



## MATHS

### BOOKS - SURA MATHS (TAMIL ENGLISH)

#### RELATIONS AND FUNCTIONS

##### Exercise 1 1

1. Find the  $A \times B$ ,  $B \times A$ , and  $A \cap B$ .

$A = \{2, -2, 3\}$  and  $B = \{1, -4\}$ .

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2. Find the  $A \times B$ ,  $B \times A$ , and  $A \cap B$ .

$A = B = \{p, q\}$

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3. Find the  $A \times B$ ,  $A \times B$ , and  $B \times A$ .  $A = \{m, n\}$ ;  $B = \Phi$ .

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4. Let  $A = \{1, 2, 3\}$  and  $B = \{x \mid x \text{ is the prime number less than } 10\}$ .

Find  $A \times B$  and  $B \times A$ .

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5. If  $B \times A = \{(-2, 3), (-2, 4), (0, 3), (0, 4), (3, 3), (3, 4)\}$  find the  $A$  and  $B$ .

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6. If  $A = \{5, 6\}$ ,  $B = \{4, 5, 6\}$ ,  $C = \{5, 6, 7\}$ . Show that  $A \times A = (B \times B) \cap (C \times C)$ .



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7. Given  $A = \{1, 2, 3\}$ ,  $B = \{2, 3, 5\}$ ,  $C = \{3, 4\}$  and  $D = \{1, 3, 5\}$ , check  $(A \cap C) \times (B \cap D) = (A \times B) \cap (C \times D)$  is true?

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8. Let  $A = \{\xi \in W \mid x < 2\}$ ,  $B = \{\xi \in N \mid 1 < x < 4\}$  and  $C = \{3, 5\}$ .

Verify that

$$A \times (B \cup C) = (A \times B) \cup (A \times C)$$

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9. Let  $A = \{\xi \in W \mid x < 2\}$ ,  $B = \{\xi \in N \mid 1 < x < 4\}$  and  $C = \{3, 5\}$ .

Verify that

$$A \times (B \cap C) = (A \times B) \cap (A \times C)$$

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10. Let  $A = \{\xi n W \mid x < 2\}$ ,  $B = \{\xi n N \mid 1 < x < 4\}$  and  $C = \{3, 5\}$ .

Verify that

$$(A \cup B) \times C = (A \times C) \cup (B \times C)$$



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11. Let  $A =$  The set of all natural numbers less than 8,  $B =$  The set of all prime numbers less than 8,  $C =$  The set of even prime number. Verify that

$$(A \cap B) \times C = (A \times C) \cap (B \times C)$$



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12. Let  $A =$  The set of all natural numbers less than 8,  $B =$  The set of all prime numbers less than 8,  $C =$  The set of even prime number. Verify that

$$A \times (B - C) = (A \times B) - (A \times C)$$



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## Exercise 1 2

1. Let  $A = \{1, 2, 3, 7\}$  and  $B = \{3, 0, -1, 7\}$ , which of the following are relation from A to B?

$$R_1 = \{(2, 1), (7, 1)\}$$

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2. Let  $A = \{1, 2, 3, 7\}$  and  $B = \{3, 0, -1, 7\}$ , which of the following are relation from A to B?

$$R_2 = \{(-1, 1)\}$$

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3. Let  $A = \{1, 2, 3, 7\}$  and  $B = \{3, 0, -1, 7\}$ , which of the following are relation from A to B?

$$R_3 = \{(2, -1), (7, 7), (1, 3)\}$$

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4. Let  $A = \{1, 2, 3, 7\}$  and  $B = \{3, 0, -1, 7\}$ , which of the following are relation from A to B?

$$R_4 = \{(7, -1), (0, 3), (3, 3), (0, 7)\}$$

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

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6. A Relation R is given by the set  $\{(x, y) \mid y = x + 3, \xi n\{0, 1, 2, 4, 5\}\}$ . Determine its domain and range.

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7. Represent each of the given relation by (a) an arrow diagram, (b) a graph and (C) a set in roster form, wherever possible.

$$\{(x, y) \mid x = 2y, \xi n\{2, 3, 4, 5\}, y \in \{1, 2, 3, 4\}.$$

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8. Represent each of the given relation by (a) an arrow diagram, (b) a graph and (C) a set in roster form, wherever possible.

$$\{(x, y) \mid y = x + 3, x, y \text{ are natural number } < 10\}$$

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9. A company has four categories of employees given by Assistants (A), Clerks(C), Mangagers (M) and an Excutive Officer(E). The company provide ₹10,000, ₹25,000, ₹50,000 and ₹1,00,000 as salaries to the people who work in the categories A, C, M and E respectively. If  $A_1, A_2, A_3, A_4$  and  $A_5$  were Assistants,  $C_1, C_2, C_3, C_4$  were Clerks,  $M_1, M_2$  and  $M_3$  were managers and  $E_1, E_2$  were Executive officers and

if the relation  $R$  is defined by  $xRy$ , where  $x$  is the salary given to person  $y$ , express the relation  $R$  through an ordered pair and an arrow diagram/

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### Exercise 1 3

1. Let  $f = \{(x, y) \mid x, y \in N \text{ and } y = 2x\}$  be a relation on  $N$ . Find the domain, co-domain and range. Is this relation a function?

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2. Let  $X = \{3, 4, 6, 8\}$ . Determine whether the relation  $R = \{x, f(x) \mid x \in X, f(x) = x^2 + 1\}$  is the function from  $X$  to  $N$ ?

