Past year questions form Sets and Cartesian Products

3 JEE Main 2021 (Online) 26th August Morning Shift

MCQ (Single Correct Answer)

Out of all 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 can not belong to the set :

A {80, 83, 86, 89}

B {84, 86, 88, 90}

C {79, 81, 83, 85}

D {84, 87, 90, 93}

## Explanation

$n(A \cup B) \geq n(A) + n(B) - n(A \cap B)$

$100 \geq 89 + 98 - n(A \cup B)$

$n(A \cap B) \geq 87$

$87 \leq n(A \cap B) \leq 89$

Concepts used here are simple set theory results.

NOTE: Although there are almost no question specifically from cartisian products, but it is a concept that helps in more complex problems from relations and functions. So do learn it.

4 JEE Main 2021 (Online) 16th March Morning Shift

MCQ (Single Correct Answer)

The number of elements in the set $\{x \in R : (|x| - 3)|x + 4| = 6\}$ is equal to :

A 4

B 2

C 3

D 1

## Explanation

Case 1 :

$x \leq -4$

$(-x - 3)(-x - 4) = 6$

$\Rightarrow (x + 3)(x + 4) = 6$

$\Rightarrow x^2 + 7x + 6 = 0$

$\Rightarrow x = -1$ or $-6$

but $x \leq -4$

$x = -6$

Case 2 :

$x \in (-4, 0)$

$(-x - 3)(x + 4) = 6$

$\Rightarrow -x^2 - 7x - 12 - 6 = 0$

$\Rightarrow x^2 + 7x + 18 = 0$

$D < 0$ No solution

Case 3 :

$x \geq 0$

$(x - 3)(x + 4) = 6$

$\Rightarrow x^2 + x - 12 - 6 = 0$

$\Rightarrow x^2 + x - 18 = 0$

$x = \frac{-1 \pm \sqrt{1+72}}{2}$

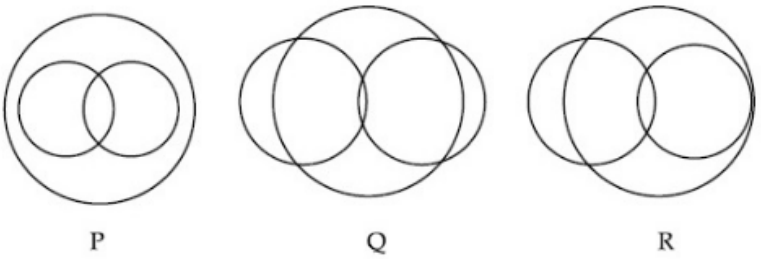
$\therefore x = \frac{\sqrt{73}-1}{2}$ only

This problem does seem lengthy but the concept used here is very basic. It is just an repetative application quadratic equations and set theory.

2 JEE Main 2021 (Online) 17th March Morning Shift

MCQ (Single Correct Answer)

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?




A Q and R

B None of these

C P and R

D P and Q

## Explanation

As none play all three games the intersection of all three circles must be zero.

Hence none of P, Q, R justify the given statement

It is an application of Venn diagrams concept from set theory.

1 JEE Main 2021 (Online) 31st August Evening Shift

Numerical

The number of 4-digit numbers which are neither multiple of 7 nor multiple of 3 is _____.

## Answer

Correct Answer is **5143**

## Explanation

A = 4-digit numbers divisible by 3

A = 1002, 1005, ....., 9999.

$9999 = 1002 + (n - 1)3$

$\Rightarrow (n - 1)3 = 8997 \Rightarrow n = 3000$

B = 4-digit numbers divisible by 7

B = 1001, 1008, ....., 9996

$\Rightarrow 9996 = 1001 + (n - 1)7$

$\Rightarrow n = 1286$

$A \cap B$ = 1008, 1029, ....., 9996

$9996 = 1008 + (n - 1)21$

$\Rightarrow n = 429$

So, no divisible by either 3 or 7

$= 3000 + 1286 - 429 = 3857$

total 4-digits numbers = 9000

required numbers = $9000 - 3857 = 5143$

2 JEE Main 2020 (Online) 5th September Morning Slot

MCQ (Single Correct Answer)

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

A 63

B 36

C 54

D 38

## Explanation

C → person like coffee

T → person like Tea

$n(C) = 73$

$n(T) = 65$

$n(C \cup T) \leq 100$

$n(C) + n(T) - n(C \cap T) \leq 100$

$73 + 65 - x \leq 100$

$x \geq 38$

$73 - x \geq 0 \Rightarrow x \leq 73$

$65 - x \geq 0 \Rightarrow x \leq 65$

$\therefore 38 \leq x \leq 65$

Once again basic set theory concepts are used here.