

JEE Main 2023 (Memory Based Paper)

30 January (Morning Shift) - Mathematics



Q1 find $\lim_{x \rightarrow 0} \frac{48 \int_0^x \frac{t^3}{1+t^6} dt}{x^4}$

(12)

Q2 find the coeff. of x^{301} in $(1+x)^{500} + x(1+x)^{499} + x^2(1+x)^{498} + x^3(1+x)^{497} \dots x^{500}$

$501 C_{301}$

Q3 7 observations having mean 8 & variance 16. if an observation "14" is omitted then find new variance & mean

$\frac{70}{6}$

Q4 $\log_{\cos x} \cot x + 4 \log_{\sin x} \tan x = 1$ where $x = \sin^{-1} \left(\frac{\alpha - \sqrt{\beta}}{2} \right)$
then find $\alpha + \beta$?

$-1 + \sqrt{5}$

Q5 if $z = 1+i$ & $z_1 = \frac{i + \bar{z}(1-i)}{\bar{z}(1-z)}$ then the value of $\frac{12}{\pi} \arg(z_1)$ is _____

(3)

Q6 A line has x & y intercepts equal to a & b respectively. The perpendicular from origin to the line makes angle $\pi/6$ with y-axis. If the area of Δ formed by the line with coordinate axes is $\frac{98}{\sqrt{3}}$ then find the value of $3(a^2 - b^2)$

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Q7 let $P(h, k)$ be any 2 points on $x^2 = 4y$ which is at the shortest distance from $Q(0, 33)$ then difference of distances from $P(h, k)$ from the directrix of $y^2 = 4(x+y)$ is: (4)

Q8 $S = \{1, 2, 3, 4, 5\}$ find the number of one-one functions defined from set S to power set S $\frac{32!}{27!}$

Q9 if $a_n = \frac{-2}{4n^2 - 16n + 15}$ & $a_1 + a_2 + \dots + a_{25} = \frac{m}{n}$

where m & n are coprime then the value of $m+n$ 191

Q10 if coeff. of x^{15} in the expansion of $(ax^3 + \frac{1}{bx^3})^{15}$ is equal to coeff. of x^{-15} in the exp. $(ax^{1/3} + \frac{1}{bx^3})^{15}$ then $|ab - 5|$ is 4

Q11 $\int_1^3 \frac{dx}{x^3(x^2+2)}$

Q12 If a funcⁿ follows the relation $5f(x+y) = f(x) \cdot f(y)$ & $f(3) = 320$ then find $\sum_{n=0}^5 f(n)$ 20

Q13 if set $A = \{a, b, c\}$ $R: A \rightarrow A$, $R = \{(a, b) (b, c)\}$ How many elements should be added to make R symmetric & transitive both? 7

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Q14 Area bounded by larger part in 1st quadrant by $x = 4y^2$, $x = 2$ & $y = x$ is A then $3A$ is $2 + \frac{1}{96} - \frac{2\sqrt{2}}{3}$

Q15 find the value of $3 \left(\frac{e-1}{e} \right) \int_1^2 x^2 e^{[x]} + [x^3] dx$ $e^8 - e$

Q16 A dice with faces as 2, 1, 0, -1, -2, 3 is thrown 5 times. The prob. that the product of the outcomes on all the throws is positive is $\frac{521}{2592}$

Q17 $\tan 15^\circ + \frac{1}{\tan 75^\circ} + \frac{1}{\tan 105^\circ} + \tan 195^\circ = 2a$
find $a + \frac{1}{a}$ (4)

Q18 Using 1, 2, 3 & 5 four digit numbers are formed where repetition is allowed. The number of numbers divisible by 15 are 21

Q19 find the maximum area bounded by $y^2 = 8x$, $x = 1$ & $y = x$ in 1st quadrant $\frac{67}{6} - \frac{4\sqrt{2}}{3}$

Q20 \vec{n} is a vector $\vec{a} \neq 0$ $\vec{b} \neq 0$ if $\vec{n} \perp \vec{c}$, $\vec{a} = \alpha \vec{b} - \vec{n}$ & $\vec{b} \cdot \vec{c} = 12$ then the value of $|\vec{c} \times (\vec{a} \times \vec{b})|$ 12
where n is a unit vector