

MATHEMATICS
WORKSHEET_010225
CHAPTER 02 RELATIONS AND FUNCTIONS

SUBJECT: MATHEMATICS

MAX. MARKS : 40

CLASS : XI

DURATION : 1½ hrs

General Instructions:

- (i). All questions are compulsory.
- (ii). This question paper contains 20 questions divided into five Sections A, B, C, D and E.
- (iii). Section A comprises of 10 MCQs of 1 mark each. Section B comprises of 4 questions of 2 marks each. Section C comprises of 3 questions of 3 marks each. Section D comprises of 1 question of 5 marks each and Section E comprises of 2 Case Study Based Questions of 4 marks each.
- (iv). There is no overall choice.
- (v). Use of Calculators is not permitted

SECTION – A

Questions 1 to 10 carry 1 mark each.

1. If R is a relation on the set $A = \{1, 2, 3, 4, 6, 7, 8, 9, 11, 12\}$ given by $x R y \Leftrightarrow y = 2x$, then R is equal to:
(a) $\{(2, 1), (4, 2), (8, 2), (9, 3)\}$
(b) $\{(2, 1), (4, 2), (6, 3)\}$
(c) $\{(5, 1), (2, 4), (3, 6)\}$
(d) none of these
2. Range of the function $f(x) = \frac{x}{x+2}$ is
(a) R (b) $R - \{2\}$ (c) $R - \{1\}$ (d) $R - \{-2\}$
3. Let $S = \{x \mid x \text{ is a positive multiple of 3 less than 100}\}$, $P = \{x \mid x \text{ is a prime number less than 20}\}$. Then $n(S) + n(P)$ is:
(a) 34 (b) 41 (c) 33 (d) 30
4. Range of the function $f(x) = \frac{x+4}{|x+4|}$ is
(a) $\{4\}$ (b) $\{-4\}$ (c) $\{-1, 1\}$ (d) any real number
5. If $[x]^2 - 5[x] + 6 = 0$, where $[]$ denote the greatest integer function, then
(a) $x \in [3, 4)$ (b) $x \in [2, 3)$ (c) $x \in [2, 3)$ (d) $x \in [2, 4)$
6. Domain of $\sqrt{a^2 - x^2}$ ($a > 0$) is
(a) $(-a, a)$ (b) $[-a, a]$ (c) $[0, a]$ (d) $(-a, 0]$
7. If $R = \{(x, y) : x, y \in \mathbb{Z}, x^2 + y^2 \leq 16\}$ is a relation on $\mathbb{Z}$, then the domain of R is:
(a) $\{0, 1, 2, 3, 4\}$
(b) $\{0, -1, -2, -3, -4\}$
(c) $\{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$
(d) none of these
8. Let $n(A) = m$ and $n(B) = n$. Then the total number of non-empty relations that can be defined from A to B is
(a) m^n (b) $n^m - 1$ (c) $mn - 1$ (d) $2^{mn} - 1$

For Q9 and Q10, a statement of assertion (A) is followed by a statement of reason (R). Choose the correct answer out of the following choices.

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

9. **Assertion (A):** If $(x - 1, y + 2) = (2, 4)$, then $x = 3$ and $y = 2$.

Reason (R): Two ordered pairs (x, y) and (p, q) equal, if their corresponding elements are equal.

10. Let $A = \{1, 2, 3, 4, 5, 6\}$. If R is the relation on A defined by $\{(a, b) : a, b \in A \text{ where } b \text{ is square of } a\}$

Assertion (A): The relations R in roster form is $\{(1, 1), (2, 4), (3, 9), (4, 16), (5, 25), (6, 36)\}$.

Reason (R): The domain and range of R is $\{1, 2, 3, 4, 5, 6\}$.

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. Define a relation R on the set N of natural numbers by

$$R = \{(x, y) : y = x + 3, x \text{ is a prime number less than } 8 : x, y \in \mathbb{N}\}.$$

Depict this relationship using a roster form.

Write down the domain and the range.

12. In function $f = \{(1, 1), (0, -2), (3, 0), (2, 4)\}$ be a linear function defined by formula, $f(x) = ax + b$. Then find 'a' and 'b'.