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3. Given the function  $f: x \rightarrow x^2 - 5x + 6$ , evaluate

$f(-1)$



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4. Given the function  $f: x \rightarrow x^2 - 5x + 6$ , evaluate

$f(2a)$



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5. Given the function  $f: x \rightarrow x^2 - 5x + 6$ , evaluate

$f(2)$



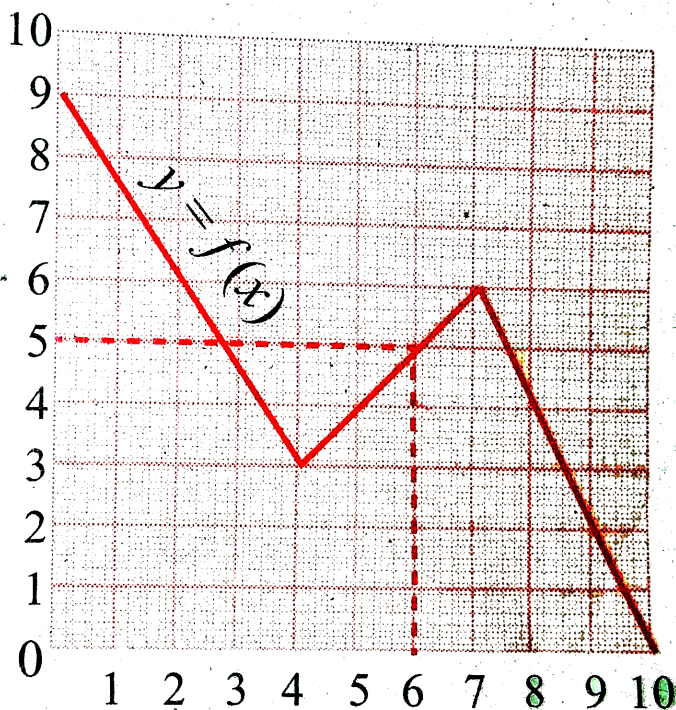
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6. Given the function  $f: x \rightarrow x^2 - 5x + 6$ , evaluate

$f(x-1)$



7. A graph representing the function  $f(x)$  is given in figure it is clear that  $f(9) = 2$ .

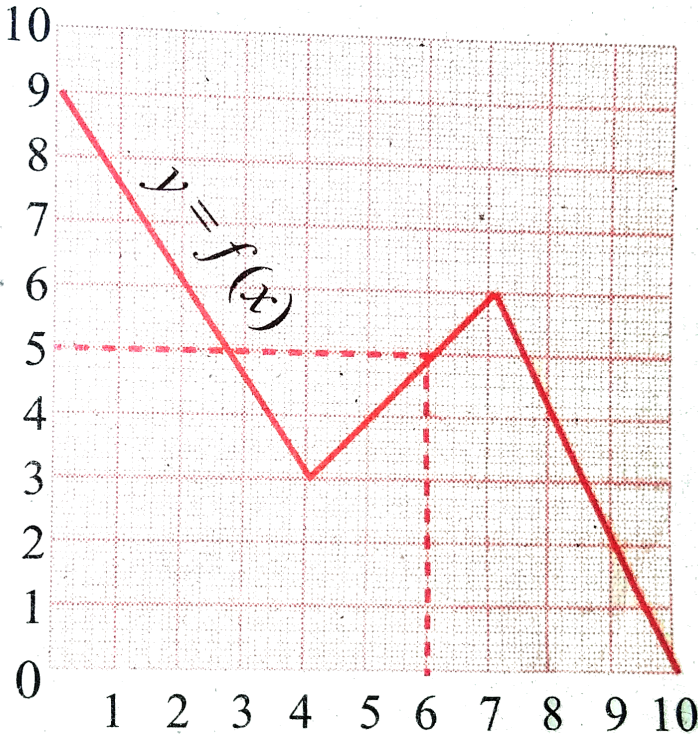


Find the following values of the function (a) $f(0)$  (b) $f(7)$  (c) $f(2)$  (d) $f(10)$



8. A graph representing the function  $f(x)$  is given in figure it is clear that

$$f(9) = 2.$$



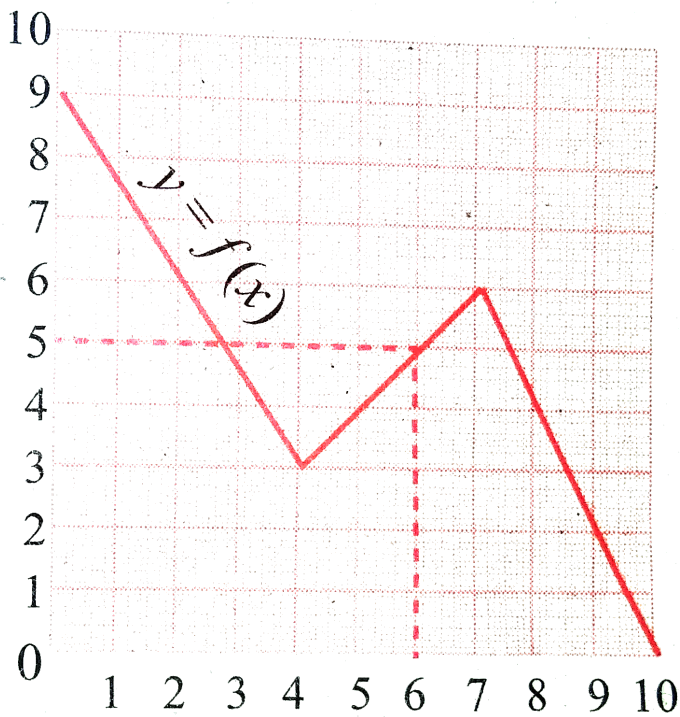
For what value of  $x$  is  $f(x)=1$ ?



