Class: 11th Spark

Subject: Mathematics

Topic: Sets (Previous Year Questions)

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1. Out of all the patients in a hospital 89% are found to be suffering from heart ailment and 98% are suffering from lungs infection. If K% of them are suffering from both ailments, then K cannot belong to the set

   [JEE (Main) 2021]

   (a) {79,81,83,85}
   (b) {84,87,90,93}
   (c) {80,83,86,89}
   (d) {84,86,88,90}

2. Let Z be the set of all integers,
   A= {(x, y) ∈ Z×Z: $(x-2)^2 + y^2 \leq 4$}
   B= {(x, y) ∈ Z×Z: $x^2 + y^2 \leq 4$} and
   C= {(x, y) ∈ Z×Z: $(x - 2)^2 +$
        $(y - 2)^2 \leq 4$}

   [JEE (Main) 2021]

   If the total number of relations form A ∩ B to A ∩ C is 2^ρ, then the value of ρ is
   (a) 25
   (b) 9
   (c) 16
   (d) 49

3. Let A = {(x, y) ∈ R×R | $2x^2 + 2y^2 - 2x - 2y = 1$},
   B = {(x, y) ∈ R×R | $4x^2 + 4y^2 - 16y + 7 = 0$} and
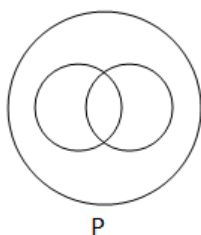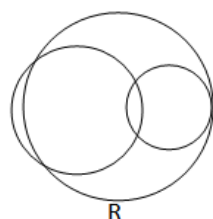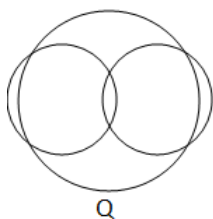   C = {(x, y) ∈ R×R | $x^2 + y^2 - 4x - 2y + 5 \leq r^2$}   **[JEE (Main) 2021]**
   Then the minimum value of |r| such that A ∪ B ⊆ C is equal to

   (a) $1 + \sqrt{5}$
   (b) $\frac{3 + 2\sqrt{5}}{2}$
   (c) $\frac{3 + \sqrt{10}}{2}$
   (d) $\frac{2 + \sqrt{10}}{2}$

4. In a school, there are three types of games to be played. Some of the students play two types of games, but none play all the three games. Which Venn diagrams can justify the above statement?

   [JEE (Main) 2021]

P

Q

R

(a) None of these
(b) P and Q
(c) P and R
(d) Q and R

5. Let S_1, S_2 and S_3 be three sets defined as   **[JEE (Main) 2021]**

$S_1 = \{z \in C: |z-1| \leq \sqrt{2}$

$S_2 = \{z \in C: \text{Re}\,((1-i)\,z) \geq 1\}$

$S_3 = \{z \in C: \text{Im}\,(z) \leq 1\}$

Then the set $S_1 \cap S_2 \cap S_3$

(a) Has exactly two elements
(b) Has infinitely many points
(c) Has exactly three elements
(d) Is a singleton

6. Consider the two sets : A = { m ∈ R :both the roots of $x^2 - (m+1)x + m + 4 = 0$ are real} and B = [-3,5)   **[JEE (Main) 2020]**

Which of the following is not true?

(a) A - B =$(-\infty, -3) \cup (5, \infty)$
(b) A ∩ B = {-3}
(c) B − A = (-3,5)
(d) A ∪ B = R

7. A survey shows that 63% of the people in a city read newspaper A, whereas 76% read newspaper B. If x% of the people read both the newspapers, then a possible value of x can be

    [JEE (Main) 2020]

(a) 65
(b) 55
(c) 37
(d) 29

8. Let$\bigcup_{i=1}^{50} X_i = \bigcup_{i=1}^{n} Y_i = T$, where each X_i contains 10 elements and Y_i contains 5 elements. If each element of the set T is an element of exactly 20 of sets $X_i's$ and exactly 6 of sets $Y_i's$, then n is equal to   **[JEE (Main) 2020]**

(a) 45
(b) 30
(c) 50
(d) 15

9. A survey shows that 73% of the persons working in an office like coffee, whereas 65% in tea. If x denotes the percentage of them, who like both coffee and tea, then x cannot be

[JEE (Main) 2020]

(a) 63
(b) 36
(c) 54
(d) 38

10. If A = { x ∈ R: |x| <2} and B = { x ∈ R: |x - 2| ≥ 3};
Then **[JEE (Main) 2020]**

(a) A − B = [-1,2)
(b) B − A = R −(-2,5)
(c) A ∪ B = R −(2,5)
(d) A ∩ B = (-2,-1)

11. Two newspapers A and B are published in a city. It is known that 25% of the city population reads a and 20% reads B while 8% reads both A and B. Further, 30% of those who read A but not B look into advertisements and 40% of those who read B but not A also look into advertisements, while 50% of those who read both A and B look into advertisements. Then the percentage of the population who look into advertisement is

[JEE (Main) 2019]

(a) 13.5
(b) 13.9
(c) 13
(d) 12.8

12. Let A, B and C be sets such that $\phi \neq A \cap B \subseteq C$. Then which of the following statements is not true?

