

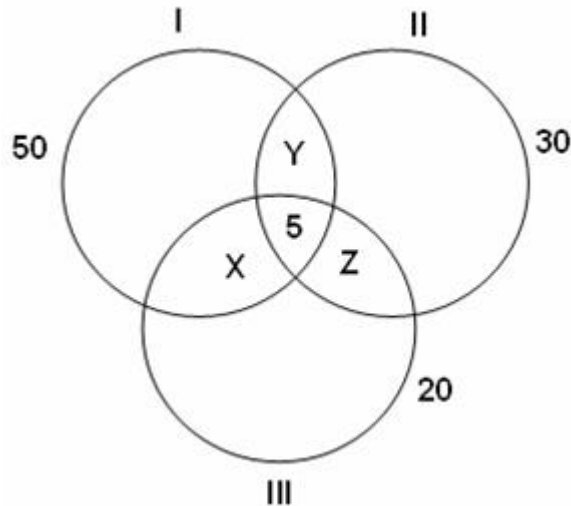
Class: XI
Subject: Maths
Topic: Sets Relations and Functions and Logarithm
No. of Questions: 20
Duration: 60 Min
Maximum Marks: 60

1. In a survey of political preference, people were asked to give their preference on three government proposals I, II and III. 78% were in favour of at least one of the proposals, 50% favoured proposal I, 30% favoured proposal II and 20% favoured proposal III. If 5% favoured all the three proposals, what percent of people favoured more than one of the three proposals?

- (A) 5%
- (B) 12%
- (C) 17%
- (D) None of these

Sol. C

Right Answer Explanation:



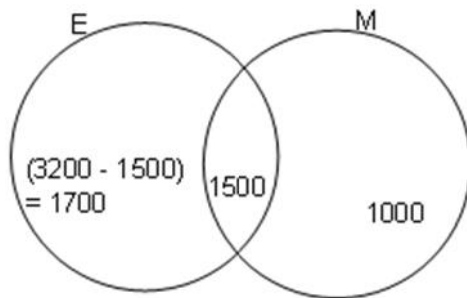
$$78 = 50 - (x + y + 5) + 30 - (y + z + 5) + 20 - (x + z + 5) + (x + y + z) + (5) \text{ or } 78 = 100 - (x + y + z) - 10$$
$$\text{or } (x + y + z) = 12 \text{ and required answer } 12 + 5 = 17\%$$

2. In a town with a population of 5000, the number of people who are egg eaters is 3200. If 2500 are meat eaters and 1500 eat both egg and meat. How many of them eat neither meat nor egg?

- (A) 4200
- (B) 1500
- (C) 800
- (D) None of these

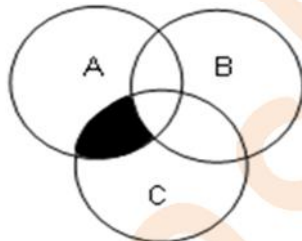
Sol. C

Right Answer Explanation:



The total number of egg or meat eaters = $1700 + 1500 + 1000 = 4200$
Number of pure vegetarians = $5000 - 4200 = 800$

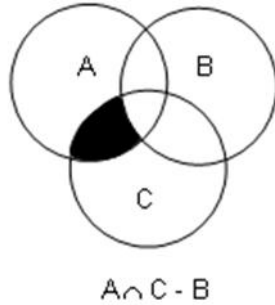
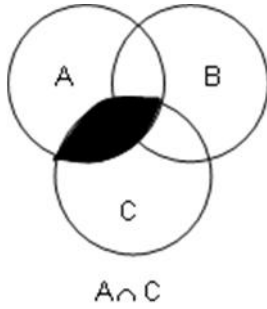
3. The shaded area in this diagram represents



- (A) $A \cap C$
- (B) $(A \cap B) - C$
- (C) $(A - C) \cap (A - B)$
- (D) $(A \cap C) - B$

Sol. D

Right Answer Explanation:



4. In a college, 40% of the students play basketball, 34% play tennis and 234 play both the games. The number of students who play neither basketball nor tennis is 52%. What is the number of students in the college?

- (A) 1050
- (B) 1000
- (C) 900
- (D) None of these

Sol. C

Right Answer Explanation:

Let B and T represent the sets of students who play basketball and tennis.

Number of students who do not play basketball = $100 - 40 = 60\%$

Number of students who do not play tennis = $100 - 34 = 66\%$

Number of students who play neither basketball nor tennis = 52%

From the Venn diagram, $8 + 52 + 14 = 74\%$ do not play either basketball or tennis and $100 - 74 = 26\%$ play both.

This number is equal to 234.

Total number of students in the college = $234/26 \times 100 = 900$

5. In a party, 40 people drank tea, 30 people drank coffee, 25 drank juice, 15 drank tea and coffee, 12 drank juice and tea, 8 drank coffee and juice, and 5 drank all the three. How many people drank only coffee?

