

**Indian Statistical Institute**  
**MSLIS, Mid-semester Examination**  
**Paper-12-ELEMENTS OF MATHEMATICS-II**

**Time: 1 hr 30 minutes**

**Total Marks: 30**

**Answer All Questions**

Q1	Explain with suitable examples the meaning of relations and sets. If $\left(\frac{x}{3} + 1, y - \frac{2}{3}\right) = \left(\frac{5}{3}, \frac{1}{3}\right)$ find the values of $x$ and $y$ .	(2)
Q2	If $G = \{7,8\}$ and $H = \{5,4,2\}$ find $G \times H$ and $H \times G$ .	(2)
Q3	Let $A = \{1,2,3,5\}$ and $B = \{4,6,9\}$ . Define a relation $R$ from $A$ to $B$ by $R = \{(x,y): \text{the difference between } x \text{ and } y \text{ is odd; } x \in A, y \in B\}$ . Write $R$ in roster form	(2)
Q4	What are functions? Is the following relation a function? Justify your answer (i) $R_1 = \{(2, 3), (12, 0), (2, 7), (-4, 6)\}$ (ii) $R_2 = \{(x,  x ) \mid x \text{ is a real number}\}$	(2)
Q5	Find the domain for which the functions $f(x) = 2x^2 - 1$ and $g(x) = 1 - 3x$ are equal.	(2)
Q6	If $f$ and $g$ are real functions defined by $f(x) = x^2 + 7$ and $g(x) = 3x + 5$ , find each of the following (a) $f(3) + g(-5)$ (b) $f(-2) + g(-1)$	(2)
Q7	Find the domain of the function $f$ given by $f(x) = \left(\frac{x^2+2x+1}{x^2-x-6}\right)$	(2)
Q8	Let the function $f : \mathbb{R} \rightarrow \mathbb{R}$ be defined by $f(x) = 4x - 1, \forall x \in \mathbb{R}$ . Then, show that $f$ is one-one.	(2)
Q9	In each of the following cases, state whether the function is one-one, onto or bijective. Justify your answer. (i) $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = 3 - 4x$ (ii) $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = 1 + x^2$	(2)

Q10	<p>a) Show that the function <math>f : \mathbb{R} \rightarrow \mathbb{R}</math> defined by <math>f(x) = \frac{x}{x^2 + 1} \quad \forall x \in \mathbb{R}</math>, is neither one-one nor onto.</p> <p>b) Show that the function <math>f: \mathbb{R} \rightarrow \mathbb{R}</math> defined as <math>f(x) = x^2</math> is neither one-one nor onto.</p>	(4)
Q11	<p>Find the inverse function of <math>f</math> given by</p> <p>a) <math>f(x) = (x - 3)^2</math>, if <math>x \geq 3</math></p> <p>b) <math>f(x) = (x + 1)/(x - 2)</math></p>	(4)
Q12	<p>What is composition of two functions? Explain with examples. Given <math>f(x) = x + 2</math> and <math>g(x) = 4 - x^2</math>, find the following.</p> <p>a. <math>(f \circ g)(x)</math></p> <p>b. <math>(g \circ f)(x)</math></p> <p>c. <math>(f \circ g)(-1)</math></p> <p>d. <math>(g \circ f)(-2)</math></p>	(4)