OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE
DEPARTMENT OF MATHEMATICS
B.Sc. (Mathematics) Degree Mid-Semester Examination
Harmattan Semester, 2021/2022 Session
MTH 101-Elementary Mathematics I

Time Allowed - 1 Hour

Type 2

Instructions: Use HB pencils ONLY. Write and Shade your **Names** and **Registration Number** in the spaces provided on the OMR sheet. **Shade the Question type**. Attempt all questions: Shade the option **E** if none of the options **A-D** is correct.
All notations have their usual meanings.

1. Suppose "$\cdot$" is the multiplication sign on any pair of real numbers (eg. $2 \cdot 5 = 10$). Which of the following is true concerning the solution x of the equation

$$0 \cdot x = 0?$$

(A) x is undefinable
(B) Equation has infinite number of solutions
(C) Equation has only one non-zero solution
(D) The only solution is $x = 0$

2. If a and b are two real numbers such that $a + b = 1$. Which of the following inequalities are true?
(A) $4ac \leq 1$ and $a^2 + b^2 \geq 1/2$
(B) $a^2 + b^2 \leq 1/2$ and $4ac \geq 1$
(D) $4ac \geq 1$ and $a^2 + b^2 \geq 1/2$
(D) $4ac \leq 1$ and $a^2 + b^2 \leq 1/2$

3. If $x, y \in \mathbb{R}$, find x satisfying the equation

$$x(3 + 4i) - y(1 + 2i) + 5 = 0.$$

(A) -2 (B) -3 (C) -4 (D) -5

4. Evaluate the imaginary part of $\sqrt{40 + 42i}$, where $i^2 = -1$.

(A) ± 3 (B) ± 5 (C) ± 7 (D) ± 9

5. If $a, b > 0$ and $a \neq b$, solve for x satisfying $a^x = b^{x-y}$ and $2 - y = 0$.

(A) $x = \dfrac{-2 \log b}{\log b/a}$ (B) $x = \dfrac{2 \log b}{\log a/b}$
(C) $x = \dfrac{2 \log b}{\log b/a}$ (D) $x = \dfrac{-2 \log b}{\log ab}$

6. A solution of the equation

$$\frac{x^3 - 2x^2 - 7x + 12}{x - 3} = 0$$

is

(A) $x = 3$
(B) $x = -2$
(C) $x = \dfrac{-1 + \sqrt{17}}{2}$
(D) $x = \dfrac{1 - \sqrt{17}}{2}$

7. If a and b are non-negative real numbers and $a^2 + b^2 = 23ab$, then $\log a + \log b$ is

(A) $2 \log\left(\dfrac{a+b}{5}\right)$ (B) $2 \log\left(\dfrac{a+b}{23}\right)$
(C) $\log\left(\dfrac{23}{a^2+b^2}\right)$ (D) $\log\left(\dfrac{a^2+b^2}{5}\right)$

8. The expression

$$\frac{x^3 - x^2 - 3x + 5}{(x-1)(x^2-1)}$$

has the form (A, B and C are constants)

(A) $1 + \dfrac{A}{x-1} + \dfrac{B}{(x-1)^2} + \dfrac{C}{x+1}$
(B) $1 + \dfrac{A}{x-1} + \dfrac{B}{x-1} + \dfrac{C}{x+1}$
(C) $\dfrac{A}{x-1} + \dfrac{B}{(x-1)^2} + \dfrac{C}{x+1}$
(D) $\dfrac{A}{x-1} + \dfrac{B}{x-1} + \dfrac{C}{x+1}$

9. If $\sum_{k=1}^{N} U_k = \frac{3N^2 + N}{2}$. Evaluate U_{15}.

(A) 345 (B) 144 (C) 45 (D) 44

10. Evaluate N, if $\sum_{n=3}^{N}(18 - 5n) = -116$.

(A) 10 (B) 9 (C) 8 (D) 7

11. Suppose α and β are the roots of the equation $x^2 - 2sx + 3s^2 + r^2 = 0$, given that s and r are real numbers. Then
(A) $\alpha, \beta \in \mathbb{R}$ and $\alpha \neq \beta$
(B) $\alpha = \beta$
(C) $\alpha, \beta \in \mathbb{C} - \mathbb{R}$
(D) α and β are undefinable

12. Supposse α and β are the roots of the equation $5x^2 - 3x - 1 = 0$. Which of the following is the value of $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$?

(A) $-\frac{72}{25}$ (B) $-\frac{18}{5}$ (C) $-\frac{9}{5}$ (D) $-\frac{3}{5}$

13. x in the inequality $\frac{1}{x-1} < 2$ satisfies two of the following inequalities:
I. $x - 1 < 0$
II. $(x-1)(2x-3) < 0$
III. $(x-1)(2x-3) > 0$
IV. $2x - 3 < 0$

(A) I. and II. only (B) III. and IV. only
(C) I. and III. only (D) II. and IV.

14. Evaluate the values of the constants a and b for which

$$\frac{6x^3 - 8x + 5}{ax + b} = 3x^2 + 6x + 8 + \frac{37}{ax + b}.$$

(A) $a = 2$, $b = -4$ (B) $a = 2$, $b = 2$
(C) $a = 2$, $b = 4$ (D) $a = 2$, $b = -2$

15. Evaluate N, given that $\sum_{k=0}^{N}(5 \times 2^k) = 315$.

(A) 8 (B) 7 (C) 6 (D) 5

16. If A and B are respectively the largest possible domains of the real-valued functions f and g of real variable x defined by

$$f(x) = \frac{x-3}{x^2 - 9} \quad \text{and} \quad g(x) = \frac{1}{x+3}.$$

Which of the the following reasons from I. to III. justify why f is not the same as g?
I. $A \neq B$ II. $A \subset B$ III. $B \subset A$

(A) I. only (B) I. and II. only
(C) I. and III. only (D) II. only

17. Let $A = \{1, 4, 9\}$ and $B = \{-3, -2, -1\}$. If the propositional function $p(x, y)$ on $A \times B$ means $x = y^2$. Which of the following from I. to IV. about the relation $f = (A, B, p(x, y))$ is/are true?

I. f is a function from A to B
II. f is not a function from A to B
III. Solution set of f is $\{(-3, 9), (-2, 4), (-1, 1)\}$.

(A) I. only (B) II. only
(C) I. and III. only (D) II. and III. only

18. The cardinality of an arbitrary finite set X is denoted by $n(X)$. Which of the following from I. to III. is/are true?
I. $n(A) = n(A - B) + n(A \cap B)$
II. $n(A \cup B) = n(A - B) + n(A \cap B) + n(B - A)$
III. $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

(A) I. only (B) III. only
(C) I. and III. only (D) I., II. and III.

19. The following define the symmetric difference $A \Delta B$ of sets A and B except

(A) $(A - B) \cup (B - A)$
(B) $[(A \cap B^c) \cup B] \cap [(A \cap B^c) \cup A^c]$
(C) $(A \cap B) - (A \cup B)$
(D) $(A \cup B) \cap (A^c \cup B^c)$

20. If the universal set $\mathcal{U} = \mathbb{R}$, and $A = \{x \in \mathbb{R} : x^2 + 1 = 0\}$. Which of the following statement(s) is/are not true?
I. A is a finite set
II. $A \neq \{-\sqrt{-1}, \sqrt{-1}\}$
III. $A = \{\ \}$
IV. $A \subseteq \mathbb{R}$
V. $A^c \neq \mathbb{R}$,

(A) I. and III. (B) II. (C) IV. (D) V.