EXAM MADE EASY
Personnel Tuition Program

MA110 END OF TOPIC TEST-Intro to set theory & Sets of numbers

DURATION: 2 HOURS **TOTAL MARKS: 100 MARKS**

INSTRUCTIONS:

1. Write your FULL NAME on the answer sheet.
2. This question paper has 5 questions
3. Each question carries 20 marks. Marks are indicated at the end of the question
4. Show all your workings on the answer sheet to be awarded full marks
5. Calculators are NOT ALLOWED.

Do not open this paper until you are told to do so.

QUESTION ONE

a). Prove the De-Morgan's law; (A ∩ B)' = A' U B' **[5 marks]**

b). Verify the De-Morgan's law; (A U B)'=A' ∩ B' **[5 marks]**

c). Use the laws of associative and distributive of union and intersection of sets to show that; AUB=(A∩B) U (A∩B') U (A'∩B). **[5 marks]**

d). Given that set A= {1, 2, 4, 6}, find P(A). **[5 marks]**

QUESTION TWO

a). Given that set A= {2, 4, 6} and set B= {7, 8}, find A×B. **[2.5 marks]**

b). Rationalize the denominator and simplify the expression; $\frac{2\sqrt{x}}{\sqrt{x}-\sqrt{y}}$. **[5 marks]**

c). Express $\frac{\sqrt{3}+1}{\sqrt{3}-1}+\sqrt{3}-1$ in the form $a+b\sqrt{3}$ where a and b are rational. **[5 marks]**

d). Express the following in the simplest form $^{a}/_{b}$ where b≠0.

(i) $0.\overline{12}$ **[2.5 marks]**

(ii) $2.07\overline{2}$ **[5 marks]**

QUESTION THREE

a). Prove that $\sqrt{3}$ is an irrational number. **[5 marks]**

b). Given that $\sqrt{6}$ is an irrational number. Clearly, prove that $\sqrt{2}+\sqrt{3}$ is also an irrational number. **[5 marks]**

c). The operation * is defined by $a*b=a+b-ab$.

(i) is the operation binary on the set of integers? Justify your answer. **[1 mark]**

(ii) is the operation commutative? Justify your answer. **[1 mark]**

(iii) compute (4*3)*2 and 4*(3*2) and state if its associative or not? **[3 marks]**

d). If $a*b=2a-b$, where a and b are real numbers. Solve the following equation using the operation; $2x*(x*3)=5$ **[5 marks]**

QUESTION FOUR

a). Rationalize the denominator of the following expression and give the numerator in simplest radicals; $\frac{1}{(\sqrt{2}+1)(\sqrt{3}-1)}$ **[5 marks]**

b). Given that **R**, the set of real is the universal set, A= (-8, 6] and B= [5, ∞), find the following and present your results on the number line;

(i) B' **[2.5 marks]**

(ii) B-A **[2.5 marks]**

c). The sets A, B and C all **intersect** and E is the universal set. Shade clearly the part described by the set; B U (A ∩ C')' in the Venn diagram. **[5 marks]**

d). Given the universal set E= [1, 12] where A= {1, 2, 3, 4, 5, 6, 7, 8, 9} and B= [1, 5). Find the following sets;

(i) A∩B **[2.5 marks]**

(ii) A-B **[2.5 marks]**

QUESTION FIVE

a). Evaluate the following;

(i) i^{25}

(ii) i^{52}

(iii) i^{55}

(iv) i^{102} **[Total 6 marks]**

b). Let $z = x + iy$ be a non-zero complex number. Express $\frac{1}{z}$ in the form $a + ib$. **[4 marks]**

c). Solve for x and y given that $(x + iy) - i = i(x + iy) + 5$ **[5 marks]**

d). Find the square root of $15 + 8i$ **[5 marks]**

END OF THE TEST. ALL THE BEST!!

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