13. Find the domain of each of the following functions given by : $f(x) = \frac{x^3 - x + 3}{x^2 - 1}$

14. Find the range of the following functions given by : $f(x) = \frac{|x - 4|}{x - 4}$

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. Find the domain and the range of the function : $f(x) = \sqrt{x^2 - 4}$

16. Find the domain and range of the real function $f(x) = \sqrt{9 - x^2}$

17. Let $A = \{1, 2, 3, 4, 5, 6\}$. Define a relation R from A to A by $R = \{(x, y) : y = x - 1\}$. Write R in roster form. Write down the domain, codomain and range of R.

SECTION – D

Questions 18 carry 5 marks.

18. Let $A = \{-2, -1, 0, 1, 2\}$ and $f : A \rightarrow \mathbb{Z}$ be given by $f(x) = x^2 - 2x - 3$. Find:

(a) the range of f

(b) pre-images of 6, -3 and 5.

SECTION – E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

19. A teacher asked randomly his two students to draw graph (figure) on the black board. Two students Raman and Prashant draw figure (graphs) (a) and (b) one by one on the board as shown below:

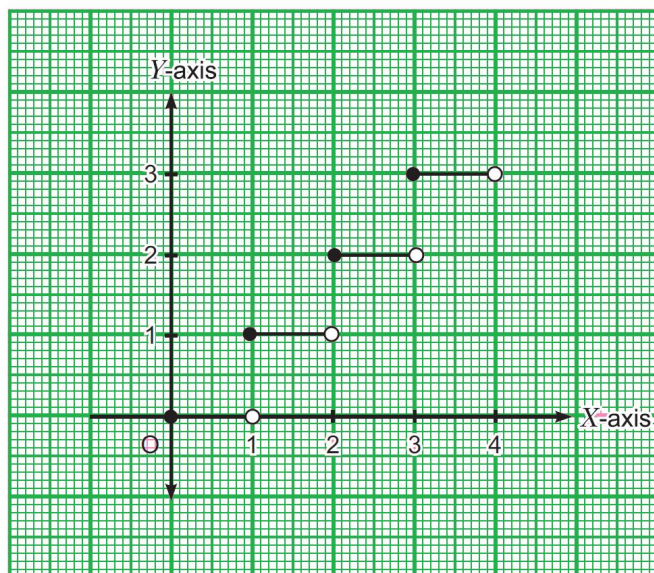


Figure (a)

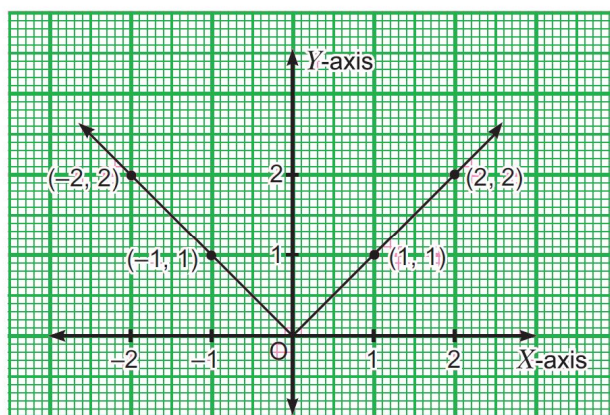


Figure (b)

- (i) For the figure (a), write the function in terms of x .
(ii) (a) For the figure (b), write the function in terms of x .

OR

- (ii) (b) Write the range of the function $f(x)$ of the figure (a).
(iii) The function $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = |x|$ then write the value of $f(-3)$.

20. Maths teacher started the lesson Relations and Functions in Class XI. He explained the following topics:

Ordered Pairs: The ordered pair of two elements a and b is denoted by (a, b) : a is first element (or first component) and b is second element (or second component).

Two ordered pairs are equal if their corresponding elements are equal. i.e., $(a, b) = (c, d) \Rightarrow a = c$ and $b = d$

Cartesian Product of Two Sets: For two non-empty sets A and B , the cartesian product $A \times B$ is the set of all ordered pairs of elements from sets A and B .

In symbolic form, it can be written as $A \times B = \{(a, b) : a \in A, b \in B\}$

Based on the above topics, answer the following questions.

- (i) If $(a - 3, b + 7) = (3, 7)$, then find the value of a and b
(ii) If $(x + 6, y - 2) = (0, 6)$, then find the value of x and y
(iii) If $(x + 2, 4) = (5, 2x + y)$, then find the value of x and y
(iv) Find x and y , if $(x + 3, 5) = (6, 2x + y)$.

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