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56 Students Selected in JEE Advanced 2016 out of 129 JEE Main 2016 Selection Success Ratio 43%

Also JEE Main 2016 Maths Marks 115/120 Siddharth Agrawal, 100/120 Himanshu Shukla, 100/120 Nikhil Jaiswal,

93/120 Swastik Sharma, 93/120 Shashwat Rangnekar & Our 112+ Students Selected for Advanced

46 Students, Scored 90% or More in Maths Class 12 (8 in M. P. Board with state Rank 7<sup>th</sup> Shivansh Maheshwari) (38 in CBSE)

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JEE MAIN 2017: SELECTIONS 115+ WITH MARKS 288, 288, 264, 250, 241, 240, 218, 214, 195, 193, 191, 187 OUT OF 360

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Q.3  $\lim_{x \rightarrow 0^+} x \left[ \left[ \frac{1}{x} \right] + \left[ \frac{2}{x} \right] - \dots - \left[ \frac{15}{x} \right] \right]$

Sol<sup>n</sup>: Since  $\star - 1 < [\star] \leq \star$

$$\frac{1}{x} - 1 + \frac{2}{x} - 1 \leq \left( \left[ \frac{1}{x} \right] + \left[ \frac{2}{x} \right] - \dots - \left[ \frac{15}{x} \right] \right) \leq \frac{1}{x} + \frac{2}{x} - \frac{15}{x}$$

$$\frac{15.16}{2x} - 15 \leq \left[ \frac{1}{x} \right] + \left[ \frac{2}{x} \right] - \left[ \frac{15}{x} \right] \leq \frac{15.16}{2x}$$

$$\frac{120}{x} - 15 \leq \left[ \frac{1}{x} \right] + \left[ \frac{2}{x} \right] - \left[ \frac{15}{x} \right] \leq \frac{120}{x}$$

~~$\lim_{x \rightarrow 0^+} x \left[ \left[ \frac{1}{x} \right] + \left[ \frac{2}{x} \right] - \dots - \left[ \frac{15}{x} \right] \right]$~~   $\lim_{x \rightarrow 0^+} x \star$

By Sandwich  
theo.

$$\lim_{x \rightarrow 0^+} (120 - 15x) \leq \lim_{x \rightarrow 0^+} x \star \leq 120$$

$$\lim_{x \rightarrow 0^+} 120 - 15x \leq L \leq \lim_{x \rightarrow 0^+} 120$$

$$120 \leq L \leq 120$$

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Q.21 Two sets  $A$  &  $B$  are as under:  
 $A = \{(a, b) \in \mathbb{R} \times \mathbb{R} : |a-5| < 1 \dots\}$

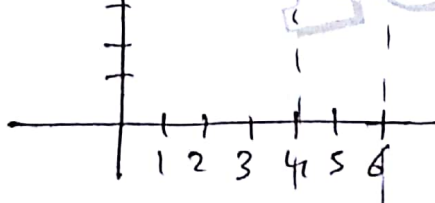
Sol<sup>n</sup>:  $A = \{(a, b) \in \mathbb{R} \times \mathbb{R} : |a-5| < 1 \text{ \& } |b-5| < 1\}$

