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Class: XII
Subject: Maths
Topic: Relations and Functions
No. of Questions: 20
Duration: 60 Min

Q1. If R is a relation from a non-empty set A to a non-empty set B, then

A. $R = A \times B$
B. $R = A \cup B$
C. $R \subseteq A \times B$
D. $R \subset A \times B$

Right Answer Explanation: C
A relation from a non-empty set A to a non-empty set B is defined as a subset of $A \times B$ or A relation R from the non-empty set A to another non empty set B is a subset of their Cartesian product $A \times B$, i.e. $R \subseteq A \times B$.

Q2. Let R be the relation on N defined as x R y, if $x + 2y = 8$. The domain of R is

A. {2, 4, 8}
B. {2, 4, 6, 8}
C. {2, 4, 6}
D. {1, 2, 3, 4}

Right Answer Explanation: C

Domain of R = $\{x \in N : x R y \text{ for some } y \in N\} = \{2, 4, 6\}$ (Q $x = 8 - 2y, y \in N = \begin{Bmatrix} 6 \text{ when } & y = 1 \\ 4 \text{ when } & y = 2 \\ 2 \text{ when } & y = 3 \end{Bmatrix}$ Note that in this case R = {(2, 3), (4, 2), (6, 1)}

Q3. The range of the function $f(x) = -\sqrt{-x^2 - 6x - 5}$ is equal to

A. [0, 2]
B. [- 2, 0]
C. [- 2, 2]
D. None of these

Right Answer Explanation: B
Note that $D_f = [-5, -1]$
(f (x) is real if $-x^2 - 6x - 6 \geq 0$ i.e. if $(x + 5)(x + 1) \leq 0$)
i.e. if $(x + 5)(x + 1) \leq 0$)
For R_f, let $y = f(x)$
$\Rightarrow y = -\sqrt{-x^2 - 6x - 5}$

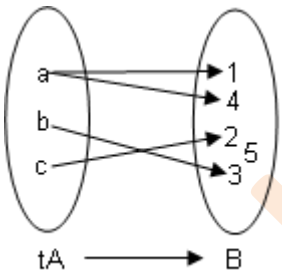
$\Rightarrow y^2 = -x^2 - 6x - 5, y \leq 0$
$\Rightarrow x^2 = 6x + (5 + y^2) = 0, y \leq 0$
$\Rightarrow 6^2 - 4.1\ (5 + y^2) \geq 0$
(x is real, disc $\geq$ 0)
$\Rightarrow y^2 \leq 4$
$\Rightarrow |y| \leq 2$ and $y \leq 0$
$R_f = [-2, 0]$

Q4. The number of relations that can be defined on the set A = {a, b, c, d} is

A. 24
B. 16
C. 4^4
D. 2^{16}

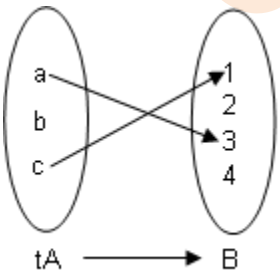
Right Answer Explanation: D
As n (A) = 4, so n (A $\times$ A) = 16. Hence, the number of subsets of A $\times$ A = 2^{16}. So, the number of relations on A is 2^{16}.

Q5. The diagram given below shows that



A. f is function from A to B
B. f is a one-one function from A to B
C. f is an onto function from A to B
D. f is not a function

Right Answer Explanation: D
As f(a) is not unique, f is not a function.
Q6. The diagram given below shows that



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www.askiitians.com
Email: info@askiitians.com
Tel: 1800-2000-838

A. f is a function from A to B
B. f is a one-one function from A to B
C. f is a bijection from A to B
D. f is not a function

Right Answer Explanation: D
As f(b) is not defined, so f is not a function.

Q7. If A = {0, 1} and B = {1, 0], then A × B is equal to

A. {(0, 1), (1, 0)}
B. {(0, 0), (1, 1)}
C. A × A
D. none of these

Right Answer Explanation: C
Here, the option covered all the ordered pairs.

Q8. If f = {(1, 4), (2, 5), (3, 6)} and g = {(4, 8), (5, 7), (6, 9)}, then (gof) is

A. { }
B. {(1, 8), (2, 7), (3, 9)
C. {(1, 7), (2, 8), (3, 9)}
D. none of these

Right Answer Explanation: B
(gof) (1) = g(f(1)) = f(4) = 8,
(gof) (2) = g(f(2)) = g(5) = 7
and (gof) (3) = g(f(3)) = g(6) = 9

Q9. The domain of the function f = {(1, 3), (3, 5), (2, 6)} is

A. 1, 3 and 2
B. {1, 3, 2}
C. {3, 5, 6}
D. 3, 5 and 6

Right Answer Explanation: B
Domain of f is a set of those points on which f is defined. So, D_f = {1, 2, 3}.
Q10. The range of the function f(x) = |x - 1| is

A. (- ∞, ∞)
B. (0, ∞)
C. [0, ∞)
D. (- ∞, 0)

Right Answer Explanation: C
Since |x| assumes every value in [0, ∞), so |x - 1| also takes every value in [0, ∞). Hence, range of f(x) = |x - 1| is [0, ∞).

