NCERT SOLUTIONS

CLASS - 11th



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Class : 11th
Subject : Maths
Chapter : 2
Chapter Name : Relations And Functions

Exercise 2.1

Q1 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.

Answer. It is given that $\left(\frac{x}{3}+1, y-\frac{2}{3}\right)=\left(\frac{5}{3}, \frac{1}{3}\right)$.
Since the ordered pairs are equal, the corresponding elements will also be equal.
Therefore, $\frac{x}{3}+1=\frac{5}{3} \quad \text{and} \quad y-\frac{2}{3}=\frac{1}{3}$.
$\frac{x}{3}+1=\frac{5}{3}$
$\Rightarrow \frac{x}{3}=\frac{5}{3}-1 \, , y-\frac{2}{3}=\frac{1}{3}$
$\Rightarrow \frac{x}{3}=\frac{2}{3} \Rightarrow y=\frac{1}{3}+\frac{2}{3}$
$\Rightarrow x=2 \quad \Rightarrow y=1$
$\therefore x=2 \text{ and } y=1$

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Q2 If the set A has 3 elements and the set B = {3, 4, 5}, then find the number of elements in (A×B).

Answer. It is given that set A has 3 elements and the elements of set B are 3,4, and 5.
⇒ Number of elements in set B = 3
Number of elements in (A x B)
= (Number of elements in A) x (Number of elements in B)
= 3x3 =9
Thus, the number of elements in (A x B) is 9.

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Q3 If G = {7, 8} and H = {5, 4, 2}, find G × H and H × G.

Answer. G = {7, 8} and H = {5, 4, 2}

We know that the Cartesian product P × Q of two non-empty sets P and Q is defined as
P × Q = {(p, q): p∈ P, q ∈ Q}
∴G × H = {(7, 5), (7, 4), (7, 2), (8, 5), (8, 4), (8, 2)}
H × G = {(5, 7), (5, 8), (4, 7), (4, 8), (2, 7), (2, 8)}

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Q4 State whether each of the following statements are true or false. If the statement is false, rewrite the given statement correctly.
(i) If P = {m, n} and Q = { n, m}, then P × Q = {(m, n),(n, m)}.
(ii) If A and B are non-empty sets, then A × B is a non-empty set of ordered pairs (x, y) such that x ∈ A and y ∈ B.
(iii) If A = {1, 2}, B = {3, 4}, then A × (B ∩ ϕ) = ϕ

Answer. (i) False
If P = {m, n} and Q = {n, m}, then
P × Q = {(m, m), (m, n), (n, m), (n, n)}
(ii) True
(iii) True

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Q5 If A = {−1, 1}, find A × A × A.

Answer. It is known that for any non-empty set A, A × A × A is defined as
A × A × A = {(a, b, c): a, b, c ∈ A}
It is given that A = {−1, 1}
∴ A × A × A = {(−1, −1, −1), (−1, −1, 1), (−1, 1, −1), (−1, 1, 1), (1, −1, −1), (1, −1, 1), (1, 1, −1), (1, 1, 1)}

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Q6 If A × B = {(a, x),(a , y), (b, x), (b, y)}. Find A and B

Answer. It is given that A × B = {(a, x), (a, y), (b, x), (b, y)}
We know that the Cartesian product of two non-empty sets P and Q is defined as P × Q = {(p, q): p ∈ P, q ∈ Q}
∴ A is the set of all first elements and B is the set of all second elements.
Thus, A = {a, b} and B = {x, y}

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Q7 Let A = {1, 2}, B = {1, 2, 3, 4}, C = {5, 6} and D = {5, 6, 7, 8}.
Verify that
(i) A × (B ∩ C) = (A × B) ∩ (A × C).

(ii) A × C is a subset of B × D.