So  $|a-5| < 1 \Rightarrow -1 < a-5 < 1$

&  $4 < a < 6$

$|b-5| < 1 \Rightarrow -1 < b-5 < 1$

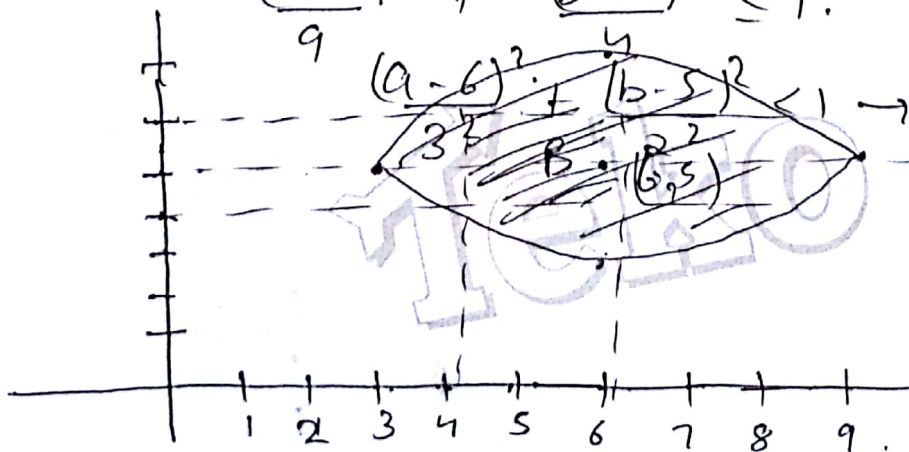
$4 < b < 6$



$B = \{(a, b) \in \mathbb{R} \times \mathbb{R} : 4(a-6)^2 + 9(b-5)^2 \leq 36\}$

$4(a-6)^2 + 9(b-5)^2 \leq 36$

$\frac{(a-6)^2}{9} + \frac{(b-5)^2}{4} \leq 1$



ellipse  
centre  $(6, 5)$   
Major axis  $\rightarrow 6$   
Minor axis  $\rightarrow 4$

$A$  is inside  
of  $B$

$A \subseteq B$



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Q.26 Let A be the sum - - - - -

$$(3) \quad 1^2 + 2 \cdot 2^2 + 3^2 + 2 \cdot 4^2 + 5^2 + 2 \cdot 6^2 - -$$

$$\text{If } B - 2A = 100 \text{ then } d = ?$$

$$S = 1^2 + 2 \cdot 2^2 + 3^2 + 2 \cdot 4^2 - - -$$

$$= 1^2 + 3^2 + 5^2 + 2 \cdot 2^2 + 2 \cdot 4^2 + 2 \cdot 6^2 - - -$$

A → First 20 terms

$$A = \underbrace{1^2 + 3^2 + 5^2 - - -}_{10 \text{ terms}} + \underbrace{2 \cdot 2^2 + 2 \cdot 4^2 + 2 \cdot 6^2 - -}_{10 \text{ terms}}$$

$$= \sum (2n-1)^2 + 2 \cdot \sum (2n)^2$$

$$= \sum 4n^2 + 1 - 4n + 2 \cdot 8 \sum n^2$$

$$\Rightarrow 12 \sum n^2 + \sum 1 - 4 \sum n + 8 \sum n^2 \rightarrow 12 \sum n^2 - 4 \sum n + \sum 1$$

$$\rightarrow \frac{12}{2} \frac{(n)(n+1)(2n+1)}{6} - \frac{4}{2} \frac{(n)(n+1)}{2} + n$$

$$\rightarrow 2n(n+1)(2n+1) - 2n(n+1) + n$$

$$\rightarrow 2n(n+1)(2n+1 - 1) + n$$

$$\rightarrow 4n^2(n+1) + n$$

$$\text{For } A \quad n = 10 \quad \& \quad \text{For } B \quad n = 20$$

$$A \Rightarrow 4410 \quad B = 33620$$

$$B - 2A = 100 \text{ then } d = ?$$

$$24840 = 100d$$

$$d = 248$$



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Q-27 let  $y = y(x)$  be the sol<sup>n</sup> ---  
Ans (4) sol<sup>n</sup>:  $\sin x \frac{dy}{dx} + y \cos x = 4x$ .

