Question Bank

RELATIONS AND FUNCTIONS

Class 11 - Mathematics

1. R = {(1, 1), (2, 2), (1, 2), (2, 1), (2, 3)} be a relation on A, then R is **[1]**

   a) not anti symmetric
   b) symmetric
   c) anti symmetric
   d) Reflexive

2. The domain and range of the real function f defined by f (x) $= \frac{4-x}{x-4}$ is given by **[1]**

   a) Clearly, Domain = R - {-4}, Range = {-1}
   b) Domain = R - {1}, Range = R
   c) Domain = R, Range = {-1, 1}
   d) Domain = R - {4}, Range = {-1}

3. The domain of the function f given by f (x) = $\frac{x^2+2x+1}{x^2-x-6}$ **[1]**

   a) R – {–3, 2}
   b) R – [3, – 2]
   c) R – {-2, 3}
   d) R – (-3, - 2)

4. If f(x) = log $\left(\frac{1+x}{1-x}\right)$ and g(x) $= \frac{3x+x^3}{1+3x^2}$ Then f(g)(x) is equal to **[1]**

   a) f (3x)
   b) -f (x)
   c) $[f(x)]^3$
   d) 3 f(x)

5. Let A = { 2 , 3 , 6 }. Which of the following relations on A are reflexive? **[1]**

   a) None of these
   b) R_1 = {(2,2) , (3,3) , (6,6)}
   c) R_2 = {(2,2) , (3,3) , (3,6) , (6,3)}
   d) R_3 = {(2,2) , (3,6) , (2,6)}

6. The minimum value of sin x + cos x is **[1]**

   a) $-2\sqrt{2}$
   b) $\sqrt{2}$
   c) 0
   d) $-\sqrt{2}$

7. Let R = {(a, a), (b, b), (c, c), (a, b)} be a relation on set A = {a, b, c}. Then, R is **[1]**

   a) transitive
   b) anti – symmetric
   c) symmetric
   d) reflexive

8. Consider the non – empty set consisting of children in a family and a relation R defined as aRb if a is brother of b. Then R is **[1]**

   a) both symmetric and transitive
   b) transitive but not symmetric
   c) neither symmetric nor transitive
   d) symmetric but not transitive

9. The domain of definition of the function f(x) = log |x| is **[1]**

   a) R
   b) $(0, \infty)$
   c) $(-\infty, 0)$
   d) R - {0}

10. If f is a real-valued function given by f(x) = $27x^3 + \frac{1}{x^3}$ and α, β are roots of $3x + \frac{1}{x}$ = 2. Then, **[1]**

a) f(α) = 10

b) $f(\beta) = -10$

c) None of these

d) $f(\alpha) \neq f(\beta)$

11. The domain of the function f(x) = $\sqrt{5|x| - x^2 - 6}$ is **[1]**

a) $[-3, -2) \cup [2, 3)$

b) $[-3, -2] \cup [2, 3]$

c) None of these

d) (-3, 2) $\cup$ (2, 3)

12. f : R $\rightarrow$ R : f (x) = x^2 is **[1]**

a) many-one and into

b) one-one and into

c) one-one and onto

d) many-one and onto

13. The relation R defined on the set A ={1,2, 3, 4, 5} by R = {(a, b) :| a^2 - b^2 | < 16}, is given by **[1]**

a) {(2, 2), (3, 2), (4, 2), (2, 4)}

b) R = {(1, 1), (2, 1), (3, 1), (4, 1), (2, 3),(2, 2), (3, 2), (4, 2), (2, 4),(3, 3), (5, 4), (3, 4)}

c) none of these

d) {(3, 3), (4, 3), (5, 4), (3, 4)}

14. The domain of the function $f(x) = \sqrt{\frac{(x+1)(x-3)}{x-2}}$ is **[1]**

a) $(-1, 2) \cup [3, \infty)$

b) $[-1, 2) \cup [3, \infty)$

c) None of these

d) $[-1, 2] \cup [3, \infty)$

15. The range of the function f(x) = $\frac{x}{|x|}$ is **[1]**

a) {-1, 1}

b) R -{0}

c) R - {-1, 1}

d) None of these

16. If A = [a, b], B = [c, d], C = [d, e] then {(a, c), (a, d), (a,e), (b,c), (b, d), (b, e)} is equal to **[1]**

a) $A \cap (B \cup C)$

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

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

d) $A \cup (B \cap C)$

17. If A = {(x, y) : x^2 + y^2 = 5} and B = {(x, y) : 2x = 5y}, then A $\cap$ B contains **[1]**

a) two points

b) one-point

c) infinite points

d) no point

18. The relation R = {1, 1), (2, 2), (3, 3)} on the set {1, 2, 3) is **[1]**

a) an equivalence relation

b) reflexive relation only

c) symmetric relation only

d) transitive relation only

19. Let R be the relation over the set of all straight lines in a plane such that l_1 R $l_2 \Leftrightarrow l_1 \perp l_2$. Then, R is **[1]**

a) symmetric and transitive but not Reflexive

b) Reflexive and transitive but not symmetric

c) Symmetric and reflexive but not transitive

d) Symmetric but neither reflexive nor transitive.

