MATHS

NCERT - NCERT MATHEMATICS (GUJRATI)

RELATIONS AND FUNCTIONS

Example

1. If (x+1, y-2)=(3,1), find the values of x and y.

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2. If P={a,b,c} and Q={r}, form the sets $P \times Q$ and $Q \times P$. Check if the products are equal or not?

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3. Let A={1,2,3}, B={3,4} and C={4,5,6}. Find

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

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

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

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

Answer:

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4. If P={1,2}, form the set $P \times P \times P$

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5. If R is the set of all real numbers, what do the cartesian products $R \times R$ and $R \times R \times R$ represent?

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6. If $A \times B = \begin{Bmatrix} (p,q) & (p,r) \\ (m,q) & (m,r) \end{Bmatrix}$, find A and B.

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7. Let A={1,2,3,4,5,6}. Define a relation R form A to A by R= {(x,y) : y=x+1}

(i) Depict this relation using an arrow diagram.

(ii) Write down the domain, codmain and range of R.

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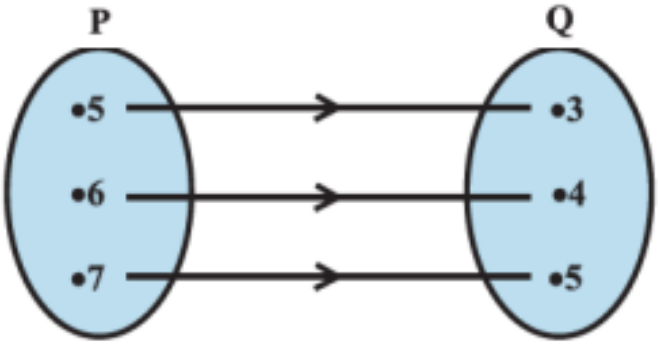
8. The Fig 2.7 shows a relationship between the sets P and Q. Write this relation

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



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9. Let A={1,2} and B={3,4}. Find the number of relations from A to B.

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10. Let N be the set of natural numbers and the relation R be defined on N such that $R = \{(x, y) : y = 2x, y \in N\}$,

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11. Examine each of the following relations given below and state in each case, giving resons whether it is function or not?

(i) R={(2,1), (3,1), (4,2)}, (ii) R={(2,2), (2,4) ,(3,3),(4,4)}

(ii) R={(1,2),(2,3),(3,4),(4,5),(5,6),(6,7)}

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12. Let N be the set of natural numbers. Define a real valued function $f: N \to n$ by f(x)=2x+1. Using this defination, complete the table given below,

x	1	2	3	4	5	6	7
y	$f(1) = \ldots$	$f(2) = \ldots$	$f(3) = \ldots$	$f(4) = \ldots$	$f(5) = \ldots$	$f(6) = \ldots$	$f(7) = \ldots$

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13. Define the function $f: R \to Rbyy = f(x) = x^2, x \in R$. Complete the Table given below by using this defination. What is the domain and range of this function? Draw the graph of f.

x	-4	-3	-2	-1	0	1	2	3	4
$y = f(x) = x^2$									

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14. Draw the graph of the function $f: R \to R$ defined by $f(x) = x^3, x \in R$.

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15. Define the real valued function $f: R - \{0\} \to R$ defined by $f(x) = \frac{1}{2}x \in R - \{0\}$. Complete the Table given below using this definition. What is the domain and range of this function?

x	-2	-1.5	-1	-0.5	0.25	0.5	1	1.5	2
$y = \frac{1}{x}$	...	...	...	...	...	...	...	...	...

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16. Let $f(x) = x^2$ and $g(x) = 2x + 1$ be two real functions. Find

$(f+g)(x), (f-g)(x), (fg)(x), \left(\frac{f}{g}\right)(x).$

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17. Let $f(x) = \sqrt{x}$ and $g(x) = x$ be two functions defined over the set of non-negative real numbers. Find $(f+g)(x), (f-g), (fg)(x)$ and $\left(\frac{f}{g}\right)(x).$

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18. Let R be the set of real numbers. Define the real function $f: R \to Rbyf(x) = x + 10$ and sketch the graph of this function.

