NCERT Solutions for 11th Class Maths: Chapter 2-Relations and Functions

Class 11: Maths Chapter 2 solutions. Complete Class 11 Maths Chapter 2 Notes.

NCERT Solutions for 11th Class Maths: Chapter 2-Relations and Functions

NCERT 11th Maths Chapter 2, class 11 Maths Chapter 2 solutions

Exercise 2.1

https://www.indcareer.com/schools/ncert-solutions-for-11th-class-maths-chapter-2-relations-and-functions/

Question-1

If $\left(\dfrac{x}{3}+1,\ y-\dfrac{2}{3}\right)=\left(\dfrac{5}{3},\ \dfrac{1}{3}\right)$, find the values of x and y.

Ans.

It is given that $\left(\dfrac{x}{3}+1,\ y-\dfrac{2}{3}\right)=\left(\dfrac{5}{3},\ \dfrac{1}{3}\right)$.

Since the ordered pairs are equal, the corresponding elements will also be equal.

Therefore, $\dfrac{x}{3}+1=\dfrac{5}{3}$ and $y-\dfrac{2}{3}=\dfrac{1}{3}$.

$\dfrac{x}{3}+1=\dfrac{5}{3}$

$\Rightarrow \dfrac{x}{3}=\dfrac{5}{3}-1$ $y-\dfrac{2}{3}=\dfrac{1}{3}$

$\Rightarrow \dfrac{x}{3}=\dfrac{2}{3}$ $\Rightarrow y=\dfrac{1}{3}+\dfrac{2}{3}$

$\Rightarrow x=2$ $\Rightarrow y=1$

$\therefore x=2$ and $y=1$

Question-2

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

Ans.

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 × B)

= (Number of elements in A) × (Number of elements in B)

= 3 × 3 = 9

Thus, the number of elements in (A × B) is 9.

Question-3

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

Ans.

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)}

Question-4

State whether each of the following statement 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 $x \in$ A and $y \in$ B.

(iii) If A = {1, 2}, B = {3, 4}, then A × (B ∩ Φ) = Φ.

Ans.

(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

Question-5

If A = {−1, 1}, find A × A × A.

Ans.

It is known that for any non-empty set A, A × A × A is defined as

A × A × A = {(a, b, c): $a, b, c \in$ 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)}

Question-6

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

Ans.

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}

Question-7

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

Ans.

(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.

Question-8

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

Ans.

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)}

Question-9

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.

Ans.

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}.

Question-10

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.

Ans.

We know that if $n(A) = p$ and $n(B) = q$, then $n(A \times B) = pq$.

$\therefore n(A \times A) = n(A) \times n(A)$

It is given that $n(A \times A) = 9$

$\therefore n(A) \times n(A) = 9$

$\Rightarrow n(A) = 3$

The ordered pairs $(-1, 0)$ and $(0, 1)$ are two of the nine elements of $A \times A$.

We know that $A \times A = \{(a, a): a \in A\}$. 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 $A \times A$ are $(-1, -1)$, $(-1, 1)$, $(0, -1)$, $(0, 0)$,

$(1, -1)$, $(1, 0)$, and $(1, 1)$

Exercise 2.2

Question-1

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

Ans.

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}

Question-2

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.

Ans.

$R = \{(x, y): y = x + 5, x \text{ is a natural number less than } 4, x, y \in \mathbf{N}\}$

The natural numbers less than 4 are 1, 2, and 3.

$\therefore R = \{(1, 6), (2, 7), (3, 8)\}$

The domain of R is the set of all first elements of the ordered pairs in the relation.

$\therefore$ Domain of $R = \{1, 2, 3\}$

The range of R is the set of all second elements of the ordered pairs in the relation.

$\therefore$ Range of $R = \{6, 7, 8\}$

Question-3

$A = \{1, 2, 3, 5\}$ 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; $x \in A, y \in B\}$. Write R in roster form.

Ans.

$A = \{1, 2, 3, 5\}$ and $B = \{4, 6, 9\}$

$R = \{(x, y):$ the difference between x and y is odd; $x \in A, y \in B\}$

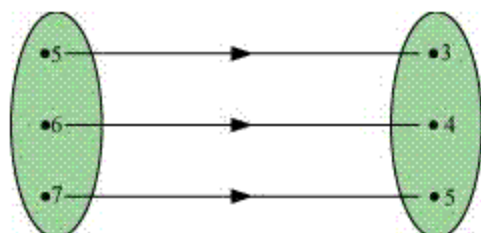$\therefore R = \{(1, 4), (1, 6), (2, 9), (3, 4), (3, 6), (5, 4), (5, 6)\}$

Question-4

The given figure shows a relationship between the sets P and Q. write this relation

(i) in set-builder form (ii) in roster form.