20. The domain of the function f defined by f(x) = $\sqrt{4-x} + \frac{1}{\sqrt{x^2-1}}$ is equal to **[1]**

a) $(-\infty, -1) \cup [1, 4)$

b) $(-\infty, -1] \cup (1, 4)$

c) $(-\infty, -1) \cup (1, 4]$

d) $(-\infty, -1) \cup [1, 4]$

21. Let f and g be real functions defined by f(x) = $\sqrt{x-1}$ and g(x) = $\sqrt{x+1}$. Find: $(\frac{f}{g})(x)$ **[1]**

22. Let X = {1, 2, 3, 4} and Y = {1, 5, 9, 11, 15, 16} Determine which of the following sets are functions from X to Y. f_3 = {(1, 5), (2, 9), (3, 1), (4, 5), (2, 11)}. **[1]**

23. Let f and g be two real function defined by f(x) = $\frac{1}{x+4}$ and g(x) = $(x + 4)^3$ find the $\frac{1}{f}$. **[1]**

24. Write the relation R = {(x, x^3) : x is a prime number less than 10} in roster form. **[1]**

25. If A = {a, b, c, d}, B = (p, q, r, s}, then which are relations from A to B? R_4 = {(a, p),(q, a),(b, s),(s, b)}. **[1]**

26. If R_1 = {(x, y) | y = 2x + 7, where x ∈ R and $-5 \leq x \leq 5$} is a relation. Then find the domain and Range of R_1. **[1]**

27. If f (x) = $\begin{cases} x^2, \text{ when } x < 0 \\ x, \text{ when } 0 \leq x < 1 \\ \frac{1}{x}, \text{ when } x > 1 \end{cases}$, Find f (1/2). **[1]**

28. Let f : R → R: f(x) = x^3 + 1 and g : R → R : g(x) = (x + 1). Find: $\left(\frac{f}{g}\right)(x)$ **[1]**

29. Express {(x, y) : $x^2 + y^2$ = 25, where x, y ∈ W} as a set of ordered pairs. **[1]**

30. If R is a relation from set A = {2, 4, 5} to set B = { 1, 2, 3, 4, 6, 8} defined by x R y ⇔ x divides y. Write R as a set of ordered pairs. **[1]**

31. If A = [1, 3, 5] and B = [2, 3], then find B × A. **[1]**

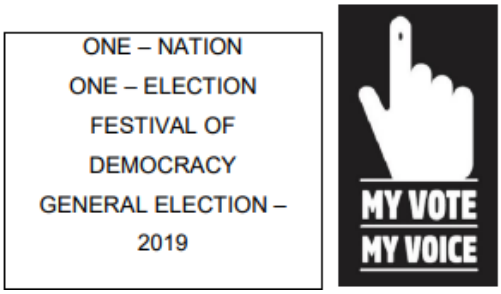
32. Let f : R → R: f(x) = $\frac{x}{c}$, where c is a constant. Find: (cf)(x) **[1]**

33. If R = {(x, y): x, y ∈ Z, $x^2 + y^2 \leq 4$} is a relation defined on the set Z of integers, then write domain of R. **[1]**

34. Let A = {1, 2}, B = {2, 3, 4}, C = {4, 5}. Find A × (B ∩ C). **[1]**

35. **Read the text carefully and answer the questions:** **[1]**

A general election of Lok Sabha is a gigantic exercise. About 911 million people were eligible to vote and voter turnout was about 67%, the highest ever.



Let I be the set of all citizens of India who were eligible to exercise their voting right in the general election held in 2019. A relation 'R' is defined on I as follows:

R = {(v_1, v_2) : v_1, v_2 ∈ I and both use their voting right in general election – 2019}

(i) Two neighbors X and Y ∈ I. X exercised his voting right while Y did not cast her vote in the general election – 2019. Which of the following is true?

a) (X, X) ∈ R b) (X, Y) ∈ R

c) (Y, X) ∈ R d) (X, Y) ∉ R

36. Prove that: (A ∩ B) × C = (A × C) ∩ (B × C). **[2]**

37. Let A = {2, 3, 5} and R = {(2, 3), (2, 5), (3, 3), (3, 5)}. Show that R is a binary relation on A. Find its domain and range. **[2]**

38. Find the values of a and b, when $\left(\frac{a}{3} + 1, b - \frac{1}{3}\right) = \left(\frac{5}{3}, \frac{2}{3}\right)$ **[2]**

39. Let A = {-2, - 1, 0, 1, 2 } and B = { 0, 1, 4, 9 }. Let R = {(-2, 4), (-1, 1), (0, 0), (1, 1), (2, 4)} **[2]**

i. Show that R is a relation from A to B.

ii. Find dom (R), range (R) and co-domain of R.