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19. Let R be a relation from Q to Q defined by $R = \{(a, b) : a, b \in Q \text{ and } a - b \in Z\}$. Show that

(i) $(a, a) \in R$ for all $a \in Q$

(ii) $(a, b) \in R$ implies that $(b, a) \in R$

(iii) $(a, b) \in R$ and $(b, c) \in R$ implies that $(a, c) \in R$

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20. Let f={(1,1),(2,3),(0,-1),(,-1,-3)} be a linear function from Z into Z. Find f(x).

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21. Find the domain of the function $f(x) = \frac{x^2 + 3x + 5}{x^2 - 5x + 4}$

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22. The function f is defined by

$$f(x) = \begin{cases} 1 - x & x < 0 \\ 1 & x = 0 \\ x + 1 & x > 0 \end{cases}$$

Draw the graph of f(x).

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Exercise 2 1

1. 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.

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2. If the set A has 3 elements and the set B =(3, 4, 5), then find the number of elements in $(A \times B)$.

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3. If G =(7, 8) and H=(5,4,2), find $G \times H$ and $H \times G$.

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4. 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 $P \times Q = \{(m, n), (n, m)\}$.

(ii) If A and B are non-empty sets, then $A \times B$ 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 $A \times (B \cap \phi) = \phi$

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5. If $A = \{-1, 1\}$, find $A \times A \times A$

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6. If $A \times B = \{(a, x), (a, y), (b, x), (b, y)\}$. Find A and B.

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7. Let A={1,2}, B={1,2,3,4}, C={5,6} and D={5,6,7,8}. Verify that (i) $A \times (B \cap C) = (A \times B) \cap (A \times C)$, $(ii) A \times C$ is a subset of $B \times D$

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

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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 $A \times B$, find A and B, where x, y and z are distinct elements.

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

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Exercise 2 2

1. Let A={1,2,3....14}. Define a relation R from A to A by

$$R = \{(x, y) : 3x - y = 0, \quad \text{where} \quad x, y \in A\}.$$

Write down its domain, condomain and range.

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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 $4, x, y \in N)$. Depict this relationship using roster form. Write down the domain and the range.

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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.

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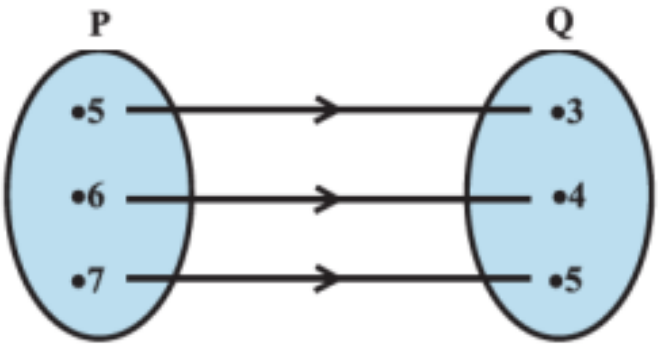
4. The Fig 2.7 shows a relationship between the sets P and Q. Write this relation

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



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5. Let A= (1, 2, 3, 4, 6). Let R be the relation on A defined by $\{(a, b)a, b \in A, b$ is exactly divisible by a]

(i) Write R in roster form

(ii) Find the domain of R

(iii) Find the range of R.

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

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

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

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9. Let R be the relation on Z defined by $R = \{(a, b) : a, b \in Z, a - b \text{is an integer}\}$. Find the domain and range of R.

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Exercise 2 3

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)}

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2. Find the domain and range of the following real functions:

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

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3. A functionfis defined by f(x)=2x-5. Write down the values of (i) f(0), (ii) f(7), (iii) f(-3)

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

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

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5. Find the range of each of the following functions.

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

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

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

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Miscellaneous Exercise On Chapter 2

1. 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.

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

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

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

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

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

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

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8. 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,

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9. Let R be a relation from N to N defined by $R = \{(a, b) : a, b \in N \text{ and } a = b^2\}$. Are the following true?

(i) $(a, a) \in R$, for all $a \in N$ (ii) $(a, b) \in R$, implies $(b, a) \in R$

(iii) $(a, b) \in R, (b, c) \in R$ implies $(a, c) \in R$.

Justify your answer in each case.

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10. 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.

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11. Let f be the subset of $Z \times Z$ defined by $f = \{(ab, a + b) : a, b \in Z\}$. Is f a function from Z to Z? Justify your answer.

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

range of f.

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