

NCERT Solutions Class 11 Maths

Chapter 2: Relations and Functions

EXERCISE 2.3

Document Information:

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Quick Summary: In NCERT Solutions Class 11 Maths Chapter 2 Exercise 2.3, students learn to identify functions, determine their domain and range, and evaluate functions at specific points. This exercise covers fundamental concepts of functions including the vertical line test, domain-range calculations, and function evaluation which are essential for building a strong foundation in calculus and scoring well in CBSE Class 11 exams.

Key Takeaways:

- A relation is a function if each element in the domain maps to exactly one element in the range using the vertical line test
- Domain is the set of all possible input values x for which the function $f(x)$ is defined
- Range is the set of all possible output values $y = f(x)$ that the function can produce
- Function evaluation involves substituting specific values into the function formula, such as finding $f(a)$ when $f(x)$ is given

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Question 1

QUESTION

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) $\{(1,3), (1,5), (2,5)\}$

SOLUTION

This question asks us to determine whether given relations are functions, and if so, to find their domain and range. The key concept here is the definition of a function: each element in the domain must map to a unique element in the range.

(i)

Step 1: Check if it is a function

A relation is a function if each element in the first set (domain) is associated with only one element in the second set (range). In this case, the first elements are 2, 5, 8, 11, 14, and 17. Each of these maps to only one value, which is 1.

Therefore, this relation is a function.

Step 2: Determine the domain

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

Domain =

Step 3: Determine the range

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

Range =

(ii)

Step 1: Check if it is a function

Here, the first elements are 2, 4, 6, 8, 10, 12, and 14. Each of these maps to a unique value (1, 2, 3, 4, 5, 6, and 7 respectively). No element in the domain is associated with more than one element in the range.

Therefore, this relation is a function.

Step 2: Determine the domain

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

Domain =

Step 3: Determine the range

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

Range =

(iii)

Step 1: Check if it is a function

In this relation, the element '1' in the domain is associated with two different elements in the range, namely '3' and '5'. This violates the definition of a function, which requires each element in the domain to map to a unique element in the range.

Therefore, this relation is **not** a function.

ANSWER

(i) Yes, Domain = $\{2, 5, 8, 11, 14, 17\}$, Range = $\{1\}$

(ii) Yes, Domain = $\{2, 4, 6, 8, 10, 12, 14\}$, Range = $\{1, 2, 3, 4, 5, 6, 7\}$

(iii) No.

Question 2

QUESTION

Find the domain and range of the following real functions:

(i) $f(x) = -|x|$

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

SOLUTION

This question asks us to find the domain and range of two real functions. The domain is the set of all possible input values (x-values) for which the function is defined, and the range is the set of all possible output values (y-values) that the function can produce.

(i)

Step 1: Determine the domain

The absolute value function is defined for all real numbers. Since we are only negating the absolute value, the function is also defined for all real numbers. Therefore, the domain is all real numbers.

Domain =

Step 2: Determine the range

The absolute value function always returns a non-negative value (i.e., for all x). When we negate it, we get $-|x|$, which will always be non-positive (i.e., for all x). The maximum value of $-|x|$ is 0, which occurs when $x = 0$. Therefore, the range is all non-positive real numbers.

Range =

(ii)

Step 1: Determine the domain

The square root function is only defined for non-negative values. Therefore, we must have $9 - x^2 \geq 0$. This inequality can be rewritten as $x^2 \leq 9$. Taking the square root of both sides, we get $-3 \leq x \leq 3$, which means x is between -3 and 3, inclusive. Therefore, the domain is the set of all real numbers between -3 and 3, inclusive.

Domain =

Step 2: Determine the range

Since $9 - x^2$ is always non-negative, the maximum value of $\sqrt{9 - x^2}$ occurs when $9 - x^2$ is maximized, which is when $x = 0$. In this case, $\sqrt{9 - x^2} = \sqrt{9} = 3$. The minimum value of $\sqrt{9 - x^2}$ occurs when $9 - x^2 = 0$, which happens when $x = 3$ or $x = -3$. Since the square root function always returns a non-negative value, the range is the set of all real numbers between 0 and 3, inclusive.

Range =

ANSWER

(i) Domain = \mathbb{R} , Range = $(-\infty, 0]$

(ii) Domain = $\{x : -3 \leq x \leq 3\}$, Range = $\{x : 0 \leq x \leq 3\}$

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Question 3

QUESTION

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

(i) $f(0)$

(ii) $f(7)$

(iii) $f(-3)$

SOLUTION

This question tests the understanding of how to evaluate a function at specific points. We are given the function and asked to find the values of , , and .

(i) Evaluating

To find , we substitute into the function:

Therefore, the value of the function at is -5.

(ii) Evaluating

To find , we substitute into the function:

Therefore, the value of the function at is 9.

(iii) Evaluating

To find , we substitute into the function:

Therefore, the value of the function at is -11.

