^3 - 4x^2 - 27x - 18.$$

4 Mks

Hence, or otherwise Factorize $f(x)$ completely

3. a. Express the following in the form $\frac{a}{b}$, where $a, b \in \mathbb{Z}$ and $b \neq 0$.

1.5 Mks, 1.5 Mks

i.) $0.\overline{121212} \dots$

ii.) $1.\overline{3121212} \dots$

b. Use the fact that $\sqrt{6}$ is Irrational to prove that $\sqrt{2} + \sqrt{3}$ is Irrational. 4 Mks

c. Sketch the graphs of:

i.) $f(x) = -|x+3| - 4$

ii.) $f(x) = 3 + \sqrt{3-x}$

2.5 Mks, 2.5 Mks

d. Solve the Polynomial Equation $x^4 - 6x^3 + 22x^2 - 30x + 13 = 0$

5 Mks

4. a. Determine the vertex and Intercepts for the following Quadratic function:

$$f(x) = x^2 - 6x - 16$$

2 Mks

b. Sketch the graph of the Polynomial given by;

$$f(x) = (x-1)^2(x-3)^3(x+4)$$

5 Mks

c. Given that the roots of $x^2 + 3x + 17 = 0$ are α and β respectively. Find a Quadratic Function

whose roots are $\alpha^3 + \beta^3$ and $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.

5 Mks

d. Given that set $A = \{1, 2, 3\}$ and set $B = \{2, 4, 6\}$, Determine whether the Operation;

$$A \circ B = P(A) - P(B).$$

is Binary on the Universal Power set, $P(E)$.

5 Mks

5. a. If $x = \frac{\sqrt{5} - \sqrt{3}}{\sqrt{5} + \sqrt{3}}$, find the value of $8x - x^2$.

4 Mks

b. Given the Functions, $f(x) = x^2 + 4$ and $g(x) = x - 9$.

4 Mks

Find the value of x for which $g[f(x)] = f[g(x)]$

c. Write the Expression $f(x) = 2x^2 + 12x + 14$ in the form $f(x) = a(x + h)^2 + k$

where $a, h, k \in \mathbb{R}$.

4 Mks

Hence, state the turning point of $f(x)$.

d. Calculate the value(s) of x that are valid for the Equation below.

$$\left| \frac{x-2}{x+3} \right| = 4$$

5 Mks

6. a. Simplify $-\frac{25}{2} \left[\frac{1+2i}{3+4i} - \frac{2-5i}{-i} \right]$

3 Mks

b. Solve for x and y given that;

$$\frac{x}{1+i} - \frac{y}{2-i} = \frac{1-5i}{3-2i}$$

5 Mks

c. Solve the Inequality below and present your answer in Interval Notation:

$$3x^2 + 2x + 2 < 2x^2 + x + 4$$

4 Mks

d. Graph the Rational Functional by finding the Asymptotes and Intercept:

$$f(x) = \frac{5x^2 - 2}{1 - x}$$

5 Mks

..... THE END.....