Answer. (i) To verify: A × (B ∩ C) = (A × B) ∩ (A × C)
We have B ∩ C = {1, 2, 3, 4} ∩ {5, 6} = ϕ
∴L.H.S. = A × (B ∩ C) = A × ϕ = ϕ
A × B = {(1, 1), (1, 2), (1, 3), (1, 4), (2, 1), (2, 2), (2, 3), (2, 4)}
A × C = {(1, 5), (1, 6), (2, 5), (2, 6)}
∴ R.H.S. = (A × B) ∩ (A × C) = ϕ
∴L.H.S. = R.H.S
Hence, A × (B ∩ C) = (A × B) ∩ (A × C)
(ii) To verify: A × C is a subset of B × D
A × C = {(1, 5), (1, 6), (2, 5), (2, 6)}
B × D = {(1, 5), (1, 6), (1, 7), (1, 8), (2, 5), (2, 6), (2, 7), (2, 8), (3, 5), (3, 6), (3, 7), (3, 8), (4, 5), (4, 6), (4, 7), (4, 8)}
We can observe that all the elements of set A × C are the elements of set B × D.
Therefore, A × C is a subset of B × D.

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Q8 Let A = {1, 2} and B = {3, 4}. Write A × B. How many subsets will A × B have?
List them.

Answer. A = {1, 2} and B = {3, 4}
∴A × B = {(1, 3), (1, 4), (2, 3), (2, 4)}
⇒ n(A × B) = 4
We know that if C is a set with n(C) = m, then n[P(C)] = 2^m.
Therefore, the set A × B has 2^4 = 16 subsets. These are ϕ, {(1, 3)}, {(1, 4)}, {(2, 3)}, {(2, 4)}, {(1, 3), (1, 4)}, {(1, 3), (2, 3)},
{(1, 3), (2, 4)}, {(1, 4), (2, 3)}, {(1, 4), (2, 4)}, {(2, 3), (2, 4)},
{(1, 3), (1, 4), (2, 3)}, {(1, 3), (1, 4), (2, 4)}, {(1, 3), (2, 3), (2, 4)},
{(1, 4), (2, 3), (2, 4)}, {(1, 3), (1, 4), (2, 3), (2, 4)}

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Q9 Let A and B be two sets such that n(A) = 3 and n(B) = 2. If (x, 1), (y, 2), (z, 1) are in A × B, find A and B, where x, y and z are distinct elements.

Answer. It is given that n(A) = 3 and n(B) = 2; and (x, 1), (y, 2), (z, 1) are in A × B.
We know that A = Set of first elements of the ordered pair elements of A × B
B = Set of second elements of the ordered pair elements of A × B.
∴ x, y, and z are the elements of A; and 1 and 2 are the elements of B.
Since n(A) = 3 and n(B) = 2, it is clear that A = {x, y, z} and B = {1, 2}.

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Q10 The Cartesian product A × A has 9 elements among which are found (−1, 0) and (0,1). Find the set A and the remaining elements of A × A.

Answer. We know that if n(A) = p and n(B) = q, then n(A × B) = pq.
∴ n(A × A) = n(A) × n(A)
It is given that n(A × A) = 9
∴ n(A) × n(A) = 9
⇒ n(A) = 3
The ordered pairs (−1, 0) and (0, 1) are two of the nine elements of A × A.
We know that A × A = {(a, a): a ∈ A}. Therefore, −1, 0, and 1 are elements of A.
Since n(A) = 3, it is clear that A = {−1, 0, 1}.
The remaining elements of set A × A are (−1, −1), (−1, 1), (0, −1), (0, 0), (1, −1), (1, 0), and (1, 1)

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Exercise 2.2

Q1 Let A = {1, 2, 3,...,14}. Define a relation R from A to A by R = {(x, y) : 3x − y = 0, where x, y ∈ A}. Write down its domain, codomain and range.