$$\frac{d}{dx}(y \sin x) = 4x.$$

$$y \sin x = 2x^2 + C.$$

$$\text{at } x = \frac{\pi}{2} \quad y = 0.$$

$$0 = 2\left(\frac{\pi}{2}\right)^2 + C \rightarrow C = -\frac{\pi^2}{2}$$

$$y \sin x = 2x^2 - \frac{\pi^2}{2} \quad \text{now } x = \frac{\pi}{6}.$$

$$y \cdot \frac{1}{2} = 2\left(\frac{\pi}{6}\right)^2 - \frac{\pi^2}{2}$$

$$y = \frac{\pi^2}{9} - \frac{2\pi^2}{2} \rightarrow -\frac{8\pi^2}{9}.$$

Q-28 The length of the projection ---  
(1)  $(5, -1, 4)$  &  $(4, -1, 3)$  ---  $x + y + z = 7$ .

or dr's  $\rightarrow (1, 0, 1)$  dr's of plane  $(1, 1, 1)$

$$\sin \theta = \frac{1 \cdot 1 + 0 \cdot 1 + 1 \cdot 1}{\sqrt{1^2 + 0^2 + 1^2} \sqrt{1^2 + 1^2 + 1^2}} = \frac{2}{\sqrt{6}}.$$

$$\cos \theta = \sqrt{1 - \sin^2 \theta} = \sqrt{1 - \frac{4}{6}} = \frac{1}{\sqrt{3}}.$$

now projection = (Length of segment)  $\times \cos \theta$ .

$$= \sqrt{1^2 + 1^2} \cdot \frac{1}{\sqrt{3}} \rightarrow \sqrt{2} \times \frac{1}{\sqrt{3}} = \sqrt{\frac{2}{3}}.$$



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Q.29. Let  $S = \{x \in \mathbb{R}, x \geq 0 \text{ \& \; } 2|\sqrt{x}-3| + \sqrt{x}(\sqrt{x}-6) + 6 = 0\}$

Sol<sup>n</sup>: Let  $\sqrt{x} = y$ . eq<sup>n</sup>  $2|y-3| + y(y-6) + 6 = 0$ .

Ans. Case-I:  $y \geq 3$ .  $2(y-3) + y(y-6) + 6 = 0$ .  
(u)  $2y - 6 + y^2 - 6y + 6 = 0 \rightarrow y^2 - 4y = 0$ .

Case-II  $0 \leq y \leq 3$ .  $y = 0$  or  $y = 4$ .  
 $\checkmark$

$2(3-y) + y(y-6) + 6 = 0$

$6 - 2y + y^2 - 6y + 6 = 0$ .

$y^2 - 8y + 12 = 0 \rightarrow y = 6, y = 2$ .

$y^2 - 6y - 2y + 12 = 0$   $\checkmark$

So  $y \in \{2, 4\}$  or  $x \in \{4, 16\}$ .

Two elements

Q.30 Let  $a_1, a_2, \dots$  A.P. then  $m$  is equal to --

(u)  $\sum_{k=0}^{12} a_{k+1} = 416 \rightarrow \frac{13}{2} (2a_1 + (13-1)d) = 416$ .

$a_9 + a_{43} = 66$

$a_1 + 24d = 32$  (i)

$a_1 + 8d + a_1 + 42d = 66$

$a_1 + 25d = 33$  (ii)

$2a_1 + 50d = 66$

(ii) - (i)  $d = 1$  &  $a_1 = 8$

new  $\sum_{k=1}^{17} a_k^2 = \sum_{n=1}^{17} (7+n)^2 \rightarrow \sum_{n=1}^{17} 49 + n^2 + 14n \rightarrow 49n + \frac{n(n+1)(2n+1)}{6}$

where  $n = 17$   
 $140m = 4760$   $m = 34$   $\checkmark$

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Q.16  
(1) The sum of coefficients of all odd  $x$  in  $(x + \sqrt{x^3 - 1})^5 + (x - \sqrt{x^3 - 1})^5$  is --

$$(x + y)^n + (x - y)^n = 2 \left( {}^nC_0 x^n + {}^nC_2 y^2 x^{n-2} + \dots \right)$$

$$\Rightarrow 2 \left( {}^5C_0 x^5 + {}^5C_2 (x^3 - 1) x^3 + {}^5C_4 (x^3 - 1)^2 x \right)$$