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9. A graph representing the function  $f(x)$  is given in figure it is clear that

$$f(9) = 2.$$



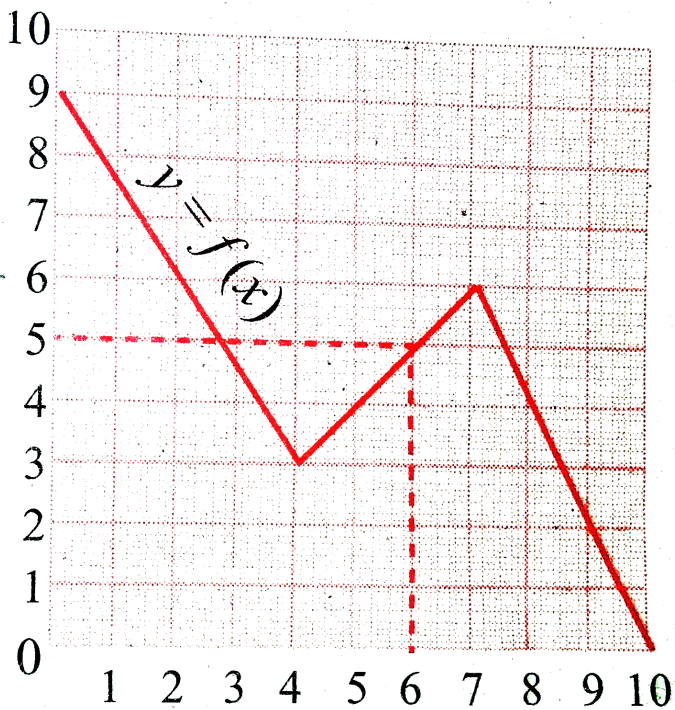
Describe the following (i) Domain (ii) Range.



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10. A graph representing the function  $f(x)$  is given in figure it is clear that

$$f(9) = 2.$$



What is the image of 6 under  $f$ ?

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

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12. A function is defined by  $f(x) = 2x - 3$

Find  $\frac{f(0) + f(1)}{2}$ .

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13. A function is defined by  $f(x) = 2x - 3$

Find  $x$  such that  $f(x) = 0$ .

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14. A function is defined by  $f(x) = 2x - 3$

Find  $x$  such that  $f(x) = x$ .

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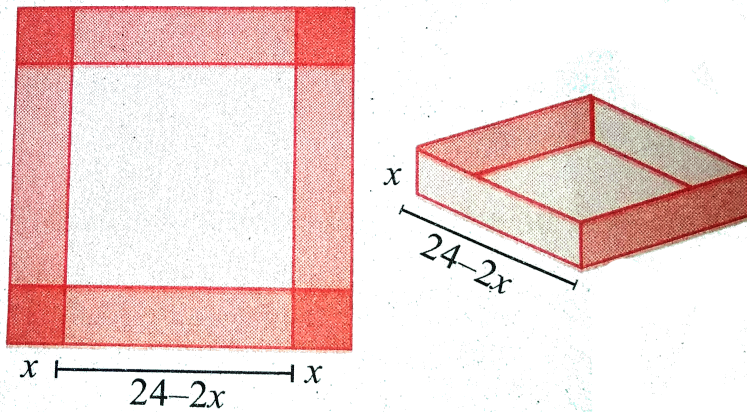
15. A function is defined by  $f(x) = 2x - 3$

Find  $x$  such that  $f(x) = f(1 - x)$ .



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16. An open box is to be made from a square piece of material, 24 cm on a side, by cutting equal squares from the corners and turning up the sides as shown in figure. Express volume  $V$  of the box as a function of  $x$ .



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17. A function  $f$  is defined by  $f(x) = 3 - 2x$ . Find  $x$  such that  $f(x^2) = (f(x))^2$ .

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18. a plane is flying at a speed of 500 km per hour. Express the distance  $d$  travelled by the plane as function of time  $t$  in hours.

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19. The data in the adjacent table depicts the length of a woman's foreheads and her corresponding height. Based on this data, a student finds a relationship between the height ( $y$ ) and the forehead length ( $x$ ) as  $y = ax + b$ , where  $a, b$  are constants.

Length ' $x$ ' of forehead (in cm)	Height ' $y$ ' (in inches)
35	56
45	65
50	69.5
55	74

Check if this relation is a functions.

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20. The data in the adjacent table depicts the length of a woman's foreheads and her corresponding height. Based on this data, a student finds a relationship between the height ( $y$ ) and the forehead length ( $x$ ) as  $y = ax + b$ , where  $a, b$  are constants.

Length ' $x$ ' of forehead (in cm)	Height ' $y$ ' (in inches)
35	56
45	65
50	69.5
55	74

Find  $a$  and  $b$ .



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21. The data in the adjacent table depicts the length of a woman's foreheads and her corresponding height. Based on this data, a student finds a relationship between the height ( $y$ ) and the forehead length ( $x$ ) as



$y = ax + b$ , where  $a, b$  are constants.

Length ' $x$ ' of forehead (in cm)	Height ' $y$ ' (in inches)
35	56
45	65
50	69.5
55	74

Find the height of a woman whose forehead length is 40 cm.



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22. The data in the adjacent table depicts the length of a woman's foreheads and her corresponding height. Based on this data, a student finds a relationship between the height ( $y$ ) and the forehead length ( $x$ ) as  $y = ax + b$ , where  $a, b$  are constants.



Length 'x' of forehead (in cm)	Height 'y' (in inches)
35	56
45	65
50	69.5
55	74

Find the length of forehead of a woman if her height is 53.3 inches.

