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Class: XI
Subject: Maths
Topic: Sets, Relation, Functions and Logarithms
No. of Questions: 21

Q1. Which of the following is a set?

A. Collection of all the intelligent students of a given class
B. Collection of all the beautiful girls in given locality
C. Collection of all the grounds on which Sachin has made a century
D. Collection of all the talented cricketers of India

Sol: C

At set is a collection of distinct elements which can be well defined.
$\therefore$ 3rd option is correct which a well-defined collection is.

Q2. Which of the following operations is not a valid operation in set theory?

A. Union of two sets
B. Intersection of two sets
C. Difference of two sets
D. None of these

Sol: D

Option (1), (2) and (3) are valid operations in set theory.

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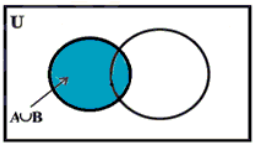
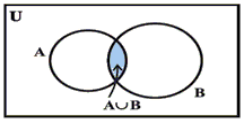
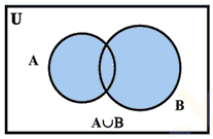
Q3. Which of the following diagrams correctly represents union of two sets A & B?

A. 

B. 

C. 

D. None of these

Sol: C

Union of two sets A and B means the set which contains all the elements of A and B and the common elements being taken only once.As option (1) represents set A, option (2) represents $A \cap B$.

$\therefore$ Option (3) is correct.

Q4. When are two sets equal?

A. If they have same number of members.
B. If they have same members.
C. If they have members of same nature.
D. None of these

Sol: B

Two sets are equal when they have same members

Q5. In a group of 50 persons, everyone takes either tea or coffee. If 35 take tea and 25 take coffee, then the number of persons who take both tea and coffee is

A. 10
B. 25
C. 35
D. 60

Sol: A

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$n(T \cap C) = n(T) + n(C) - n(T \cup C)$
$= 35 + 25 - 50$
$= 60 - 50 = 10$

Q6. Match the following:

p. Natural numbers (N)	a. {1, 2, 3, ...}
q. Whole numbers (W)	b. Integers – negative integers
r. Rational numbers (Q)	c. N ∪ W ∪ Integers ∪ Q
s. Real numbers (R)	d. W ∪ integers ∪ fractions

A. p - b, q - a, r - d, s - c
B. p - b, q - a, r - c, s - d
C. p - a, q - b, r - d, s - c
D. none of these

Sol: C

Real numbers also represents set of irrational number which is not included in any of the options.

Q7. If set A = {3, 15, 4, 7} and if we denote each element of set a as 'n' then, which of the following sets represents the elements of the type '2n + 1'

A. {7, 61, 9, 15}
B. {7, 9, 15, 31}
C. (7, 61, 9, 15)
D. {7, 31, 15, 29}

Sol: B

Put n = 3, 15, 4, 7 in 2n + 1
$\therefore$ Only 2nd option is correct.

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Q8. In a town, 48% people are educated, 51% people are young and 60% are servicemen. 24% are educated and young, 25% are young and servicemen, 27% are educated and servicemen and 5%have all the qualities. If the total number of persons in this town is 300, what is the ratio of those who have exactly two characteristics and those who have only one characteristic?

A. $\frac{31}{22}$
B. $\frac{47}{61}$
C. $\frac{61}{47}$
D. None of these

Sol: D

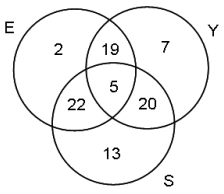
Ratio = $\frac{\text{The no. of persons who have exactly two characteristics}}{\text{The no. of persons who have exactly only one characteristics}}$ = 61 / 22

Q9. In a town, 48% people are educated, 51% people are young, 60% are servicemen, 24% are Educated and young, 25% are young and servicemen, 27% are educated and servicemen and 5% have all three characteristics. How many people (in percentage terms) do not have any of these three characteristics?

A. 12%
B. 0%
C. 9%
D. None of these

Sol: A

With the help of Venn diagram



Total number of persons who have at least one characteristic
= 2 + 19 + 7 + 22 + 5 + 20 + 13 = 88%
So, the persons who do not have any of these characteristics
= 100 – 88 = 12%

Q10. Which of the following statements are false?

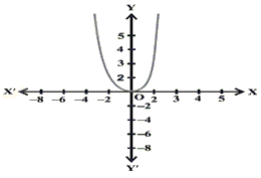
a. Every function is a relation but every relation is not a function
b. Every relation is a function but every function is not a relation
c. There is no relation between functions and relations.
d. Function is just another name of relation.

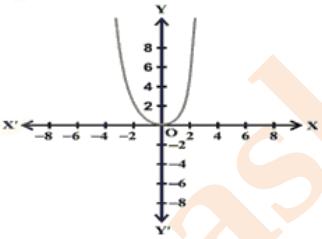
A. a, c and d
B. a, b and d
C. b, c and d
D. a, b and c

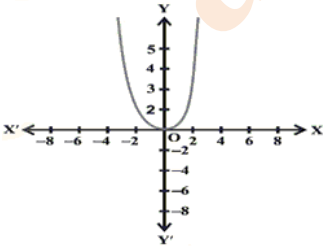
Sol: C

Every function is a relation.

Q11. Which of the following is/are graph(s) of $f(x) = x^2$?

A. 

B. 

C. 

D. All of the above

Sol: B

After calculating domain and range of $f(x) = x^2$
The point which are coming out are (– 2, 4), (– 1, 1), (0, 0), (1, 1), (2, 4)
Scale = 5 small divisions = 1 unit

Q12. Let A and B be two given sets, then in order to define a relation on these two sets which of the following must hold?