- (A) 15
- (B) 12
- (C) 17
- (D) Cannot be determined

Sol. B

Right Answer Explanation:

Those who only drink coffee are $30 - 10 - 5 - 3 = 12$

6. 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.

Sol. A

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

Domain of $\sin x$ is \mathbb{R} . But domain of $\log x$ is $x > 0$. Hence domain of given function is values of x such that

$$\sqrt{\frac{4-x^2}{1-x}} > 0 \Rightarrow \frac{4-x^2}{1-x} > 0$$

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

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

Hence (A) is the correct answer.

7. The period of $f(x) = \sin 3f\{x\} + \tan f[x]$ is:

(A) 0

(B) 1

(C) π

(D) None of these.

Sol. B

$\tan \pi[x] = 0$ because $\pi[x]$ will always be integral multiple of π

$$\Rightarrow f(x) = \sin 3\pi\{x\}$$

Hence period of $f(x)$ is 1

Hence (B) is the correct answer

8. If $f(x) = (3 - x^7)^{\frac{1}{7}} \forall x \in R$, then $f(f(x)) =$

(A) x

(B) x^2

(C) x^7

(D) $x - x^7$

Sol. A

$$f(x) = (3 - x^7)^{1/7}$$

$$f(f(x)) = (3 - f(x)^7)^{1/7} = (3 - ((3 - x^7)^{1/7})^7)^{1/7} = x$$

Hence (A) is the correct answer.

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

(A) $R = A \cup B$

(B) $R = A \times B$

(C) $R \subset A \times B$.

(D) None of these

Ans. (D) By definition R will be $A \times B$ or subset of $A \times B$

10. What is the range of the function $f(x) = \frac{|x-1|}{x-1}, x \neq 1$?

Solution

Given function is, $f(x) = \frac{|x-1|}{x-1}, x \neq 1$

The above function may be written as

$$f(x) = \begin{cases} \frac{x-1}{x-1}, & \text{if } x > 1 \\ -\frac{(x-1)}{x-1}, & \text{if } x < 1 \end{cases}$$

$$\Rightarrow f(x) = \begin{cases} 1 & \text{if } x > 1 \\ -1 & \text{if } x < 1 \end{cases}$$

∴ Range of $f(x)$ is the set $\{-1, 1\}$.

11. Let $A = \{p, q, r, s\}$ and $B = \{1, 2, 3\}$. Which of the following relations from A to B is not a function?

(A) $R_1 = \{(p, 1), (q, 2), (r, 1), (s, 2)\}$

(B) $R_2 = \{(p, 1), (q, 1), (r, 1), (s, 1)\}$

(C) $R_3 = \{(p, 1), (p, 2), (r, 2), (s, 2)\}$

(D) $R_1 = \{(p, 2), (q, 3), (r, 2), (s, 2)\}$

Sol. C

$$R_3 = \{(p, 1), (p, 2), (r, 2), (s, 2)\}$$

is not a function as p is having 2 images which is violating definition of function

Hence (C) is the correct answer.

12. If $(\log_5 x)^2 + \log_5 x < 2$, then x belongs to:

(A) $\left(\frac{1}{25}, 5\right)$

(B) $\left(\frac{1}{5}, \frac{1}{\sqrt{5}}\right)$

(C) $(1, \infty)$

(D) none of these

Sol. A

$$\text{We have } (\log_5 x)^2 + \log_5 x < 2$$

$$\text{Put } \log_5 x = a \text{ then } a^2 + a < 2$$

$$\Rightarrow a^2 + a - 2 < 0 \Rightarrow (a + 2)(a - 1) < 0$$

$$\Rightarrow -2 < a < 1 \text{ or } -2 < \log_5 x < 1$$

$$\therefore 5^{-2} < x < 5$$

$$\text{i.e. } 1/25 < x < 5$$

Hence (A) is the correct answer.

13. Solution set of the inequality $5^{x+2} > \left(\frac{1}{25}\right)^{\frac{1}{x}}$ is:

- (A) $(-2, 0)$
- (B) $(0, \infty)$
- (C) $(-5, 5)$
- (D) $(-2, 2)$

Sol. B

$$\text{We have } 5^{x+2} > \left(\frac{1}{25}\right)^{\frac{1}{x}} \left(\begin{array}{l} \text{If } a > 1, \text{ then} \\ a^m > a^n \Rightarrow m > n \end{array} \right)$$

$$\Rightarrow 5^{x+2} > 5^{-\frac{2}{x}}$$

$$\Rightarrow x + 2 > -\frac{2}{x}$$

$$\Rightarrow \left(\frac{x^2 + 2x + 2}{x}\right) > 0$$

$$\Rightarrow \frac{1}{x} > 0 \Rightarrow x \in (0, \infty)$$

Hence (B) is the correct answer.