What is its domain and range?

Ans.

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}

Question-5

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.

Ans.

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}

Question-6

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

Ans.

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}

Question-7

Write the relation R = {(x, x³): x is a prime number less than 10} in roster form.

Ans.

R = {(x, x³): 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)}

Question-8

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

Ans.

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.

Question-9

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.

Ans.

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**

Exercise 2.3

Question-1

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)}

Ans.
https://www.indcareer.com/schools/ncert-solutions-for-11th-class-maths-chapter-2-relations-and-functions/

(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.

Question-2

Find the domain and range of the following real function:

(i) $f(x) = -|x|$ (ii) $f(x) = \sqrt{9-x^2}$

Ans.

(i) $f(x) = -|x|, x \in R$

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 $x \in R$, 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.

$\therefore$ 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 $\{x : -3 \leq x \leq 3\}$ or $[-3, 3]$.

For any value of x such that $-3 \leq x \leq 3$, the value of $f(x)$ will lie between 0 and 3.

$\therefore$ The range of $f(x)$ is $\{x : 0 \leq x \leq 3\}$ or $[0, 3]$.

Question-3

A function f is defined by $f(x) = 2x - 5$. Write down the values of

(i) $f(0)$, (ii) $f(7)$, (iii) $f(-3)$

Ans.

The given function is $f(x) = 2x - 5$.

Therefore,

(i) $f(0) = 2 \times 0 - 5 = 0 - 5 = -5$

(ii) $f(7) = 2 \times 7 - 5 = 14 - 5 = 9$

(iii) $f(-3) = 2 \times (-3) - 5 = -6 - 5 = -11$

Question-4

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

Find (i) $t(0)$ (ii) $t(28)$ (iii) $t(-10)$ (iv) The value of C, when $t(C) = 212$

Ans.

The given function is $t(C) = \dfrac{9C}{5} + 32$.

Therefore,

(i) $t(0) = \dfrac{9 \times 0}{5} + 32 = 0 + 32 = 32$

(ii) $t(28) = \dfrac{9 \times 28}{5} + 32 = \dfrac{252 + 160}{5} = \dfrac{412}{5}$

(iii) $t(-10) = \dfrac{9 \times (-10)}{5} + 32 = 9 \times (-2) + 32 = -18 + 32 = 14$

(iv) It is given that $t(C) = 212$

$\therefore 212 = \dfrac{9C}{5} + 32$

$\Rightarrow \dfrac{9C}{5} = 212 - 32$

$\Rightarrow \dfrac{9C}{5} = 180$

$\Rightarrow 9C = 180 \times 5$

$\Rightarrow C = \dfrac{180 \times 5}{9} = 100$

Thus, the value of t, when $t(C) = 212$, is 100.

Question-5

Find the range of each of the following functions.

(i) $f(x) = 2 - 3x$, $x \in$ **R**, $x > 0$.

(ii) $f(x) = x^2 + 2$, x, is a real number.

(iii) $f(x) = x$, x is a real number

Ans.

Find the range of each of the following functions.

(i) $f(x) = 2 - 3x, x \in \mathbf{R}, x > 0$.

(ii) $f(x) = x^2 + 2, x$, is a real number.

(iii) $f(x) = x, x$ is a real number

(i) $f(x) = 2 - 3x, x \in \mathbf{R}, x > 0$

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	...
$f(x)$	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 $f = (-\infty, 2)$

———×———

Chapterwise NCERT Solutions for Class 11 Maths :

https://www.indcareer.com/schools/ncert-solutions-for-11th-class-maths-chapter-2-relations-and-functions/

About NCERT

The National Council of Educational Research and Training is an autonomous organization of the Government of India which was established in 1961 as a literary, scientific, and charitable Society under the Societies Registration Act. The major objectives of NCERT and its constituent units are to: undertake, promote and coordinate research in areas related to school education; prepare and publish model textbooks, supplementary material, newsletters, journals and develop educational kits, multimedia digital materials, etc.

Organise pre-service and in-service training of teachers; develop and disseminate innovative educational techniques and practices;collaborate and network with state educational departments, universities, NGOs and other educational institutions; act as a clearing house for ideas and information in matters related to school education; and act as a nodal agency for achieving the goals of Universalisation of Elementary Education. In addition to research, development, training, extension, publication and dissemination activities, NCERT is an implementation agency for bilateral cultural exchange programmes with other countries in the field of school education.Its headquarters are located at Sri Aurobindo Marg in New Delhi. Visit the Official NCERT website to learn more.

https://www.indcareer.com/schools/ncert-solutions-for-11th-class-maths-chapter-2-relations-and-functions/