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MATHS

NCERT - NCERT MATHEMATICS (ENGLISH)

RELATIONS AND FUNCTIONS

Exercise 2 2

1. $A = \{1, 2, 3. 5\}$ 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.

A.

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

B.

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

C.

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

D.

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

Answer: D

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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. Let $A = \{1, 2, 3, \ldots, 14\}$. 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, co-domain and range.

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4. 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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5. Let $A = \{1, 2, 3, 4, 6\}$. Let R be the relation on A defined by $\left\{\left(a\dot{b}\right) : a, b \in A, b\right.$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. Let R be the relation on Z defined by $R = \{(a, b) : a, b \in Z, ab$ is an integer}.Find the domain and range of R.

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

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

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9. The Figure 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?

A. if p“$\frac{p}{r}$ and cos R.$\frac{p}{q}$ ”

B. null

C. null

D. null

Answer: null

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Solved Examples

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

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2. Examine each of the following relations given below and state in each case, giving reasons whether it is a function or not?(i) $R = \{(2, 1), (3, 1), (4, 2)\}$, (ii) $R = \{(2, 2), (2, 4), (3, 3), (4, 4)\}$ (iii) `R= {(1, 2

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

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4. Let N be the set of natural numbers and the relation R be defined on N such that $R = \{(x, y) : y = 2x, x, y \in N\}$.What is the domain, codomain and range of R? Is this relation a function?

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

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

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

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9. Let R be a relation from Q to Q defined by $R = \{(a, b) : a, b \in Q \text{ and } a, b \in Z\}$. $Showt\hat{}$(a,a) in R for all a in Q $,\{a, b\} \in R \Rightarrow$ that $\{b, a\} \in R, \{a, b\} \in R \text{ and } \{b, c\} \in R \Rightarrow t\widehat{a, c} \in R$`

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

A. $2, 1$

B. $2, -1$

C. $-2, 1$

D. None

Answer: A

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12. Let $A = \{1, 2, 3\}$, $B = \{3, 4\}$and $C = \{4, 5, 6\}$. Find(i) $A \times (B \cap C)$ (ii) $(A \times B) \cap (A \times C)$(iii) $A \times (B \cup C)$ (iv) $(A \times B) \cup (A \times C)$

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13. If $P = \{a, b, c\}$and $A \times B = \{(p, q), (p, r), (m, q), (m, r)\}$ $Q = \{r\}$, form the sets $P \times QandQ \times P$.Are these two products equal?

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

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16. The function f is defined by $f(x) = \left\{ \begin{matrix} 1 - x & x < 0 \\ 1 & x = 0 \\ x + 1 & x > 0 \end{matrix} \right\}$. Draw the graph of $f(x)$.

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

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

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19. If $A \times B = \{(p, q), (p, r), (m, q), (m, r)\}$, find A and B.

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20. Let $A = \{1, 2, 3, 4, 5, 6\}$. Define a relation R from A to A by $R = \{(x, y) : y = x + 1\}$(i) Depict this relation using an arrow

diagram.(ii) Write down the domain, co-domain and range of R.

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21. The Fig 2.6 shows a relation between the sets P and Q. Write this relation (i) in set- builder form, (ii) in roster form.What is its domain and range?

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

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Exercise 2 1

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

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

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

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

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9. 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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10. 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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Miscellaneous Exercise

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

A. R

B. R - {4}

C. R - {2,6}

D. R - {2}

Answer: C

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2. The relation f is defined by $f(x) = \{x^2, 0 \leq x \leq 33x, 3 \leq x \leq 10$The relation g is defined by $g(x) = \{x^2, 0 \leq x \leq 33x, 2 \leq x \leq 10$Show that f is a function and g is not a function.

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

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4. 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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5. Let R be a relation from N to N defined by $R = \left\{(a, b) : a\dot{b} \in N\right.$and $a = b^2$). Are the following true?(i) $(a, a) \in R, f$ or $alla \in N$(ii) $(a, b) \in R, implies(b, a) \in R$(iii) `(a ,

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

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

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8. 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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9. 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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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 y

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11. 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 rage of f.

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

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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),

A. i only

B. ii only

C. i and ii both

D. neither i nor ii

Answer: A

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2. Find the domain and range of each of the following real valued function: $f(x) = -|x|$.

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

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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) $f(x) = 23x, x \in R, x > 0$(ii) $f(x) = x^2 + 2$, x is a real number. (iii) $f(x) = x, x$ is a real number.

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