14. If $x = \frac{(7+5\sqrt{2})^{\frac{1}{3}}}{2+2\sqrt{2}}$, then x belongs to:

- (A) $(2, 3)$
- (B) $(0, 1)$
- (C) $(-1, 0)$
- (D) $(3, 4)$

Sol. B

Cube both the sides, we get

$$x^3 = \frac{7+5\sqrt{2}}{8(7+5\sqrt{2})} = \frac{1}{8}$$

$$\Rightarrow x = \frac{1}{2}. \text{ Clearly } x \text{ lies between } 0 \text{ and } 1.$$

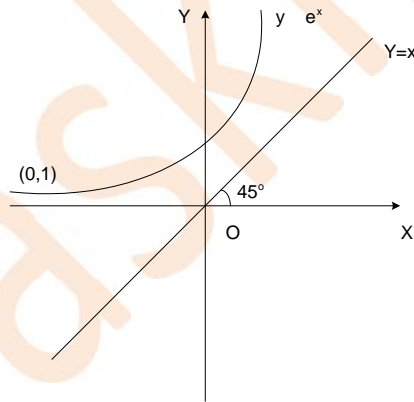
Hence (B) is the correct answer.

15. If $A = \{ (x, y) | y = e^x, x \in \mathbb{R} \}$ and $B = \{ (x, y) | y = x, x \in \mathbb{R} \}$, then

- (A) $A \subseteq B$
- (B) $A \subset B$
- (C) $A \cap B = \emptyset$
- (D) $A \cap B \neq \emptyset$

Sol. C

A is the set of all points on the graph of $y = e^x$. B is the set of all points on the line $y = x$. Since the curves are non-intersecting, we have $A \cap B = \emptyset$.



Hence (C) is the correct answer.

16. Let $R = \{(x, y) : x^2 + y^2 = 1, x, y \in \mathbb{R}\}$ be a relation in \mathbb{R} . The relation R is:

- (A) reflexive
- (B) symmetric
- (C) transitive
- (D) anti-symmetric

Sol. B

We have $R = \{(x, y) : x^2 + y^2 = 1; x, y \in \mathbb{R}\}$.

$$(4)^2 + (4)^2 = 32 \neq 1 \therefore (4, 4) \notin R.$$

$\therefore R$ is not reflexive.

$$\text{Let } (x, y) \in R \therefore x^2 + y^2 = 1$$

$$\Rightarrow y^2 + x^2 = 1 \Rightarrow (y, x) \in R$$

$\therefore R$ is symmetric.

$(0, 1), (1, 0) \in R$ because

$$(0)^2 + (1)^2 = 1 \text{ and } (1)^2 + (0)^2 = 1.$$

Also $(0)^2 + (0)^2 = 0 \neq 1 \therefore (0, 0) \notin R$.

$\therefore R$ is not transitive.

Hence (B) is the correct answer.

17. The range of the function $f(x) = [\sin x]$ is

- (A) $[1, 1]$
- (B) $\{1, -1\}$
- (C) $(-1, 1)$
- (D) $\{-1, 0, 1\}$

Sol. D

Right Answer Explanation:

We know that the range of $\sin x$ is $[-1, 1]$, but as $[]$ here refers to greatest integer function, so the outcomes will only be the integers ranging in $[-1, 1]$, which are $\{-1, 0, 1\}$.

18. The range of the function $f(x) = x - [x]$ is

- (A) $[0, 1)$
- (B) $[0, 2]$
- (C) $(0, 1)$
- (D) None of these

Sol. A

Right Answer Explanation:

When the left most integer is subtracted from its corresponding real number, the result will always range between 0 and 1 (1 not included).

19. The domain of $(2, 3), (4, 5), (6, 7)$ is

- (A) $(3, 4, 7)$
- (B) $(2, 4, 6)$
- (C) $(2, 5, 7)$
- (D) None of these

Sol. B

Right Answer Explanation:

Let the given relation be R.

In the relation R from $A \rightarrow B$, $x \in A$ and $y \in B$ and $(x, y) \in R$, set A will contain x part of each ordered pair (x, y) . Hence, A is $\{2, 4 \text{ and } 6\}$.

20. Write fog, if $f: R \rightarrow R$ and $g: R \rightarrow R$ are given by $f(x) = |x|$ and $g(x) = |5x - 2|$

- (A) $|5x-2|$
- (B) $|5|x|-2|$
- (C) $|2-5|x||$
- (D) $5|x|-2$

Ans. A

Given, $f(x) = |x|$, $g(x) = |5x - 2|$

Now, $f \circ g(x) = f[g(x)] = f\{|5x - 2|\}$

$=||5x - 2|| = |5x - 2|$