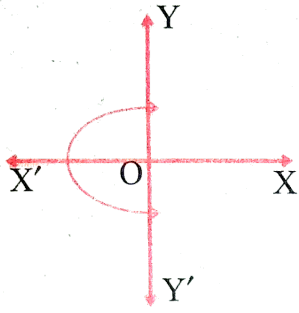


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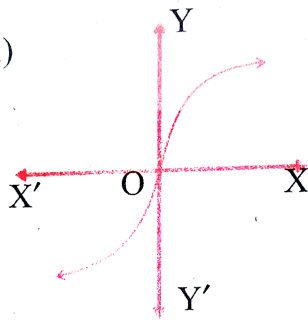
### Exercise 1 4

1. Determine whether the graph given below represents functions. Give reason for your answers concerning each graph

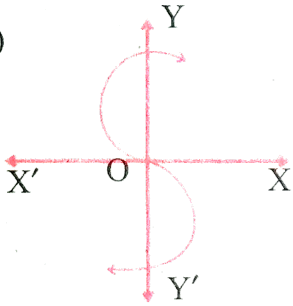
(i)



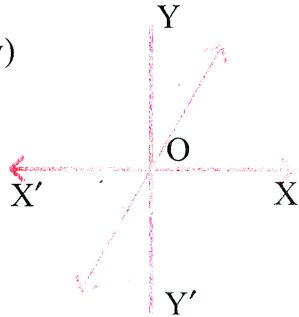
(ii)



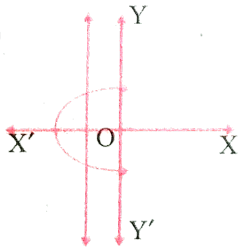
(iii)



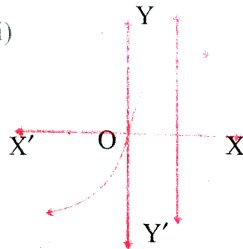
(iv)



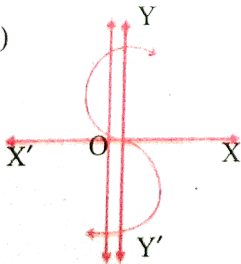
(i)



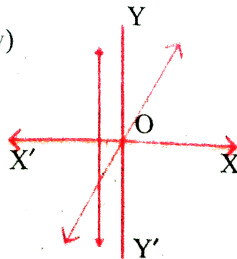
(ii)



(iii)



(iv)



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2. Let:  $f: A \rightarrow B$  be a function defined by  $f(x) = \frac{x}{2} - 1$ . Where  $A = \{2, 4, 6, 10, 12\}$ ,  $B = \{0, 1, 2, 4, 5, 9\}$ . Represents  $f$  by set of ordered pairs,

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3. Let:  $f: A \rightarrow B$  be a function defined by  $f(x) = \frac{x}{2} - 1$ . Where  $A = \{2, 4, 6, 10, 12\}$ ,  $B = \{0, 1, 2, 4, 5, 9\}$ . Represents  $f$  by a table,

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4. Let:  $f: A \rightarrow B$  be a function defined by  $f(x) = \frac{x}{2} - 1$ . Where  $A = \{2, 4, 6, 10, 12\}$ ,  $B = \{0, 1, 2, 4, 5, 9\}$ . Represents  $f$  by an arrow diagram diagram,

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5. Let:  $f: A \rightarrow B$  be a function defined by  $f(x) = \frac{x}{2} - 1$ . Where  $A = \{2, 4,$

$6, 10, 12\}$ ,  $B = \{0, 1, 2, 4, 5, 9\}$ . Represents  $f$  by

a graph,



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6. Represent the function  $f = \{(1, 2), (2, 2), (3, 2), (4, 3), (5, 4)\}$

through

an arrow diagram



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7. Represent the function  $f = \{(1, 2), (2, 2), (3, 2), (4, 3), (5, 4)\}$

through

a table form



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8. Represent the function  $f = \{(1, 2), (2, 2), (3, 2), (4, 3), (5, 4)\}$  through a graph



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9. Show that the function  $f: \mathbb{N} \rightarrow \mathbb{N}$  defined by  $f(x) = 2x - 1$  is one-one but not onto.



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10. Show that the function  $f: \mathbb{N} \rightarrow \mathbb{N}$  defined by  $f(m) = m^2 + m + 3$  is one-one function.



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11. Let  $A = \{1, 2, 3, 4\}$  and  $B = \mathbb{N}$ , Let  $f: A \rightarrow B$  be defined by  $f(x) = x^3$  then,

Find the range of  $f$ .



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12. Let  $A = \{1, 2, 3, 4\}$  and  $B = \mathbb{N}$ . Let  $f: A \rightarrow B$  to defined by  $f(x) = x^3$  then, identify the type of function



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13. In each of the following cases state whether the functions is bijective or not. Justify your answer:

$$f: \mathbb{R} \rightarrow \mathbb{R} \text{ defined by } f(x) = 2x + 1$$



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14. In each of the following cases state whether the functions is bijective or not. Justify your answer:

$$f: \mathbb{R} \rightarrow \mathbb{R} \text{ defined by } f(x) = 3 - 4x^2$$



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



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16. If the function f is defined by

$$f(x) = \{(x + 2, \text{ if } x > 1), (2 \text{ if } -1 \leq x \leq 1)$$

$\}, (x - 1 \text{ if } -3 < x < -1) : \}$  find the values of

$f(3)$



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17. If the function  $f$  is defined by

$$f(x) = \{(x + 2, \text{ if } x > 1), (2 \text{ if } -1 \leq x \leq 1)$$

$\}, (x - 1 \text{ if } -3 < x < -1) : \}$  find the values of

$f(0)$



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18. If the function  $f$  is defined by

$$f(x) = \{(x + 2, \text{ if } x > 1), (2 \text{ if } -1 \leq x \leq 1)$$

$\}, (x - 1 \text{ if } -3 < x < -1) : \}$  find the values of

$f(-1.5)$



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19. If the function  $f$  is defined by

$$f(x) = \{(x + 2, \text{ if } x > 1), (2 \text{ if } -1 \leq x \leq 1)$$

$\}, (x - 1 \text{ if } -3 < x < -1) : \}$  find the values of

$f(2) + f(-2)$



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

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

$F \in df(-3) + f(2)$

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

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

$F \in df(7) - f(1)$

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

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

$F \in d^2f(4) + f(8)$

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23. A function  $f: [-5, 9] \rightarrow R$  is defined as follows:

$$f(x) = \{(6x + 1 \text{ if } -5 \leq x < 2$$

$$\}, (5x^2 - 1 \text{ if } 2 \leq x < 6), (3x - 4 \text{ if } 6 \leq x \leq 9) : \}$$

Find  $\frac{2f(-2) - f(6)}{f(4) + f(-2)}$



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24. The distance  $S$  an object travels under the influence of gravity in time  $t$  seconds is given by  $S(t) = \frac{1}{2}gt^2 + at + b$  where, ( $g$  is the acceleration due to gravity),  $a, b$ , are constants. Check if the function  $S(t)$  is one-one.