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Q11.Number of relation that can be defined on a set A = (a, b, c) is

A. 24
B. 512
C. 4^4
D. 2^{16}

Right Answer Explanation: B
A = (a, b, c,)

If A set contains n elements, then no. of relations on A is 2^{n^2}
Here n = 2, so number of relations = 2^9

Q12.Let A = {1, 2, 3}, then the domain of the relation R = {(1, 1), (2, 3), (2, 1)} defined on A is

A. {1, 2}
B. {1, 3}
C. {1, 2, 3}
D. None of these

Right Answer Explanation: A
Domain of R = {x $\in$ A: (x, y) $\in$ R for some y $\in$ A} = {1, 2}

Q13.Let A = {a, b, c}. Then, the range of the relation R = {(a, b), (a, c), (b, c)} defined on A is

A. {a, b}
B. {a, b, c}
C. {c}
D. {b, c}

Right Answer Explanation: D
Range of R = {y $\in$ A: (x, y) $\in$ R for some x $\in$ A} = {b, c}

Q14.Let A = {1, 2, 3}. The total no. of distinct relations which can be defined over A is

A. 6
B. 8
C. 2^9
D. None of these

Right Answer Explanation: C
If a set A has x distinct elements, then the number of all relations is 2^{x^2}

Q15. The domain of $f(x) = \sin\left(\log\left(\sqrt{\frac{4-x^2}{1-x}}\right)\right)$ is

A. $(-2,1)\cup(2,\infty)$
B. $(-2,\infty)$
C. $(2,\infty)$
D. None of these

Right Answer Explanation: A

Given $f(x) = \sin\left(\log\sqrt{\frac{4-x^2}{1-x}}\right)$

domain of sin x is R. But domain of log x is $x > 0$. Hence domain of given function is values of x such that $\sqrt{\frac{4-x^2}{1-x}} > 0 \Rightarrow \frac{4-x^2}{1-x} > 0$

$\Rightarrow \frac{(x-2)(x+2)}{x-1} > 0$

$\Rightarrow x \in (-2,1)\cup(2,\infty)$

Q16. Let $f(x) = \frac{1}{1-x}$, then (fofof) (x) equals to

A. x
B. $\frac{1}{1-3x}$
C. $\frac{x}{1-3x}$
D. None of these

Right Answer Explanation: A
Firstly, find (fof) (x) say g(x)
Then find f(g(x)) = x.

Q17. Which of the following functions is an even function?

A. $f(x) = x(x^2 - x^4)$
B. $f(x) = \sin(5x + x^3)$
C. $f(x) = x^2 - 3x + 4$
D. $f(x) = x^2 + |x|$

Right Answer Explanation: D
For a function to be an even function, f(– x) = f(x) for all x.
Consider (1): $f(x) = x(x^2 – x^4) = x^3 – x^5$
$f(– x) = (– x)^3 – (– x)^5 = – x^3 + x^5 = – (x^3 – x^5)$ f(– x) □ f(x)
Thus, f(x) is not an even function. It is an odd function as, f(– x) = – f(x).
Consider (2): $f(x) = \sin(5x + x^3)$
$f(– x) = \sin(– 5x + (– x)^3) = \sin(– 5x – x^3) = \sin(–(5x + x^3)) = – \sin(5x + x^3)$
f(– x) ≠ f(x) This function is not an even function. It is an odd function.
Consider (3): $f(x) = x^2 – 3x + 4$; $f(– x) = x^2 + 3x + 4$ f(– x) ≠ f(x)
Also, f(– x) ≠ – f(x) This function is neither an even function nor an odd function.
Consider (4): $f(x) = x^2 + |x|$
$f(– x) = x^2 + |– x| = x^2 + |x| = f(x)$
This function is an even function.

Q18. Domain of the real function $\sqrt{2 - x} - \frac{1}{\sqrt{9 - x^2}}$ is

A. (– 3, 1)
B. [– 3, 1]
C. (– 3, 2]
D. [– 3, 1)

Right Answer Explanation: C

Calculate the domain of $\sqrt{2 - x}$ and $\frac{1}{\sqrt{a - x^2}}$ and then find out where it intersects.

Q19. If the binary operation*, defined on Q, is defined as a*b = 2a + b –ab, for all as b ∈ Q find the value of *4.

A. 2
B. 4
C. -2
D. None of these

Solution: C

Given that, a*b = 2a + b – ab, ∀ a, b ∈ Q.

On putting a = 3 and b = 4, we get

3*4 = 2. 3 + 4 – 3. 4

= 6 + 4 -12 = -2

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Q20. Let *: R × R → R is defined as a*b = 2a + b. find (2*3)*4.

A. 24
B. -18
C. 14
D. None of these

Solution: D

Given that, *: R × R → R

Such that a*b = 2a + b.

On putting a = 2 and b = 3, we get

(2*3) = 2 (2) + 3 = 4 + 3 = 7

∴ (2*3)*4=7*4 = 2 (7)+4 =14 +4 =18