Final Answers:

(i)

(ii)

(iii)

ANSWER

(i) $f(0) = -5$

(ii) $f(7) = 9$

(iii) $f(-3) = -11$

Question 4

QUESTION

The function t which maps temperature in degree Celsius into degree Fahrenheit is defined by

$$t(C) = (9C)/(5) + 32.$$

Find:

(i) $t(0)$

(ii) $t(28)$

(iii) $t(-10)$

(iv) The value of C when $t(C)=212$

SOLUTION

We are given a function that converts temperature from Celsius to Fahrenheit and asked to evaluate it at specific values and find the inverse.

(i) Find

We need to substitute into the function:

Therefore, .

(ii) Find

Substitute into the function:

Therefore, .

(iii) Find

Substitute into the function:

Therefore, .

(iv) Find when

We are given , so we need to solve for :

Therefore, .

ANSWER

(i) 32

(ii) $(412)/(5)$

(iii) 14

(iv) 100

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Question 5

QUESTION

Find the range of each of the following functions.

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

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

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

SOLUTION

This question asks us to find the range of three different functions. The range of a function is the set of all possible output values (y-values) that the function can produce.

(i)

Step 1: Analyze the function

We have a linear function, where is a real number and is strictly greater than 0. Since, we need to consider how the term behaves.

Step 2: Determine the behavior of $-3x$

As increases from 0 towards infinity, decreases from 0 towards negative infinity. In other words, can take any value in the interval .

Step 3: Determine the range of $f(x)$

Since, we add 2 to the interval. This shifts the entire interval up by 2 units. Therefore, the range of is .

Final Answer: Range =

(ii) is a real number

Step 1: Analyze the function

We have a quadratic function, where is a real number. We know that is always non-negative (i.e.,).

Step 2: Determine the minimum value of x^2

The minimum value of is 0, which occurs when .

Step 3: Determine the range of $f(x)$

Since, we add 2 to. Since the minimum value of is 0, the minimum value of is. As increases or decreases, increases towards infinity, so also increases towards infinity. Therefore, the range of is .

Final Answer: Range =

(iii) is a real number

Step 1: Analyze the function

This is the identity function, where $f(x) = x$. This means that the output is the same as the input.

Step 2: Determine the range

Since x can be any real number, the output can also be any real number. Therefore, the range of f is the set of all real numbers, denoted by \mathbb{R} .

Final Answer: Range = \mathbb{R}

ANSWER

(i) Range = $(-\infty, 2)$

(ii) Range = $[2, \infty)$

(iii) Range = \mathbb{R}

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Key Formulas

Important Formulas for Exercise 2.3

Formula / Concept	Description
Cartesian Product	The Cartesian product of two non-empty sets A and B is the set of all possible ordered pairs where the first element is from A and the second element is from B.
$A \times B = \{(a, b) : a \in A, b \in B\}$	Formula for the Cartesian product of two sets A and B.
If $n(A) = p$ and $n(B) = q$, then $n(A \times B) = pq$	If set A has 'p' elements and set B has 'q' elements, then their Cartesian product will have 'pq' elements.

Formula / Concept	Description
Relation	A relation R from a non-empty set A to a non-empty set B is a subset of the Cartesian product $A \times B$.
Function	A relation f from a set A to a set B is said to be a function if every element of set A has one and only one image in set B.
$f: A \rightarrow B$ where $f(x) = y$	This denotes a function 'f' from set A to set B, where 'y' is the unique image of 'x'.
Domain	The set of all possible input values for a function. For a function $f: A \rightarrow B$, the domain is the set A.
Range	The set of all possible output values of a function. For a function $f(x)$, the range is the set of all values that $f(x)$ takes.
Codomain	The set of all possible outputs for a function. For a function $f: A \rightarrow B$, the codomain is the set B. The range is a subset of the codomain.
Real Function	A function whose domain and codomain are subsets of the set of real numbers \mathbb{R} .
Identity Function	A function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $y = f(x) = x$ for each $x \in \mathbb{R}$. The domain and range are both \mathbb{R} .
Constant Function	A function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $y = f(x) = c$, where c is a constant. The domain is \mathbb{R} and the range is the set $\{c\}$.
Polynomial Function	A function $f: \mathbb{R} \rightarrow \mathbb{R}$ is said to be a polynomial function if for each $x \in \mathbb{R}$, $y = f(x) = a_0 + a_1x + a_2x^2 + \dots + a_nx^n$, where n is a non-negative integer and $a_0, a_1, \dots, a_n \in \mathbb{R}$.
Rational Function	Functions of the type $(f(x))/(g(x))$, where $f(x)$ and $g(x)$ are polynomial functions of x defined in a domain, where $g(x) \neq 0$.
Modulus Function	The function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = x $ for each $x \in \mathbb{R}$. The domain is \mathbb{R} and the range is $[0, \infty)$.
Signum Function	The function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = \begin{cases} 1, & \text{if } x > 0 \\ 0, & \text{if } x = 0 \\ -1, & \text{if } x < 0 \end{cases}$. The domain is \mathbb{R} and the range is $\{-1, 0, 1\}$.
Greatest Integer Function	The function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = [x]$, where $[x]$ denotes the greatest integer less than or equal to x. The domain is \mathbb{R} and the range is the set of integers \mathbb{Z} .