(a) $B \cap C \neq \phi$ **[JEE (Main) 2019]**
(b) If (A-C) ⊆ B, then A⊆B
(c) (C ∪ A) ∩ (C ∪ B)=C
(d) If (A-B) ⊆ C, then A⊆ C

13. In a class of 140 students numbered 1 to 140, all even numbered students opted Mathematics course, those whose number is divisible by 3 opted Physics course and those whose number is divisible by 5 opted Chemistry course. Then the number of students who did not opt for any of the three courses is **[JEE (Main) 2019]**

(a) 102
(b) 38
(c) 1
(d) 42

14. Let S = {1, 2, 3, …., 100}. The number of non-empty subsets A of S such that the product of elements in A is even is **[JEE (Main) 2019]**

(a) $2^{50}(2^{50}-1)$
(b) $2^{50}-1$
(c) $2^{50}+1$
(d) $2^{100}-1$

15. Two sets A and B as under :
A = {(a, b) ∈ R × R: |a-5|<1 and |b-5|<1};
B = {(a, b) ∈ R × R: $4(a-6)^2 + 9(b-5)^2 \leq 36$
Then **[JEE (Main) 2018]**

(a) Neither A ⊂ B nor B ⊂ A
(b) B ⊂ A
(c) A ⊂ B

(d) A ∩ B = φ (an empty set)

16. In a certain town, 25% of the families own a phone and 15% own a car, 65% families own neither a phone nor a car and 2000 families own both a car and a phone. Consider the following three statements :

[JEE (Main) 2015]

(1) 5% families own both a car and a phone
(2) 35% families own either a car or a phone
(3) 40,000 families live in the town
    Then
(a) Only (1) and (2) are correct
(b) Only (1) and (3) are correct
(c) Only (2) and (3) are correct
(d) All (1), (2) and (3) are correct

17. If A, B and C are three sets such that **[JEE (Main) 2009]**
    A ∩ B = A ∩ C and A ∪ B = A ∪ C, then
(a) A = C
(b) B = C
(c) A ∩ B = φ
(d)   A = B

18. The set S = {1, 2, 3,…., 12} is to be partitioned into three sets A, B, C of equal size. Thus A ∪ B ∪ C = S, A ∩ B = B ∩ C = A ∩ C = φ. Thus number of ways to partition S is **[JEE (Main) 2007]**

(a) $\dfrac{12!}{(4!)^3}$

(b) $\dfrac{12!}{(4!)^4}$

(c) $\dfrac{12!}{3!(4!)^3}$

(d) $\dfrac{12!}{3!(4!)^4}$

NUMERICAL VALUE TYPE

19. If A = { x ∈ R : |x -2|>1}, B = { x ∈ R : $\sqrt{x^2 - 3}$ > 1} , C = { x ∈ R : |x -4|≥2} and Z is the set of all integers, then the number of subsets of the set (A ∩ B ∩ C)^c ∩ Z is _____.   **[JEE (Main) 2021]**

20. The sum of all the elements in the set {n ∈ {1, 2,…., 100}| H.C.F. of n and 2040 is 1} is equal to ____.

[JEE (Main) 2021]

21. Let A = {n ∈ N: n is a 3-digit number}
    B = {9k+2: k ∈ N} and
    C = {9k+ l: k ∈ N} for some l (0<l<9)
    If the sum of all the elements of the set the set A ∩ (B ∪ C) is 2.74 × 400, then l is equal to _____.
[JEE (Main) 2021]

22. Set A has m elements and Set B has n elements. If the total number of subsets of A is 112 more than the total number subsets of B, then the value of m·n is _____.   **[JEE (Main) 2020]**

23. Let X = {n ∈ N: 1 ≤ n ≤ 50}. If {n ∈ X: n is a multiple of 2} and B = {n ∈ X: n is a multiple of 7}, then the number of elements in the smallest subset of X containing both A and B is ____.

[JEE (Main) 2020]

ANSWER KEY

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
(a)	(a)	(b)	(a)	(b)	(a)	(b)	(b)	(b)	(b)
11.	**12.**	**13.**	**14.**	**15.**	**16.**	**17.**	**18.**	**19.**	**20.**
(b)	(b)	(b)	(a)	(c)	(d)	(b)	(a)	(256)	(1251)
21.	**22.**	**23.**							
(5)	(28)	(29)							