Answer. The relation R from A to A is given as
R = {(x, y): 3x − y = 0, where x, y ∈ A}
i.e., R = {(x, y): 3x = y, where x, y ∈ A}
∴R = {(1, 3), (2, 6), (3, 9), (4, 12)}
The domain of R is the set of all first elements of the ordered pairs in the relation.
∴Domain of R = {1, 2, 3, 4}
The whole set A is the codomain of the relation R.
∴Codomain of R = A = {1, 2, 3, ..., 14}
The range of R is the set of all second elements of the ordered pairs in the relation.
∴Range of R = {3, 6, 9, 12}

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Q2 Define a relation R on the set **N** of natural numbers by R = {(x, y) : y = x + 5, x is a natural number less than 4; x, y ∈**N**}. Depict this relationship using roster form. Write down the domain and the range.

Answer. R = {(x, y): y = x + 5, x is a natural number less than 4, x, y∈ N}
The natural numbers less than 4 are 1, 2, and 3.
∴R = {(1, 6), (2, 7), (3, 8)}
The domain of R is the set of all first elements of the ordered pairs in the relation.

∴ Domain of R = {1, 2, 3}
The range of R is the set of all second elements of the ordered pairs in the relation.
∴ Range of R = {6, 7, 8}

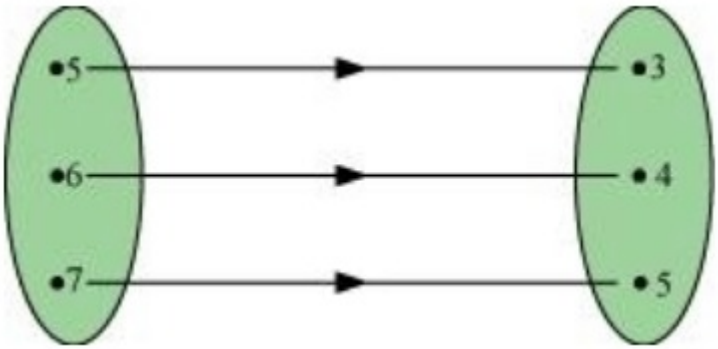
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Q3 A = {1, 2, 3, 5} and B = {4, 6, 9}. Define a relation R from A to B by R = {(x, y): the difference between x and y is odd; x ∈ A, y ∈ B}. Write R in roster form.

Answer. A = {1, 2, 3, 5} and B = {4, 6, 9}
R = {(x, y): the difference between x and y is odd; x ∈ A, y ∈ B}
∴R = {(1, 4), (1, 6), (2, 9), (3, 4), (3, 6), (5, 4), (5, 6)}

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Q4 The Fig shows a relationship between the sets P and Q. Write this relation



(i) in set-builder form (ii) roster form.
What is its domain and range?

Answer. According to the given figure, P = {5, 6, 7}, Q = {3, 4, 5}
(i) R = {(x, y): y = x − 2; x ∈ P} or R = {(x, y): y = x − 2 for x = 5, 6, 7}
(ii) R = {(5, 3), (6, 4), (7, 5)}
Domain of R = {5, 6, 7}
Range of R = {3, 4, 5}

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Q5 Let A = {1, 2, 3, 4, 6}. Let R be the relation on A defined by
{(a, b): a , b ∈A, b is exactly divisible by a}.
(i) Write R in roster form
(ii) Find the domain of R
(iii) Find the range of R.

Answer. A = {1, 2, 3, 4, 6}, R = {(a, b): a, b ∈ A, b is exactly divisible by a}
(i) R = {(1, 1), (1, 2), (1, 3), (1, 4), (1, 6), (2, 2), (2, 4), (2, 6), (3, 3), (3, 6), (4, 4), (6, 6)}
(ii) Domain of R = {1, 2, 3, 4, 6}

(iii) Range of R = {1, 2, 3, 4, 6}

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Q6 Determine the domain and range of the relation R defined by R = {(x, x + 5) : x ∈ {0, 1, 2, 3, 4, 5}}.