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25. The function 't' which maps temperature in Celsius ( $C$ ) into temperature in Fahrenheit ( $F$ ) is defined by  $t(C)=F$  where  $F = \frac{9}{5}C + 32$ .

Find  $t(0)$



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26. The function 't' which maps temperature in Celsius (C) into temperature in Fahrenheit (F) is defined by  $t(C)=F$  where  $F = \frac{9}{5}C + 32$ .

Find  $t(28)$

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27. The function 't' which maps temperature in Celsius (C) into temperature in Fahrenheit (F) is defined by  $t(C)=F$  where  $F = \frac{9}{5}C + 32$ .

Find  $t(-10)$

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28. The function 't' which maps temperature in Celsius (C) into temperature in Fahrenheit (F) is defined by  $t(C)=F$  where  $F = \frac{9}{5}C + 32$ .

Find the value of C where  $t(C)=212$

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29. The function 't' which maps temperature in Celsius (C) into temperature in Fahrenheit (F) is defined by  $t(C)=F$  where  $F = \frac{9}{5}C + 32$ . Find the temperature when the Celsius value is equal to the Fahrenheit value.

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## Exercise 1 5

1. Using the function f and g given below, find the fog and gof. Check whether fog=gof.

$$f(x) = x - 6, g(x) = x^3$$

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2. Using the function  $f$  and  $g$  given below, find the  $f \circ g$  and  $g \circ f$ . Check whether  $f \circ g = g \circ f$ .

$$f(x) = \frac{2}{x}, g(x) = 2x^2 - 1$$



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3. Using the function  $f$  and  $g$  given below, find the  $f \circ g$  and  $g \circ f$ . Check whether  $f \circ g = g \circ f$ .

$$f(x) = \frac{x + 6}{3}, g(x) = 3 - x$$



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4. Using the function  $f$  and  $g$  given below, find the  $f \circ g$  and  $g \circ f$ . Check whether  $f \circ g = g \circ f$ .

$$f(x) = 3 + x, g(x) = 1 + x$$



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5. Using the function  $f$  and  $g$  given below, find the  $f \circ g$  and  $g \circ f$ . Check whether  $f \circ g = g \circ f$ .

$$f(x) = 4x^2 - 1, g(x) = 1 + x$$

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6. Find the value of  $k$ , such that  $f \circ g = g \circ f$

$$f(x) = 3x + 2, g(x) = 6x - k$$

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7. Find the value of  $k$ , such that  $f \circ g = g \circ f$

$$f(x) = 2x - k, g(x) = 4x + 5$$

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8. If  $f(x) = 2x - 1, g(x) = \frac{x + 1}{2}$ , show that  $f \circ g = g \circ f = x$ .

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9. If  $f(x) = x^2 - 1$ ,  $g(x) = x - 2$  find  $a$ , if  $\text{gof}(a)=1$ .

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10. Find  $k$ , if  $f(k) = 2k - 1$  and  $\text{fof}(k) = 5$ .

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11. Let  $A, B, C \in N$  and a function  $f: A \rightarrow B$  be defined by  $f(x) = 2x + 1$  and  $g: B \rightarrow C$  be defined by  $g(x) = x^2$ . Find the range of  $\text{fog}$  and  $\text{gof}$ .

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12. If  $f(x) = x^2 - 1$ . Find  $\text{fof}$

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13. If  $f(x) = x^2 - 1$ . Find fofof



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14. If  $f: R \rightarrow R$  and  $g: R \rightarrow R$  are defined by  $f(x) = x^5$  and  $g(x) = x^4$  then check if f, g are one-one and fog is one-one?



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15. Consider the function  $f(x), g(x), h(x)$  as given below. Show that  $(f \circ g) \circ h = f \circ (g \circ h)$  in each case.

$f(x) = x - 1, g(x) = 3x + 1$  and  $h(x) = x^2$ .



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16. Consider the function  $f(x), g(x), h(x)$  as given below. Show that  $(f \circ g) \circ h = f \circ (g \circ h)$  in each case.

$$f(x) = x^2, g(x) = 2x \text{ and } h(x) = x + 4$$



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17. Consider the function  $f(x), g(x), h(x)$  as given below. Show that  $(f \circ g) \circ h = f \circ (g \circ h)$  in each case.

$$f(x) = x - 4, g(x) = x^2 \text{ and } h(x) = 3x - 5$$



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18. Let  $f = \{(-1, 3), (0, -1), (2, -9)\}$  be linear function from  $Z$  into  $Z$ . Find  $f(x)$ .



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19. In electrical circuit theory, a circuit  $C(t)$  called a linear circuit if it satisfies the superposition principle given by  $C(at_1 + bt_2) = aC(t_1) + bC(t_2)$ , where  $a, b$  are constants. Show that the circuits  $C(t) = 3t$  is linear.

