

Ambedkar College of Arts and Science, Wandoor

Class Test 0 — Precalculus Diagnostic

Differential Calculus — MAT1CJ101

B.Sc. Mathematics Honours (CUFYUGP 2024) — Semester I

Name: _____ ID No.: _____

Date: _____ Time: 30 Mins **Maximum Marks: 30**

Answer all questions in the space provided.

Part A — Short Answer ($6 \times 2 = 12$ marks)

1. Let $A = \{1, 2, 3, 4\}$ and let $R = \{(1, 1), (2, 2), (3, 3), (4, 4), (1, 2), (2, 1), (3, 4)\}$ be a relation on A . Is R reflexive? Is R symmetric? Justify each answer in one line. [2]

2. Let $f(x) = 2x - 3$ and $g(x) = x^2$. Find $(f \circ g)(x)$ and $(g \circ f)(x)$. [2]

3. Solve the inequality $2x + 5 > 1$. Write the solution set in interval notation. [2]

4. (a) Factor completely: $x^2 - 5x + 6$. (b) State the end behaviour of $f(x) = -2x^3 + x - 1$ as $x \rightarrow \infty$ and as $x \rightarrow -\infty$. [2]

5. (a) Simplify: $\frac{a^5 \cdot a^{-2}}{a}$. (b) Evaluate $\log_3 27$. [2]

6. (a) Convert $\frac{5\pi}{6}$ radians to degrees. (b) Evaluate $\tan\left(\frac{\pi}{4}\right)$. [2]

Part B — Applied Problems ($6 \times 3 = 18$ marks)

7. Let $A = \{1, 2, 3, 4, 5, 6\}$. Define a relation R on A by $x R y$ iff x and y leave the same remainder when divided by 3. List the equivalence classes of R . **[3]**

8. Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be given by $f(x) = 3x - 2$. Show that f is bijective, and find its inverse function $f^{-1}(x)$. **[3]**

9. Solve the quadratic inequality $x^2 - x - 6 \leq 0$ using a sign chart. Write the solution set in interval notation. **[3]**

10. Find the vertical and horizontal asymptotes of $f(x) = \frac{2x - 1}{x + 3}$. **[3]**

11. Solve for x : $\log_2 x + \log_2(x - 2) = 3$. (Check for extraneous roots.) **[3]**

12. Solve $2 \sin x - 1 = 0$ for $x \in [0, 2\pi)$. **[3]**