Answer. R = {(x, x + 5): x ∈ {0, 1, 2, 3, 4, 5}}
∴ R = {(0, 5), (1, 6), (2, 7), (3, 8), (4, 9), (5, 10)}
∴Domain of R = {0, 1, 2, 3, 4, 5}
Range of R = {5, 6, 7, 8, 9, 10}

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Q7 Write the relation R = {(x, x^3) : x is a prime number less than 10} in roster form.

Answer. R = {(x, x^3) : x is a prime number less than 10}
The prime numbers less than 10 are 2, 3, 5, and 7.
∴R = {(2, 8), (3, 27), (5, 125), (7, 343)}

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Q8 Let A = {x, y, z} and B = {1, 2}. Find the number of relations from A to B.

Answer. It is given that A = {x, y, z} and B = {1, 2}.
∴ A × B = {(x, 1), (x, 2), (y, 1), (y, 2), (z, 1), (z, 2)}
Since n(A × B) = 6, the number of subsets of A × B is 2^6.
Therefore, the number of relations from A to B is 2^6.

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Q9 Let R be the relation on **Z** defined by R = {(a,b): a, b ∈ **Z**, a − b is an integer}. Find the domain and range of R.

Answer. R = {(a, b): a, b ∈ Z, a − b is an integer}
It is known that the difference between any two integers is always an integer.
∴Domain of R = Z
Range of R = Z

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Exercise 2.3

Q1 Which of the following relations are functions?
Give reasons. If it is a function, determine its domain and range.
(i) {(2,1), (5,1), (8,1), (11,1), (14,1), (17,1)}
(ii) {(2,1), (4,2), (6,3), (8,4), (10,5), (12,6), (14,7)}
(iii) {(1,3), (1,5), (2,5)}.

Answer. (i) {(2, 1), (5, 1), (8, 1), (11, 1), (14, 1), (17, 1)}
Since 2, 5, 8, 11, 14, and 17 are the elements of the domain of the given relation having their unique images, this relation is a function.
Here, domain = {2, 5, 8, 11, 14, 17} and range = {1}
(ii) {(2, 1), (4, 2), (6, 3), (8, 4), (10, 5), (12, 6), (14, 7)}
Since 2, 4, 6, 8, 10, 12, and 14 are the elements of the domain of the given relation having their unique images, this relation is a function.
Here, domain = {2, 4, 6, 8, 10, 12, 14} and range = {1, 2, 3, 4, 5, 6, 7}
(iii) {(1, 3), (1, 5), (2, 5)}
Since the same first element i.e., 1 corresponds to two different images i.e., 3 and 5, this relation is not a function.

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Q2 Find the domain and range of the following real functions:
(i) f(x) = - $|x|$
(ii) f(x) = $\sqrt{9 - x^2}$

Answer. (i) f(x) = - $|x|$, x ∈ R
We know that |x| = $\begin{cases} x, x \geq 0 \\ -x, x < 0 \end{cases}$
$\therefore f(x) = -|x| = \begin{cases} -x, x \geq 0 \\ x, x < 0 \end{cases}$
Since f(x) is defined for x ∈ R, the domain of f is R.
It can be observed that the range of f(x) = −|x| is all real numbers except positive real numbers.
∴The range of f is(-\infty, 0] .
(ii) f(x) = $\sqrt{9 - x^2}$
Since $\sqrt{9 - x^2}$ is defined for all real numbers that are greater than or equal to −3 and less than or equal to 3, the domain of f(x) is {x : −3 ≤ x ≤ 3} or [−3, 3].
For any value of x such that −3 ≤ x ≤ 3, the value of f(x) will lie between 0 and 3.
∴The range of f(x) is {x: 0 ≤ x ≤ 3} or [0, 3].

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Q3 A function f is defined by f(x) = 2x −5. Write down the values of
(i) f (0), (ii) f (7), (iii) f (−3).