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### Exercise 1 6

1. If  $n(A \times B) = 6$  and  $A = \{1, 3\}$ , then  $n(B)$  is

- A. 1
- B. 2
- C. 3
- D. 6

**Answer: C**

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2.  $A = \{a, b, p\}$ ,  $B = \{2, 3\}$ ,  $C = \{p, q, r, s\}$  then  $n[(A \cup C) \times B]$  is

A. 8

B. 20

C. 12

D. 16

**Answer: C**



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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.  $(B \times ) \subset (A \times C)$

C.  $(A \times B) \subset (A \times D)$

D.  $(D \times A) \subset (B \times A)$

**Answer: A**



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4. 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

**Answer: B**



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5. The range of the relation  $r = \{(x, x^2) \mid x \text{ is a prime number less than } 13\}$  is

- A.  $\{2, 3, 5, 7\}$
- B.  $\{2, 3, 5, 7, 11\}$
- C.  $\{4, 9, 25, 49, 121\}$
- D.  $\{1, 4, 9, 25, 49, 121\}$

**Answer: C**



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6. If the ordered pairs  $(a + 2, 4)$  and  $(5, 2a + b)$  are equal to then  $(a, b)$  is

- A.  $(2, -2)$
- B.  $(5, 1)$
- C.  $(2, 3)$

D.  $(3, -2)$

**Answer: D**



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7. Let  $n(A) = m$  and  $n(B) = n$  that the total number of non-empty relations that can be defined from A to B is

A.  $m^n$

B.  $n^m$

C.  $2^{mn} - 1$

D.  $2^{mn}$

**Answer: C**



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8. If  $\{(a, 8), (6, b)\}$  represents an identity functions then the values of a and b are respectively

A. (8, 6)

B. (8, 8)

C. (6, 8)

D. (6, 6)

**Answer: A**



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9. Let  $A = \{1, 2, 3, 4\}$  and  $B = \{4, 8, 9, 10\}$ . A function  $f: A \rightarrow B$  given by  $f = \{(1, 4), (2, 8), (3, 9), (4, 10)\}$  is a

A. Many-one functions

B. Identity functions

C. One-to-one function

## D. Into function

**Answer: C**



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10. If  $f(x) = 2x^2$  and  $g(x) = \frac{1}{3x}$ . Then fog is

A.  $\frac{3}{2x^2}$

B.  $\frac{2}{3x^2}$

C.  $\frac{2}{9x^2}$

D.  $\frac{1}{6x^2}$

**Answer: C**



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11. If  $f: A \rightarrow B$  is a bijective function and if  $n(B) = 7$ , then  $n(A)$  is equal to

A. 7

B. 49

C. 1

D. 14

**Answer: A**



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12. Let  $f$  and  $g$  be two functions given by

$$f = \{(0, 1), (2, 0), (3, -4), (4, 2), (5, 7)\}$$

$g(x) = \{(0, 2), (1, 0), (2, 4), (-4, 2), (7, 0)\}$  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.  $\{0, 1, 2\}$

**Answer: D**



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13. Let  $f(x) = \sqrt{1 + x^2}$  then

A.  $f(xy) = f(x) \cdot f(y)$

B.  $f(xy) \geq f(x) \cdot f(y)$

C.  $f(xy) \leq f(x) \cdot f(y)$

D. None of these

**Answer: C**



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14. If  $g = \{(1, 1), (2, 3), (3, 5), (4, 7)\}$  is a function given by  $g(x) = \alpha x + \beta$  then the values of  $\alpha$  and  $\beta$  are

A.  $(-1, 2)$

B.  $(2, 1)$

C.  $(-1, -2)$

D.  $(1, 2)$

**Answer: B**



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15.  $f(x) = (x + 1)^3 - (x - 1)^3$  represents a function which is

A. linear

B. cubic

C. reciprocal

D. quadratic

**Answer: D**

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## Unit Exercise 1

1. If the ordered pairs  $(x^2 - 3x, y^2 + 4y)$  and  $(-2, 5)$  are equal to then find  $x$  and  $y$ .

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2. The Cartesian product  $A \times A$  has 9 elements among which  $(-1, 0)$  and  $(0, 1)$  are found. Find the set  $A$  and the remaining elements of  $A \times A$ .

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3. Given that  $f(x) = \{(\sqrt{x-1}, x \geq 1), (4, x < 1)\}$

find  $f(0)$

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4. Given that  $f(x) = \{(\sqrt{x-1}, x \geq 1), (4, x < 1)\}$

find  $f(3)$

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5. Given that  $f(x) = \{(\sqrt{x-1}, x \geq 1), (4, x < 1)\}$

find  $f(a+1)$  in terms of  $a$ . (Given that  $a \geq 0$ ).

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6. Let  $A = \{9, 10, 11, 12, 13, 14, 15, 16, 17\}$  and let  $f: A \rightarrow N$  be defined by  $f(n) =$  the highest prime factor of  $n \in A$ . Write  $f$  as a set of ordered

pairs and find the range of  $f$ .

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7. Find the domain of the function

$$f(x) = \sqrt{1 + \sqrt{1 - \sqrt{1 - x^2}}}$$

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

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9.  $A = \{1, 2\}$  and  $B = \{1, 2, 3, 4\}$ ,  $C = \{5, 6\}$  and  $D = \{5, 6, 7, 8\}$ .

Verify whether  $A \times C$  is a subset of  $B \times D$ ?

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10. If  $f(x) = \frac{x-1}{x+1}$ ,  $x \neq -1$  show that  $f(f(x)) = \frac{-1}{x}$  provided  $x \neq 0$ .

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11. The function  $f$  and  $g$  are defined by  $f(x) = 6x + 8$ ,  $g(x) = \frac{x-2}{3}$ .  
Calculate the value of  $g\left(\frac{f(1)}{2}\right)$

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12. The function  $f$  and  $g$  are defined by  $f(x) = 6x + 8$ ,  $g(x) = \frac{x-2}{3}$ .  
Write an expression for  $gf(x)$  in its simplest form.