$$\Rightarrow 2 \left( x^5 + 10(x^6 - x^3) + 5(x^6 + 1 - 2x^3)x \right)$$

$$\Rightarrow 2 \left( \underbrace{1x^5 - 10x^3 + 5x^7 + 5x - 10x^4}_{\text{odd}} \right)$$

$$= 2(1 - 10 + 5 + 5) \Rightarrow \underline{\underline{2}}$$

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Q.15. If  $\sum_{i=1}^9 (x_i - 5) = 9$  . . . . .  $x_1, x_2, \dots, x_9$  is . . .  
Ans (4) Soln:  $\sum_{i=1}^9 (x_i - 5) \Rightarrow \sum_{i=1}^9 x_i - \sum_{i=1}^9 5 = 9$ .

$\sum_{i=1}^9 - 45 = 9 \Rightarrow \sum_{i=1}^9 x_i = 54$  . . . (i)  
 $\bar{x} = \frac{\sum_{i=1}^9 x_i}{9} = \frac{54}{9} = 6$   
 $\text{var}(x) = \sum_{i=1}^9 (x_i - 6)^2 = 45$

$\text{var}(x) = \sum_{i=1}^9 (x_i^2 + 36 - 12x_i) / 9$  . . . (ii)

but  $\sum_{i=1}^9 (x_i - 5)^2 = 45 \Rightarrow \sum_{i=1}^9 x_i^2 + 25 - 10x_i = 45$

$\sum_{i=1}^9 x_i^2 + \sum_{i=1}^9 25 - 10 \sum_{i=1}^9 x_i = 45$

$\sum_{i=1}^9 x_i^2 + 25 \times 9 - 10 \times 54 = 45$

$\sum_{i=1}^9 x_i^2 = 360$  . . . (iii)

So  $\text{var}(x) = \left( \sum_{i=1}^9 x_i^2 + \sum_{i=1}^9 36 - 12 \sum_{i=1}^9 x_i \right) / 9$

S.D =  $\sqrt{\frac{360 + 36 \times 9 - 12 \times 54}{9}} = 4$   
=  $\sqrt{4} = 2$  Ans. (4 option)



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For Doubt Discussion on Maths : WhatsApp Number of Suhag Kariya : 9009 260 559

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Q-24 The boolean expression.  
(2)  $\sim(P \vee q) \vee (\sim P \wedge q)$  is eq<sup>n</sup> to - - -

Sol<sup>n</sup>:

$$(\sim P \wedge \sim q) \vee (\sim P \wedge q)$$

$$\text{Let } \sim P = A \quad \sim q = B \quad \& \quad q = C.$$

$$\text{which } (A \wedge B) \vee (A \wedge C)$$

$$\Rightarrow \sim P \wedge (\sim q \vee q) \rightarrow (T.)$$

$$\Rightarrow \sim P \wedge (T)$$

$$\Rightarrow \sim P \wedge T.$$

$$\Rightarrow \sim P.$$

Q-25 Let m be the slope of line.

$$L \Rightarrow (y-3) = m(x-2)$$

$$y = mx + 3 - 2m.$$

$$\text{at } B \quad x = 0, y = 3 - 2m.$$

$$B(0, 3 - 2m) \quad \& \quad R\left(\frac{2m-3}{m}, 3 - 2m\right)$$

$$\& \text{ at } A \quad y = 0.$$

$$x = \frac{2m-3}{m}.$$

$$K = 3 - 2m \quad \left\{ \begin{array}{l} h = \frac{2m-3}{m} \\ h = \frac{2m-3}{m} \end{array} \right.$$

$$m = \frac{3-K}{2}.$$

$$h = 2 - \frac{3-K}{2} \times 2$$

$$h = \frac{2(3-K) - (3-K)}{2}$$

$$\frac{3h - hK}{2} = \frac{3(3-K) - (3-K)K}{2}$$

$$A\left(\frac{2m-3}{m}, 0\right)$$