Answer. The given function is f(x) = 2x – 5.
Therefore, R , x > 0.
(ii) f (x) = x 2 + 2, x is a real number.
(iii) f (x) = x, x is a real number.

Answer. (i) f(x) = 2 – 3x, x ∈ R, x > 0
The values of f(x) for various values of real numbers x > 0 can be written in the tabular form as

x	0.01	0.1	0.9	1	2	2.5	4	5	5
$f(x)$	1.97	1.7	-0.7	-1	-4	-5.5	-10	-13	...

Thus, it can be clearly observed that the range of f is the set of all real numbers less than 2.
I.e., range of f=$(-\infty, 2)$
Alter:
Let x > 0
$\Rightarrow 3x > 0$
$\Rightarrow 2 - 3x < 2$
$\Rightarrow f(x) < 2$
$\therefore$ Range of $f = (-\infty, 2)$

(ii) f(x)= x^2 + 2,x, is a real number
The values of f(x) for various values of real numbers x can be written in the tabular form as

x	0	± 0.3	± 0.8	± 1	± 2	± 3	
$f(x)$	2	2.09	2.64	3	6	11	....

Thus, it can be clearly observed that the range of f is the set of all real numbers greater than 2.
I.e., range of f=[2,∞)
Alter:
Let x be any real number.
Accordingly,
$x^2 \geq 0$
$\Rightarrow x^2 + 2 \geq 0 + 2$
$\Rightarrow x^2 + 2 \geq 2$
$\Rightarrow f(x) \geq 2$
Therefore, Range of f = [2,∞)
(iii) f(x) = x, x is a real number
It is clear that the range of f is the set of all real numbers.
Therefore, Range of f = R

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Miscellaneous Exercise

Q1 The relation f is defined by $f(x) = \begin{cases} x^2, 0 \leq x \leq 3 \\ 3x, 3 \leq x \leq 10 \end{cases}$

The relation g is defined by $g(x) = \begin{cases} x^2, & 0 \leq x \leq 2 \\ 3x, & 2 \leq x \leq 10 \end{cases}$

Show that f is a function and g is not a function.

Answer. The relation f is defined by $f(x) = \begin{cases} x^2, 0 \leq x \leq 3 \\ 3x, 3 \leq x \leq 10 \end{cases}$

It is observed that for

$0 \leq x < 3, f(x) = x^2$

$3 < x \leq 10, f(x) = 3x$

Also, at x=3, f(x) =3^2 = 9 or f(x) = 3 x 3 = 9

i.e., at x = 3, f(x) = 9

Therefore, for 0 ≤ x ≤ 10, the images of f(x) are unique.

Thus, the given relation is a function.

The relation g is defined by $g(x) = \begin{cases} x^2, & 0 \leq x \leq 2 \\ 3x, & 2 \leq x \leq 10 \end{cases}$

It can be observed that for x = 2, g(x) = 2^2 = 4 and g(x) = 3 x 2 = 6

Hence, element 2 of the domain of the relation g corresponds to two different images i.e., 4 and 6. Hence, this relation is not a function.

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Q2 If f(x) = x^2 , find $\frac{f(1.1)-f(1)}{(1.1-1)}$.

Answer. f(x) = x^2

Therefore, $\frac{f(1.1)-f(1)}{(1.1-1)}$ = $\frac{(1.1)^2-(1)^2}{(1.1-1)} = \frac{1.21-1}{0.1} = \frac{0.21}{0.1} = 2.1$

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Q3 Find the domain of the function $f(x) = \frac{x^2+2x+1}{x^2-8x+12}$.

Answer. The given function is $f(x) = \frac{x^2+2x+1}{x^2-8x+12}$

$f(x) = \frac{x^2+2x+1}{x^2-8x+12}$ = $\frac{x^2+2x+1}{(x-6)(x-2)}$

It can be seen that function f is defined for all real numbers except at x = 6 and x = 2.