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13. Write the domain of the following real functions

$$f(x) = \frac{2x+1}{x-9}$$

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14. Write the domain of the following real functions

$$p(x) = \frac{-5}{4x^2 + 1}$$

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15. Write the domain of the following real functions

$$g(x) = \sqrt{x - 2}$$

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16. Write the domain of the following real functions

$$h(x) = x + 6$$

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1.  $f = \{(2, 1), (3, b), (4, b), (5, c)\}$  is a \_\_\_\_.

- A. identity function
- B. one-one function
- C. many-one function
- D. constant function

**Answer: C**



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2. If  $n(A) = p$  and  $n(B) = q$  then  $n(A \times B)$  \_\_\_\_.

- A.  $p + q$
- B.  $p - q$
- C.  $p \times q$
- D.  $\frac{p}{q}$

**Answer: C**

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**3. Define a function.**

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**4. Let  $f$  be function  $f: \mathbb{N} \rightarrow \mathbb{N}$  be defined by  $f(x) = 3x + 2, \forall x \in \mathbb{N}$ .**

Find the images of 1, 2, 3

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**5. Let  $f$  be function  $f: \mathbb{N} \rightarrow \mathbb{N}$  be defined by  $f(x) = 3x + 2, \forall x \in \mathbb{N}$ .**

Find the pre-images of 29, 53

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6. Let  $f$  be function  $f: N \rightarrow N$  be defined by  $f(x) = 3x + 2, \xi nN$ .

Identify the types of function.

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7. A relation 'f' is defined by  $f(x) = x^2 - 2$  where  $\xi n\{-2, -1, 0, 3\}$

List the elements of f.

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8. A relation 'f' is defined by  $f(x) = x^2 - 2$  where  $\xi n\{-2, -1, 0, 3\}$

Is f a function?

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9. Let  $A = \{1, 2, 3, 4, 5, 6\}, B = W$  and  $f: A \rightarrow$  is defined by

$f(x) = x^2 - 1$  find the range of f.

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10. Let  $A = \{1, 2, 3, 4\}$  and  $B = N$ , Let  $f: A \rightarrow B$  be defined by  $f(x) = x^3$  then,

Find the range of  $f$ .

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11. Let  $A = \{1, 2, 3, 4\}$  and  $B = N$ . Let  $f: A \rightarrow B$  to defined by  $f(x) = x^3$  then, identify the type of function

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12. If  $f(x) = 3x - 2$ ,  $g(x) = 2x + k$  and if  $f \circ g = g \circ f$ , then find the value of  $k$ .

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13.

Let

$A = \{\xi nN \mid 1 < x < 4\}$ ,  $B = \{\xi nW \mid 0 \leq x < 2\}$  and  $C = \{\xi nN \mid x < \dots\}$

. Then verify the  $A \times (B \cap C) = (A \times B) \cap (A \times C)$ .



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### Additional Question Answers

1. Let  $A = \{1, 2, 3, 4\}$  and  $B = \{-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$ .

Let  $R = \{(1, 2), (2, 6), (3, 10), (4, 9)\} \subset A \times B$  be a relation. Show that

$R$  is a function and find its domain, co-domain and the range of  $R$ .



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2. Let  $A = \{0, 1, 2, 3\}$  and  $B = \{1, 2, 3, 5, 7, 9\}$  be two sets. Let

$f: A \rightarrow B$  be a function given by  $f(x) = 2x + 1$ . Represents this

function as

a set of of ordered pairs



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3. Let  $A = \{0, 1, 2, 3\}$  and  $B = \{1, 2, 3, 5, 7, 9\}$  be two sets. Let  $f: A \rightarrow B$  be a function given by  $f(x) = 2x + 1$ . Represents this function as  
a table



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4. Let  $A = \{0, 1, 2, 3\}$  and  $B = \{1, 2, 3, 5, 7, 9\}$  be two sets. Let  $f: A \rightarrow B$  be a function given by  $f(x) = 2x + 1$ . Represents this function as  
an arrow



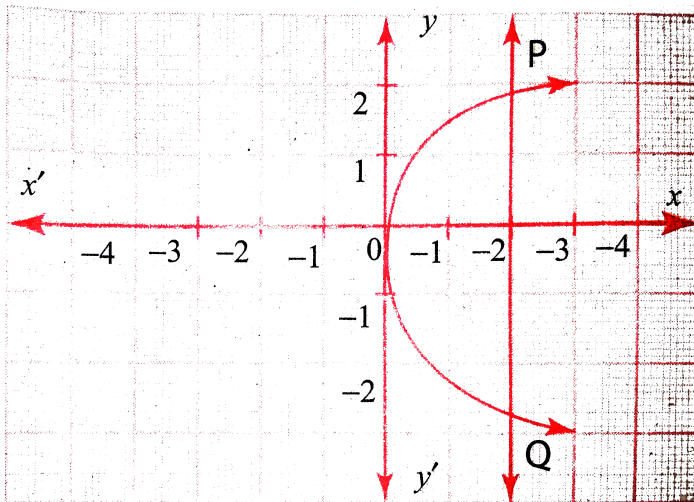
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5. Let  $A = \{0, 1, 2, 3\}$  and  $B = \{1, 2, 3, 5, 7, 9\}$  be two sets. Let  $f: A \rightarrow B$  be a function given by  $f(x) = 2x + 1$ . Represents this

function as

a graph

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**State whether the graph represent a function.  
Use vertical line test.**

6.