40. Find the domain and the range of the real function: f(x) = $\frac{1}{\sqrt{x^2-1}}$ **[2]**

41. Write the domain of the relation R defined on the set Z of integers as follows: **[2]**

(a, b) ∈ R ⇔ $a^2 + b^2 = 25$

42. Draw the graph of the constant functions f(x) = -2. **[2]**

43. Let f, g be two real functions defined by f(x) = $\sqrt{x+1}$ and $g(x) = \sqrt{9-x^2}$, then describe of the function $\frac{5}{g}$. **[2]**

44. Find the domain and the range of the real function: f(x) = $\sqrt{\frac{x-5}{3-x}}$ **[2]**

45. Draw the graph of the smallest integer function f(x) = [x] **[2]**

46. Let R = [(x, y): x, y ∈ Z and $x^2 + y^2 = 25$}. Express R and R^{-1} as sets of ordered pairs. Show that R = R^{-1}. **[2]**

47. If f(x) = $4x - x^2, x \in R$ then write the value of f(a + 1) - f(a - 1). **[2]**

48. Find the simplified form of **[2]**

$f(x) = |x - 2| + |2 - x|$, if $-3 \leq x \leq 3$.

49. Draw the graph of the step function f(x) = [x]. **[2]**

50. Find the domain of $f(x) = \frac{1}{x+2}$. **[2]**

51. Let R be the relation on the set Z of all integers defined by **[3]**

R= {(x, y) x-y is divisible by n}.

Prove that

(i) $(x, y) \in R \Rightarrow (y, x) \in R$ for all x, y ∈ Z

(ii) (x, y) ∈ R and (y, z) ∈ $R \Rightarrow (x, z) \in R$ for all x, y, z ∈ R

52. 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. **[3]**

53. If $A \subseteq B$, then prove that **[3]**

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

54. Find the domain and the range of the real function, f(x) = $\frac{x^2+1}{x^2-1}$ **[3]**

55. Find the domain and range of the real function, $f(x) = \frac{3}{2-x^2}$. **[3]**

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

57. Let f :R → R: f(x) = x^3 for all x ∈ R . Find its domain and range. Also, draw its graph. **[3]**

58. A function f is defined by f(x) = 2x – 5 Write down the values of **[3]**

i. f(0)

ii. f(7)

iii. f(-3)

59. Let A = {-2, -1, 0, 1, 2} and f : A → Z : f(x) = x^2 - 2x - 3. Find f(A). **[3]**

60. 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. **[3]**

61. Let X = {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? **[3]**

(i) f is a relation from X to Y

(ii) f is a function from X to Y. Justify.

62. Draw the graph of the function f(x) = $\begin{cases} 1+2x & x < 0 \\ 3+5x, & x \geq 0 \end{cases}$. Also, find its range. **[3]**

63. Find the sum and the difference of the identity function and the modulus function. **[3]**

64. Write the domain and the range of the function, f(x) = $\sqrt{x - [x]}$ **[3]**

65. For any sets A, B and C, prove that: $A \times (B \cap C) = (A \times B) \cap (A \times C)$ **[3]**

66. If A = {2, 3, 5} and B = {5, 7}, find: **[5]**

i. $A \times B$

ii. $B \times A$

iii. $A \times A$

iv. $B \times B$

67. Let R be relation defined on the set of natural number N as follows: **[5]**

R = {(x, y): x ∈ N, y ∈ N, 2x + y = 41}. Find the domain and range of the relation R. Also verify whether R is reflexive, symmetric and transitive.

68. If A = {a,d}, B = {b, c, e} and C = {b, c, f}, then verify that **[5]**

i. A×(B ∪ C) = (A×B) ∪ (A×C)

ii. A×(B ∩ C) = (A×B) ∩ (A×C)

69. Let A = R – {3} and B = R- {1}. Consider the function of f: A → B defined by f(x) = $\frac{x-2}{x-3}$ is one – one and onto. **[5]**

70. i. Let R be the relation on the set Z of all integers defined by R = {(x, y): x - y is divisible by n}. Prove that **[5]**

a. (x, y) ∈ R

⇒ (y, x) ∈ R for all x, y ∈ Z.

b. (x, y) ∈ R and (y, z) ∈ R

⇒ (x, z) ∈ R for all x, y, z ∈ Z.

ii. Find the domain and range of the function $f(x) = \frac{x^2-9}{x-3}$.

iii. Find the domain of the function $f(x) = \frac{x^2+3x+5}{x^2+x-6}$.

71. **State True or False:** **[5]**

(i) If A ⊆ B, then A × C ⊆ B × C for any set C. **[1]**

(ii) In Arrow Diagram, we draw arrows from the first element to the second element of all ordered pairs belonging to relation R. **[1]**

(iii) If A ⊆ B, then A × A ⊆ (A × B) ∩ (B) **[1]**

(iv) If A = {1, 3, 6} and B = {x, y}, then A × B = {(1, x), (3, x), (3, y), (6, x)} **[1]**

(v) The set of all ordered pairs (a, b) of elements a ∈ A and b ∈ B is called the cartesian product of sets A and B and is denoted by A × B. **[1]**