Hence, the domain of f is R - {2,6}.

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Q4 Find the domain and the range of the real function f defined by $f(x) = \sqrt{(x-1)}$.

Answer. He given real function is $f(x) = \sqrt{(x-1)}$
It can be seen that $\sqrt{(x-1)}$ is defined for (x-1) ≥ 0.
i.e.,
$f(x) = \sqrt{(x-1)}$ is defined for $x \geq 1$.
Therefore, the range of f is the set of all real numbers greater than or equal to 0 i.e., the range of f = $[0, \infty)$.

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Q5 Find the domain and the range of the real function f defined by $f(x) = |x-1|$.

Answer. The given real function is $f(x) = |x-1|$.
It is clear that $|x-1|$ is defined for all real numbers.
Therefore, Domain of f = R
Also, for $x \in R$, $|x-1|$ assumes all real numbers.
Hence, the range of f is the set of all non-negative real numbers.

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Q6 Let $f = \left\{\left(x, \frac{x^2}{1+x^2}\right) : x \in \mathbf{R}\right\}$ be a function from $\mathbf{R}$ into $\mathbf{R}$. Determine the range of f.

Answer.
$f = \left\{\left(x, \frac{x^2}{1+x^2}\right) : x \in \mathbf{R}\right\}$
$= \left\{(0,0), \left(\pm 0.5, \frac{1}{5}\right), \left(\pm 1, \frac{1}{2}\right), \left(\pm 1.5, \frac{9}{13}\right), \left(\pm 2, \frac{4}{5}\right), \left(3, \frac{9}{10}\right), \left(4, \frac{16}{17}\right), \ldots\right.$
The range of f is the set of all second elements. It can be observed that all these elements are greater than or equal to 0 but less than 1.
[Denominator is greater numerator]
Thus, range of f= [0, 1)

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Q7 Let $f, g : \mathbf{R} \to \mathbf{R}$ be defined, respectively by $f(x) = x + 1$, $g(x) = 2x - 3$. Find $f + g$, $f - g$ and $\frac{f}{g}$.

Answer. $f, g : \mathbf{R} \to \mathbf{R}$ is defined as f(x) = x+1, g(x) = 2x-3
(f + g) (x) = f(x) + g(x) = (x + 1) + (2x – 3) = 3x – 2
∴(f + g) (x) = 3x – 2
(f – g) (x) = f(x) – g(x) = (x + 1) – (2x – 3) = x + 1 – 2x + 3 = – x + 4
∴ (f – g) (x) = –x + 4

$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}, g(x) \neq 0, x \in \mathbf{R}$

$\therefore \left(\frac{f}{g}\right)(x) = \frac{x+1}{2x-3}, 2x - 3 \neq 0 \text{ or } 2x \neq 3$

$\therefore \left(\frac{f}{g}\right)(x) = \frac{x+1}{2x-3}, x \neq \frac{3}{2}$

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Q8 Let *f* = {(1,1), (2,3), (0,-1), (-1, -3)} be a function from **Z** to **Z** defined by *f(x) = ax + b*, for some integers *a,b*. Determine *a,b*.

Answer. f = {(1, 1), (2, 3), (0, −1), (−1, −3)}
f(x) = ax + b
(1, 1) ∈ f
⇒ f(1) = 1
⇒ a × 1 + b = 1
⇒ a + b = 1
(0, −1) ∈ f
⇒ f(0) = −1
⇒ a × 0 + b = −1
⇒ b = −1
On substituting b = −1 in a + b = 1, we obtain a + (−1) = 1 ⇒ a = 1 + 1 = 2.
Thus, the respective values of a and b are 2 and -1.

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Q9 Let R be a relation from **N** to **N** defined by R = {(a, b) : a, b ∈**N** and a = b^2 }. Are the following true?
(i) (a,a) ∈ R, for all a ∈ **N**
(ii) (a,b) ∈ R, implies (b,a) ∈ R
(iii) (a,b) ∈ R, (b,c) ∈ R implies (a,c) ∈ R.
Justify your answer in each case.

