RMHS   # UNIT TEST: Relations & Functions   **RMHS**

Time: 90 mins]   10TH STANDARD **MATHEMATICS**   [Marks: 50

I. Answer all the Questions. Write the option code and the corresponding answer: ($5 \times 1 = 5$)

1. If there are 1024 relations from a set $A = \{1, 2, 3, 4, 5\}$ to a set B, then the number of elements in B is
   (A) 3   (B) 2   (C) 4   (D) 8

2. Let $n(A) = m$ and $n(B) = n$ then the total number of relations that can be defined from A to B is
   (A) m^n (B) n^m (C) $2^{mn} - 1$ (D) 2^{mn}

3. If $A = \{1, 2\}$, $B = \{1, 2, 3, 4\}$, $C = \{5, 6\}$ and $D = \{5, 6, 7, 8\}$ then state which of the following
   statement is true.   (A) $(A \times C) \subset (B \times D)$ (B) $(B \times D) \subset (A \times C)$
                             (C) $(A \times B) \subset (A \times D)$ (D) $(D \times A) \subset (B \times A)$

4. Let f and g be two functions given by $f = \{(0, 1), (2, 0), (3, -4), (4, 2), (5, 7)\}$
   $g = \{(0, 2), (1, 0), (2, 4), (-4, 2), (7, 0)\}$ then the range of $f \circ g$ is
   (A) $\{0, 2, 3, 4, 5\}$ (B) $\{-4, 1, 0, 2, 7\}$ (C) $\{1, 2, 3, 4, 5\}$ (D) $\{0, 1, 2\}$

5. If $\{(a, 8), (6, b)\}$ represents an identity function, then the value of a and b are respectively
   (A) $(8, 6)$ (B) $(8, 8)$ (C) $(6, 8)$ (D) $(6, 6)$

II. Answer any SIX Questions: ($6 \times 2 = 12$)

6. If $A \times B = \{(3, 2), (3, 4), (5, 2), (5, 4)\}$, then find A and B

7. Let $A = \{1, 2, 3, 4, ..., 45\}$ and R be the relation defined as "is a square of" on A. Write R as a subset of $A \times A$. Also, find the domain and range of R.

8. Let $X = \{1, 2, 3, 4\}$ and $Y = \{2, 4, 6, 8, 10\}$ and $R = \{(1, 2), (2, 4), (3, 6), (4, 8)\}$. Show that R is a function and find its domain, co-domain and range?

9. Let $f(x) = 2x + 5$. If $x \neq 0$ then find $\dfrac{f(x+2) - f(2)}{x}$

10. If $A = \{-2, -1, 0, 1, 2\}$ and $f : A \to B$ is an onto function defined by $f(x) = x^2 + x + 1$ then find B.

11. Show that the function $f : N \to N$ defined by $f(x) = 2x - 1$ is one-one but not onto.

12. Find $f \circ g$ and $g \circ f$ when $f(x) = 3 + x$, $g(x) = x - 4$

III. Answer any FIVE Questions: ($5 \times 5 = 25$)

13. Let $A = \{x \in W / x < 2\}$, $B = \{x \in N / 1 < x \leq 4\}$ and $C = \{3, 5\}$ Verify that. $A \times (B \cap C) = (A \times B) \cap (A \times C)$

14. Let $A = \{1, 2, 3, 4\}$ and $B = \{2, 5, 8, 11, 14\}$ be two sets. Let $f : A \to B$ be a function given by $f(x) = 3x - 1$. Represent this function (i) by arrow diagram (ii) in a table form (iii) as a set of ordered pairs (iv) in a graphical form.

15. If the function $f : R \to R$ is defined by $f(x) = \begin{cases} 2x + 7 & \text{if } x < -2 \\ x^2 - 2 & \text{if } -2 \leq x < 3 \\ 3x - 2 & \text{if } x \geq 3 \end{cases}$

    then the values of (i) $f(4)$ (ii) $f(-2)$ (iii) $f(4) + 2f(1)$

16. Let $A = \{-1, 1\}$, $B = \{0, 2\}$. If the function $f : A \to B$ defined by $f(x) = ax + b$ is an onto function? Find a and b.

17. If $f(x) = x - 4$, $g(x) = x^2$ and $h(x) = 3x - 5$. Prove that $f \circ (g \circ h) = (f \circ g) \circ h$.

IV. Answer the following question: ($1 \times 8 = 8$)

18. Construct a triangle similar to a given triangle PQR with its sides equal to $\dfrac{2}{3}$ of the
    corresponding sides of the triangle PQR (Scale factor $\dfrac{2}{3} < 1$)