State whether the graph represent a function. Use vertical line test

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7. Let  $f = \{(2, 7), (3, 4), (7, 9), (-1, 6), (0, 2), (5, 3)\}$  be function from  $A = \{-1, 0, 2, 3, 5, 7\}$ , to  $B = \{2, 3, 4, 5, 7, 9\}$ . Is this an one-one function

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8. Let  $f = \{(2, 7), (3, 4), (7, 9), (-1, 6), (0, 2), (5, 3)\}$  be function from  $A = \{-1, 0, 2, 3, 5, 7\}$ , to  $B = \{2, 3, 4, 6, 7, 9\}$ . Is this an onto function

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9. Let  $f = \{(2, 7), (3, 4), (7, 9), (-1, 6), (0, 2), (5, 3)\}$  be function from  $A = \{-1, 0, 2, 3, 5, 7\}$ , to  $B = \{2, 3, 4, 5, 7, 9\}$ . Is this both one-one and onto function

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10.  $f(x) = (1 + x)$

$g(x) = (2x - 1)$

Show that  $f \circ (g(x)) = g \circ (f(x))$



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11. Let  $A = \{1, 2, 3, 4, 5\}$ ,  $B = N$  and  $f: A \rightarrow B$  be defined by  $f(x) = x^2$ . Find the range of  $f$ . Identify the type of function.



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12. The following table represents a function from  $A = \{5, 6, 8, 10\}$  to  $B = \{19, 15, 9, 11\}$ , where  $f(x) = 2x - 1$ . Find the values of  $a$  and  $b$ .



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13. If  $R = \{(a, -2), (-5, b), (8, c), (d, -1)\}$  represents the identify functions, find the value of  $a, b, c$  and  $d$ .



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14. A function  $f: [-7, 6) \rightarrow R$  is defined as follows.

$$f(x) = \begin{cases} x^2 + 2x + 1 & -7 \leq x < -5 \\ x + 5 & -5 \leq x \leq 2 \\ x - 1 & 2 < x < 6 \end{cases}$$

Find  $2f(-4) + 3f(2)$



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15. A function  $f: [-7, 6) \rightarrow R$  is defined as follows.

$$f(x) = \begin{cases} x^2 + 2x + 1 & -7 \leq x < -5 \\ x + 5 & -5 \leq x \leq 2 \\ x - 1 & 2 < x < 6 \end{cases}$$

Find  $f(-7) - f(-3)$



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16. A function  $f: [16) \rightarrow R$  is defined as follows.

$$f(x) = \begin{cases} x + 1 & 1 \leq x < 2 \\ 2x - 1 & 2 \leq x < 4 \\ 3x^2 - 10 & 4 \leq x < 6 \end{cases}$$

Find the value of  $f(5)$

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17. A function  $f: [16) \rightarrow R$  is defined as follows.

$$f(x) = \begin{cases} x + 1 & 1 \leq x < 2 \\ 2x - 1 & 2 \leq x < 4 \\ 3x^2 - 10 & 4 \leq x < 6 \end{cases}$$

Find the value of  $f(3)$

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18. A function  $f: [16) \rightarrow R$  is defined as follows.

$$f(x) = \begin{cases} x + 1 & 1 \leq x < 2 \\ 2x - 1 & 2 \leq x < 4 \\ 3x^2 - 10 & 4 \leq x < 6 \end{cases}$$

Find the value of  $f(2) - f(4)$ .

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Unit Test

1.  $n(R) = \{(x, x^2) \mid x \text{ is a prime number less than } 13\}$  is

A. 6

B. 7

C. 5

D. 4

Answer: c



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2.  $A = \{a, b, p\}$ ,  $B = \{2, 3\}$ ,  $C = \{p, q, r, s\}$  then  $n[(A \cup C) \times B]$  is

A. 8

B. 20

C. 12

D. 16

**Answer: C**



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3. Let  $A = \{1, 2, 3, 4\}$  and  $B = \{4, 8, 9, 10\}$ . A function  $f: A \rightarrow B$  given by  $f = \{(1, 4), (2, 8), (3, 9), (4, 10)\}$  is a

A. Many-one functions

B. Identity functions

C. One-one and onto function

D. onto function

**Answer: C**



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4. If  $g = \{(1, 1), (2, 3), (3, 5), (4, 7)\}$  is a function given by  $g(x) = \alpha x + \beta$  then the values of  $\alpha$  and  $\beta$  are

A.  $(-1, 2)$

B.  $(2, 1)$

C.  $(-1, -2)$

D.  $(1, 2)$

**Answer: B**

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5. The range of the relation  $r = \{(x, x^2) \mid x \text{ is a prime number less than } 13\}$  is

A.  $\{2, 3, 5, 7\}$

B.  $\{2, 3, 5, 7, 11\}$

C.  $\{4, 9, 25, 49, 121\}$

D.  $\{1, 4, 9, 25, 49, 121\}$

**Answer: C**

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

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7. Let  $f = \{(x, y) \mid x, y \in \mathbb{N} \text{ and } y = 2x\}$  be a relation on  $\mathbb{N}$ . Find the domain, co-domain and range. Is this relation a function?

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8. A function  $f$  is defined by  $f(x) = 3 - 2x$ . Find  $x$  such that  $f(x^2) = (f(x))^2$ .

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9. Let  $A, B, C \in \mathbb{N}$  and a function  $f: A \rightarrow B$  be defined by  $f(x) = 2x + 1$  and  $g: B \rightarrow C$  be defined by  $g(x) = x^2$ . Find the range of  $f \circ g$  and  $g \circ f$ .

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

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

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12. Represent the function  $f = \{(1, 2), (2, 2), (3, 2), (4, 3), (5, 4)\}$  through  
an arrow diagram

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13. Represent the function  $f = \{(1, 2), (2, 2), (3, 2), (4, 3), (5, 4)\}$  through  
a table form

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14. Represent the function  $f = \{(1, 2), (2, 2), (3, 2), (4, 3), (5, 4)\}$  through a graph



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