

X - MATHS

Chapter: ①

Relations and functions.5 marks:

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

Solution:

Given: $A = \{1, 2, 3, 4\}$ $B = \{2, 5, 8, 11, 14\}$

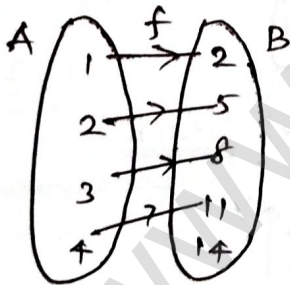
$$f(x) = 3x - 1.$$

$$x=1 \Rightarrow f(1) = 3(1) - 1 = 3 - 1 = 2$$

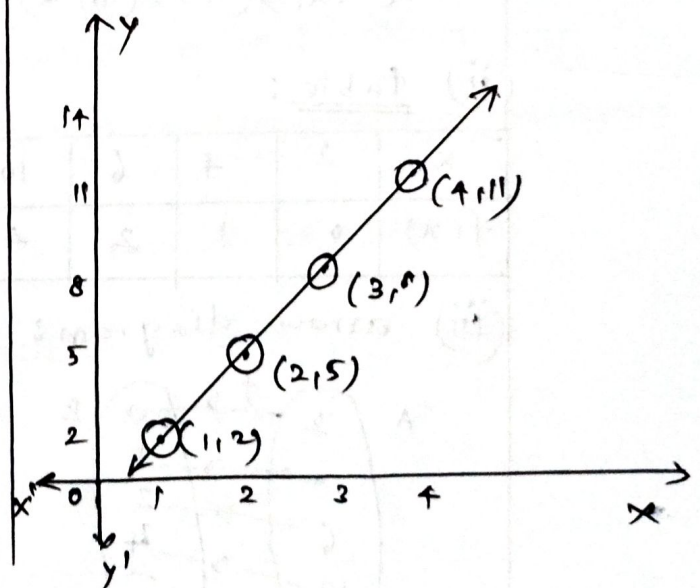
$$x=2 \Rightarrow f(2) = 3(2) - 1 = 6 - 1 = 5$$

$$x=3 \Rightarrow f(3) = 3(3) - 1 = 9 - 1 = 8$$

$$x=4 \Rightarrow f(4) = 3(4) - 1 = 12 - 1 = 11.$$

(i) arrow diagram:(ii) Table:

x	1	2	3	4
$f(x)$	2	5	8	11

(iv) graph:(iii) set of ordered pairs:

$$f = \{(1, 2), (2, 5), (3, 8), (4, 11)\}$$

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(2) Let $f: A \rightarrow B$ be a function defined by $f(x) = \frac{x}{2} - 1$.

where $A = \{2, 4, 6, 10, 12\}$ and $B = \{0, 1, 2, 4, 5, 9\}$.

Represent by

- (i) set of ordered pairs (ii) a table (iii) an arrow diagram
(iv) a graph.

Solution:

Given: $A = \{2, 4, 6, 10, 12\}$ $B = \{0, 1, 2, 4, 5, 9\}$

$$f(x) = \frac{x}{2} - 1.$$

$$x = 2 \Rightarrow f(2) = \frac{2}{2} - 1 = 1 - 1 = 0$$

$$x = 4 \Rightarrow f(4) = \frac{4}{2} - 1 = 2 - 1 = 1$$

$$x = 6 \Rightarrow f(6) = \frac{6}{2} - 1 = 3 - 1 = 2$$

$$x = 10 \Rightarrow f(10) = \frac{10}{2} - 1 = 5 - 1 = 4$$

$$x = 12 \Rightarrow f(12) = \frac{12}{2} - 1 = 6 - 1 = 5$$

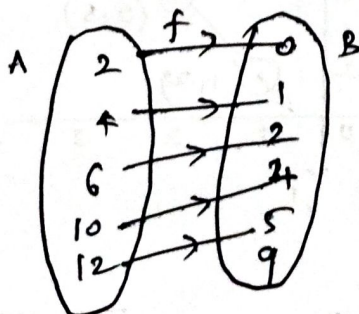
(i) set of ordered pairs:

$$f = \{(2, 0), (4, 1), (6, 2), (10, 4), (12, 5)\}$$

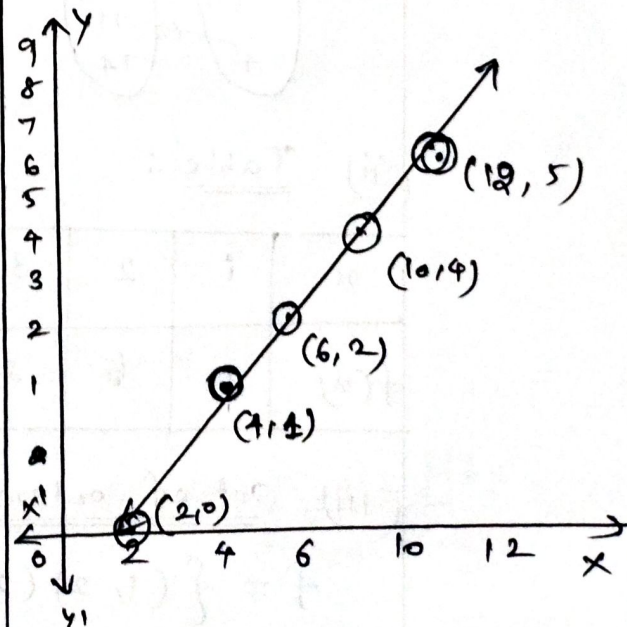
(ii) table:

x	2	4	6	10	12
$f(x)$	0	1	2	4	5

(iii) arrow diagram:



(iv) Graph:



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Example: 1.19If the function $f: \mathbb{R} \rightarrow \mathbb{R}$ is defined by

$$f(x) = \begin{cases} 2x+7, & x < -2 \\ x^2-2, & -2 \leq x < 3 \\ 3x-2, & x \geq 3. \end{cases}$$

Then find the values of

(i) $f(4)$ (ii) $f(-2)$ (iii) $f(4) + 2f(1)$ (iv) $\frac{f(1) - 3f(4)}{f(-3)}$

Solution:

Given: $f(x) = \begin{cases} 2x+7, & x < -2 \\ x^2-2, & -2 \leq x < 3 \\ 3x-2, & x \geq 3 \end{cases}$

(i) $f(4) = 3(4) - 2 = 12 - 2 = 10$

(ii) $f(-2) = (-2)^2 - 2 = 4 - 2 = 2$

(iii) $f(1) = (1)^2 - 2 = 1 - 2 = -1$

$f(4) + 2f(1) = 10 + 2(-1) = 10 - 2 = 8$

(iv) $f(-3) = 2(-3) + 7 = -6 + 7 = 1$

$\frac{f(1) - 3f(4)}{f(-3)} = \frac{-1 - 3(10)}{1} = \frac{-1 - 30}{1} = -31.$

Exercise 1.4

(10) A function $f: [-5, 9] \rightarrow \mathbb{R}$ is defined as follows.

$$f(x) = \begin{cases} 6x+1 & \text{if } -5 \leq x < 2 \\ 5x^2-1 & \text{if } 2 \leq x < 6 \\ 3x-4 & \text{if } 6 \leq x \leq 9. \end{cases}$$

Find

(i) $f(-3) + f(2)$ (ii) $f(7) - f(1)$ (iii) $2f(4) + f(8)$ (iv) $\frac{2f(-2) - f(6)}{f(4) + f(-2)}$

Solution:

$$\text{given: } f(x) = \begin{cases} 6x+1 & \text{if } x = -5, -4, -3, -2, -1, 0, 1 \\ 5x^2-1 & \text{if } x = 2, 3, 4, 5 \\ 3x-4 & \text{if } x = 6, 7, 8, 9 \end{cases}$$

$$(i) \quad f(-3) = 6(-3) + 1 = -18 + 1 = -17$$

$$f(2) = 5(2)^2 - 1 = 5(4) - 1 = 20 - 1 = 19$$

$$f(-3) + f(2) = -17 + 19 = 2.$$

$$(ii) \quad f(7) = 3(7) - 4 = 21 - 4 = 17$$

$$f(1) = 6(1) + 1 = 6 + 1 = 7$$

$$f(7) - f(1) = 17 - 7 = 10.$$

$$(iii) \quad f(4) = 5(4)^2 - 1 = 5(16) - 1 = 80 - 1 = 79$$

$$f(8) = 3(8) - 4 = 24 - 4 = 20$$

$$2f(4) + f(8) = 2(79) + 20$$

$$= 158 + 20$$

$$= 178$$

$$(iv) \quad f(-2) = 6(-2) + 1 = -12 + 1 = -11$$

$$f(6) = 3(6) - 4 = 18 - 4 = 14$$

$$\frac{2f(-2) - f(6)}{f(4) + f(-2)} = \frac{2(-11) - 14}{79 - 11}$$

$$= \frac{-22 - 14}{68} = \frac{-36}{68} = \frac{-9}{17}.$$

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