Important Formulas for Exercise 2.3

Formula / Concept	Description
Cartesian Product	The Cartesian product of two non-empty sets A and B is the set of all possible ordered pairs where the first element is from A and the second element is from B. [cite: 3, 5, 16]
$A \times B = \{(a, b) : a \in A, b \in B\}$	Formula for the Cartesian product of two sets A and B. [cite: 1, 3, 15]
If $n(A) = p$ and $n(B) = q$, then $n(A \times B) = pq$	If set A has 'p' elements and set B has 'q' elements, then their Cartesian product will have 'pq' elements. [cite: 3, 5, 13]
Relation	A relation R from a non-empty set A to a non-empty set B is a subset of the Cartesian product $A \times B$. [cite: 6]
Function	A relation f from a set A to a set B is said to be a function if every element of set A has one and only one image in set B. [cite: 1, 3, 7, 8]
$f: A \rightarrow B$ where $f(x) = y$	This denotes a function 'f' from set A to set B, where 'y' is the unique image of 'x'. [cite: 1, 3, 7]
Domain	The set of all possible input values for a function. For a function $f: A \rightarrow B$, the domain is the set A. [cite: 2, 10, 19]
Range	The set of all possible output values of a function. For a function $f(x)$, the range is the set of all values that $f(x)$ takes. [cite: 2, 10, 19]
Codomain	The set of all possible outputs for a function. For a function $f: A \rightarrow B$, the codomain is the set B. [cite: 10] The range is a subset of the codomain.
Real Function	A function whose domain and codomain are subsets of the set of real numbers \mathbb{R} .
Identity Function	A function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $y = f(x) = x$ for each $x \in \mathbb{R}$. The domain and range are both \mathbb{R} . [cite: 28]
Constant Function	A function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $y = f(x) = c$, where c is a constant. The domain is \mathbb{R} and the range is the set $\{c\}$. [cite: 27, 28]
Polynomial Function	A function $f: \mathbb{R} \rightarrow \mathbb{R}$ is said to be a polynomial function if for each x in \mathbb{R} , $y = f(x) = a_0 + a_1x + a_2x^2 + \dots + a_nx^n$, where n is a non-negative integer and $a_0, a_1, \dots, a_n \in \mathbb{R}$. [cite: 28]
Rational Function	Functions of the type $(f(x))/(g(x))$, where $f(x)$ and $g(x)$ are polynomial functions of x defined in a domain, where $g(x) \neq 0$. [cite: 28]
Modulus Function	

Formula / Concept	Description
	The function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = x $ for each $x \in \mathbb{R}$. The domain is \mathbb{R} and the range is $[0, \infty)$. [cite: 2, 28]
Signum Function	The function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = \begin{cases} 1, & \text{if } x > 0 \\ 0, & \text{if } x = 0 \\ -1, & \text{if } x < 0 \end{cases}$. The domain is \mathbb{R} and the range is $\{-1, 0, 1\}$. [cite: 28]
Greatest Integer Function	The function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = [x]$, where $[x]$ denotes the greatest integer less than or equal to x . The domain is \mathbb{R} and the range is the set of integers \mathbb{Z} . [cite: 28]

🔗 Top FAQs

Q1. How many questions are in NCERT Solutions Class 11 Maths Chapter 2 Relations and Functions Exercise 2.3 for CBSE 2025-26?

Exercise 2.3 of NCERT Solutions for Class 11 Maths Chapter 2 Relations and Functions contains exactly 5 questions. These questions focus on functions, their domains, ranges, and related concepts which carry significant weightage in CBSE board exam 2025-26.

Q2. Where can I download free PDF of NCERT Solutions for Class 11 Maths Chapter 2 Relations and Functions Exercise 2.3 with step by step solutions?

You can download the free PDF of NCERT Solutions for Class 11 Maths Chapter 2 Relations and Functions Exercise 2.3 from the official NCERT website or various educational portals. These PDFs include detailed step by step solutions for all 5 questions, updated as per the CBSE syllabus 2025-26.

Q3. How many marks does Relations and Functions Chapter 2 Exercise 2.3 carry in CBSE Class 11 Maths board exam 2025-26?

Relations and Functions from Chapter 2 is part of Unit I - Sets and Functions, which carries 8 marks in total for CBSE Class 11 Maths board exam 2025-26. Exercise 2.3 specifically covers functions concepts that are crucial for scoring well in this unit.

Q4. Which is the most difficult question in Exercise 2.3 of NCERT Solutions Class 11 Maths Chapter 2 Relations and Functions?

Question 5 in Exercise 2.3 of NCERT Solutions for Class 11 Maths Chapter 2 Relations and Functions is generally considered the most challenging as it involves complex function analysis and domain-range calculations. Students can refer to step by step solutions in free PDF downloads to understand the approach better.

Q5. What is Cartesian Product explained in NCERT Solutions Class 11 Maths Chapter 2 Relations and Functions Exercise 2.3?

Cartesian Product in NCERT Class 11 Maths Chapter 2 is the set of all ordered pairs (a, b) where a belongs to set A and b belongs to set B , denoted as $A \times B$. This concept forms the foundation for understanding relations and functions covered in Exercise 2.3 and is important for CBSE board exam 2025-26.

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