Answer. R = {(a, b) : a, b ∈**N** and a = b^2 }
(i) It can be seen that 2 ∈ N; however, $2 \neq 2^2 = 4$
Therefore, the statement, "(a,a) ∈ R, for all a ∈ N" is not true.
(ii) It can be seen that (9,3) ∈ N because 9,3 ∈ N and 9 = 3^2.
Now, $3 \neq 9^2 = 81; \text{ therefore, } (3, 9) \notin \mathrm{N}$
Therefore, the statement "(a,b) ∈ R, implies (b, a) ∈ R" is not true.
(iii) It can be seen that (16,4) ∈ R, (4, 2) ∈ R because 16, 4, 2 ∈ N and 16 = 4^2 and $4 = 2^2$.
Now, $16 \neq 2^2 = 4; \text{ therefore, } (16, 2) \notin \mathrm{N}$
Therefore, the statement "(a, b) ∈ R, (b, c) ∈ R implies (a, c) ∈ R"is not true.

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Q10 Let A ={1,2,3,4}, B = {1,5,9,11,15,16} and f = {(1,5), (2,9), (3,1), (4,5), (2,11)} Are the following true?
(i) *f* is a relation from A to B
(ii) *f* is a function from A to B.
Justify your answer in each case.

Answer. A = {1, 2, 3, 4} and B = {1, 5, 9, 11, 15, 16}
∴A × B = {(1, 1), (1, 5), (1, 9), (1, 11), (1, 15), (1, 16), (2, 1), (2, 5), (2, 9), (2, 11), (2, 15), (2, 16), (3, 1), (3, 5), (3, 9), (3, 11), (3, 15), (3, 16), (4, 1), (4, 5), (4, 9), (4, 11), (4, 15), (4, 16)}
It is given that f = {(1, 5), (2, 9), (3, 1), (4, 5), (2, 11)}
(i) A relation from a non-empty set A to a non-empty set B is a subset of the Cartesian product A x B.
It is observed that f is a subset of A x B.
Thus, f is a relation from A to B.
(ii) Since the same first element i.e., 2 corresponds to two different images i.e., 9 and 11, relation f is not a function.

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Q11 Let *f* be the subset of **Z** × **Z** defined by f = {(ab, a + b) : a, b ∈ **Z**}. Is *f* a function from **Z** to **Z**? Justify your answer.

Answer. The relation f is defined as f = {(ab, a + b): a, b ∈ Z}
We know that a relation f from a set A to a set B is said to be a function if every element of set A has unique images in set B.
Since 2, 6, −2, −6 ∈ Z, (2 × 6, 2 + 6), (−2 × −6, −2 + (−6)) ∈ f
i.e., (12, 8), (12, −8) ∈ f
It can be seen that the same first element i.e., 12 corresponds to two different images i.e., 8 and −8. Thus, relation f is not a function.

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Q12 Let A = {9,10,11,12,13} and let f : $A \rightarrow N$ be defined by *f (n)* = the highest prime factor of *n*. Find the range of *f*.

Answer. A = {9, 10, 11, 12, 13}
f: A → N is defined as
f(n) = The highest prime factor of n
Prime factor of 9 = 3
Prime factors of 10 = 2, 5
Prime factor of 11 = 11
Prime factors of 12 = 2, 3
Prime factor of 13 = 13
∴f(9) = The highest prime factor of 9 = 3

f(10) = The highest prime factor of 10 = 5
f(11) = The highest prime factor of 11 = 11
f(12) = The highest prime factor of 12 = 3
f(13) = The highest prime factor of 13 = 13
The range of f is the set of all f(n), where $n \in A$.
$\therefore$Range of f = {3, 5, 11, 13}

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