A. Relation can be defined between any two sets
B. One of them should be non-empty
C. Both of them should be non-empty
D. There must be some connection between these two sets

Sol: C

A relation between two given sets A and B can be defined when both of them are non-empty.

Q13. If P and Q are two non-empty sets, then which of the following statements defines cartesian product most appropriately?

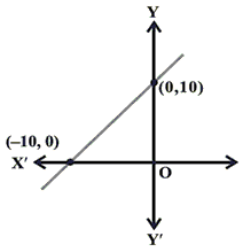
A. $P \times Q = \{(p , q) : p \in P, q \in Q\}$
B. $P \times Q = \{p \times q : p \in P, q \in Q\}$
C. $P \times Q = \{p\, q : p \in P, q \in Q\}$
D. $P \times Q = \{(q , p) : p \in P, q \in Q\}$

Sol: A

The Cartesian product of two sets (p, q) is represented as $P \times Q = \{(p, q) : p \in P, q \in Q\}$

Q14. Which of the following graphs will give all the real numbers as its values?

A.



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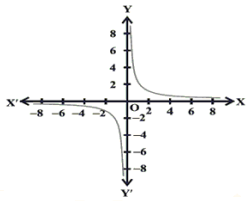
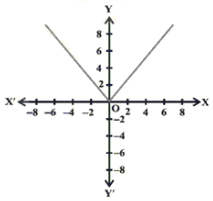
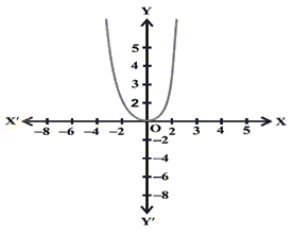
B. 

C. 

D. 

Sol: A

Option (2) is incorrect because function can't achieve zero.
Option (3) and (4) is incorrect because the function can't achieve negative real values.
Hence (1) is correct.

Q15. Which of the following is true?

A. If we draw a line parallel to y-axis then it can cut the graph of a function at atmost 2 points
B. If we draw a line parallel to y-axis then it can cut the graph of a function at atmost 1 point
C. If we draw a line parallel to x-axis then it can cut the graph of a function at atmost 1 point
D. All of the above are true

Sol: B

Option (1) is rejected because it is not a function.
Option (3) is rejected because after drawing the graph of sin x.

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Q16. The value of $2 \log \frac{5}{3} - \log \frac{7}{4} + 2 \log 3 + \frac{1}{2} \log 49$ is

A. log 2
B. 0
C. 2
D. 3

Sol: C

$2 \log 5/3 - \log 7/4 + 2 \log 3 + \frac{1}{2} \log 49$

$= 2(\log 5 - \log 3) - (\log 7 - \log 4) + 2 \log 3 + \log (7^2)^{\frac{1}{2}}$
$= 2\log 5 - 2 \log 3 - \log 7 + 2 \log 2 + 2 \log 3 + \log 7$
$= 2 (\log 5 + \log 2) = 2 \log (10) = 2$

Q17. The possible value(s) of x for the equation $\log_2 x^2 + \log_x 2 = 3$ is/are

A. 2, $\sqrt{2}$
B. $1 \pm \sqrt{2}$
C. 1, $\sqrt{2}$
D. $2 \pm \sqrt{2}$

Sol: C

Q18. If log(a – b) = log a – log b, then find a in terms of b.

A. $\frac{b^2}{b-1}$
B. $\frac{b^2}{b+1}$
C. $\frac{b}{b^2+1}$
D. None of these

Sol: A

$\log (a - b) = \log a - \log b$

$\log (a - b) = \log \left(\frac{a}{b}\right)$

$a - b = \frac{a}{b}$

$ab - b^2 = a$

$ab - a = b^2$

$a (b - 1) = b^2$

$a = \frac{b^2}{(b - 1)}$.

Q19. $\log_3 x - \log_x 27 < 2$ for any x in

A. $(\frac{1}{3}, 27)$

B. $(\frac{1}{27}, 3)$

C. $(\frac{1}{9}, 9)$

D. None of these

Sol: D

$\log_3 x - \log_x 27 < 2$

$\frac{\log x}{\log 3} - \frac{\log 3^3}{\log x} < 2$

$\frac{\log x}{\log 3} - \frac{3\log 3}{\log x} < 2$

$\log_3 x - \frac{3}{\log_3 x} < 2$

Put $\log_3 x = y$

$y - \frac{3}{y} < 2$

Q20. $0.2^{\log_{\sqrt{5}}\left(\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\ldots\ldots\infty\right)}$

A. 2
B. 4
C. 1
D. None of these

Sol: B

$$0.2^{\log_{\sqrt{5}}\left[\frac{\frac{1}{4}}{1-\frac{1}{2}}\right]}$$

$$= 0.2^{\log_{\sqrt{5}}\left[\frac{1}{2}\right]} = 5^{-1\,[\log_{\sqrt{5}} 1 - \log_{\sqrt{5}} 2]}$$

$$= 5^{[\log_{\sqrt{5}} 2]} = 5^{[\log_5 2 / \log_5 \sqrt{5}]} = 5^{[\log_5 2 / \left(\frac{1}{2}\right)]}$$

$$= 5^{2\log_5 2} = 5^{\log_5 2^2} = 2^2 = 4.$$

Q21. If $(\log_e x)^2 - 5\log_e x + 6 = 0$, then the value(s) of x could be

A. 2
B. e^2
C. e^3
D. Both (2) and (3)

Sol: D

Let Log x = y, then the given equation becomes $y^2 - 5y + 6 = 0$. y = 2 or y = 3.
Hence Log x = 2 or Log x = 3. $x = e^2$ or $x = e^3$.