

THE POLYTECHNIC, IBADAN
DEPARTMENT OF MATHEMATICS & STATISTICS
FIRST SEMESTER EXAMINATION, 2022/2023 SESSION

COURSE CODE: MTH 112

COURSE TITLE: FUNCTIONS & GEOMETRY

CLASS: ND I STATISTICS (FT & DPP)

TIME: 2 HOURS

INSTRUCTION: ATTEMPT ANY FOUR QUESTIONS

1a. Given a function $f(x) = \frac{2x^2 - x + 3}{x + 5}$ Find (i) $f(2)$ (ii) $f^{-1}(x)$ (iii) domain of f if $2 \leq x < 7$

b. (i) Find the range and domain of $f: x \mapsto \frac{1}{2x+1}$ if $x: 1 \leq x \leq 5$

(ii) If $f: x \mapsto \frac{1}{x}$ and domain of $f = \{\text{all the positive integers less than 15}\}$. Find the range of f .

2a. Given that $f(x) = x + 1$ and $g(x) = 2x^2 + 3x + 5$. Find (i) $fg(x)$ (ii) $gf(x)$ (iii) $fg(-1)$
 (iv) $gf(\frac{1}{2})$

b. A function f is defined as $f(x) = \frac{x+3}{x-2}$. Find the inverse of the function and use it to evaluate $f^{-1}(4)$

3a. Identify each of the following relation R

(i) $R = \{(3,4), (3,5), (4,3), (5,4), (4,5)\}$

(ii) $R = \{(3,3), (3,5), (5,5), (5,9), (7,7), (7,9), (9,9)\}$

(iii) $R = \{(1,5), (3,3), (3,5), (5,3), (5,1)\}$

b. Find the solution set of each of the relation below

(i) A to B where $A = \{12, 14, 16, 18\}$ and $B = \{3, 6, 8\}$ defined by " a is a multiple of b "

(ii) X to Y where $X = \{2, 3, 4\}$ and $Y = \{9, 12, 15\}$ defined by " x is a factor of y ".

4a. If $\sin A = \frac{3}{5}$ and $\cos B = \frac{12}{13}$. Find the value of $\frac{\cos A}{1 + \sin B} + \frac{1 + \sin B}{\cos A}$

b. Prove the following identities: (i) $\frac{\tan A}{1 + \sec A} + \frac{1 + \sec A}{\tan A} = 2 \csc A$

(ii) $\frac{1}{1 + \cos^2 A} + \frac{1}{1 + \sec^2 A} = 1$

6. a. Evaluate $\int_1^3 (x^2 + 5) dx$

b. At every point (x,y) of a certain curve, the slope is equal to 8 times the abscissa. Find the equation of the curve if it passes through $(1,3)$.

c. Find the area of the region under the curve $y = x^3 - 2$ between the ordinate $x = -2$ and $x = 1$