JEE Main 2023 (Memory Based Paper)

29 January (Morning Shift) - Mathematics

Q1 A function $f(x)$ is such that $f(x+y) = f(x) + f(y) - 1$ $\forall\ x, y \in R$, and $f'(0) = 2$ then $|f(-2)| =$

ans: 3

Q2 if product of real part of $z_1\ z_2$ is 0 i.e. $Re(z_1 z_2) = 0$ & $Re(z_1 + z_2) = 0$ then $Im(z_1)$ & $Im(z_2)$ is

(a) >0 <0 (c) <0 <0

(b) >0 >0 (d) <0 >0

Q3 $x^2 dy - y(1+x)\,dx = 0$ & $y(1) = e$ then find $\lim_{x \to 0^+} y(x)$

ans: 0

Q4 find domain of $f(x) = \dfrac{\log_{(x-1)}(x-2)}{e^{2\log_e x}(x^2 - 4x + 3)}$

$(2, \infty) - \{3\}$

Q5 if $A^2 = A + \alpha I$ & $A^4 = 27A + \beta I$ then $\alpha + \beta =$

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Q6 A basket contains 7 rotten apples & 4 good apples One apple is drawn one by one without replacement till all the good apples are drawn. find the probability that this occurs when total 5 apples are drawn.

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Q7 if $f(x) = \max(x^2, 1 + [x])$

then find $\int_0^2 f(x)\,dx$

$\frac{5}{3} + \frac{4\sqrt{2}}{3}$

Q8 if $a_1\ a_2\ a_3 \ldots$ are positive numbers in GP such that $a_5 + a_7 = 12$ & $a_6\ a_4 = 9$ then find the value of $a_7 + a_9 =$

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Q9 Consider a func^n $f(x) = \frac{2x^2+x+1}{x^2+1}$ then

(a) $f(x)$ is one one $\forall x \in (0,2)$ ✓

(b) $f(x)$ is one one $\forall x \in (1,\infty)$

(c) many one $\forall x \in (0,2)$

(d) one one $\forall x \in (0,\infty)$

Q10 A function satisfies the Relation $f(x+y) = f(x) + f(y)$ $\forall x, y \in N$ & $\sum_{r=1}^{n} \frac{f(r)}{r(r+1)(r+2)} = \frac{1}{12}$ $f(1) = \frac{1}{5}$

Then find n $n=10$

Q11 Consider $y = f(x)$ passing through $(1,1)$ & satisfying the following diff. eq^n $y(x+1)\,dx + x^2\,dy = 0$

Then $y = f(x)$ is given by

(a) $\ln xy = \frac{1}{x} - 1$ ✓ (b) $\ln xy = \frac{1}{x^2}$

(c) $\ln xy = 1/y$ (d) $\ln xy = \frac{1}{x} + 1$

Q12 find the area common to

$x^2 + y^2 \leq 21$ $x \geq 1$ & $y^2 \leq 4x$

$\frac{8}{3} + 2\sqrt{3} + \frac{21\pi}{2} - \sin^{-1}\left(\sqrt{3/7}\right)$

Q13 in the expansion of $(1+2x)^n$ the ratio of 3 consecutive coefficients is 2:5:8 find the middle term of $(1+2x)^n$

$^8C_4 (2x)^4$

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Q14 In a football club there are 15 players, each player has a T-shirt of their own name. Find the number of ways such that atleast 13 players pick the correct T-shirt of their own name

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Q15 Consider 3 coplanar vectors

$\bar{a} = 3\hat{i} - 4\hat{j} + \lambda\hat{k}$ Then find λ

$\bar{b} = 4\hat{i} + 3\hat{j} - \hat{k}$

$\bar{c} = \hat{i} + 3\hat{j} - 4\hat{k}$

Q16 Consider $\left(\alpha x - \frac{1}{\beta x}\right)^{11}$ coeff. of x^9 = coeff. of x^{-9}

find $(\alpha\beta)^2$

ans : 1

Q17 five digit number from 1, 2, 3, 5, 7 with repetition are formed. Then the number 35337 lies at which position when counting is done backwards

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Q18 if A_1 is the area bounded by $2x \le y \le \sqrt{4(x-1)^2}$ in 1st quadrant & A_2 is the area bounded by $y = \min\left(2x, \sqrt{4(x-1)^2}\right)$ & x-axis

find $\frac{A_1}{A_2}$

1:1

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Q19 Two tangents are drawn at $A(4,-11)$ & $B(8,-5)$ to the circle $x^2+y^2-3x+10y-15=0$. These tangents meet at P. If the radius of circle centered at P & touching AB is $\frac{\lambda}{5\sqrt{13}}$ find λ

Q20 Incident Ray $y=\frac{x}{\sqrt{3}}$ is incidented on a reflecting surface $x+y=1$. The point of intersec^{n} of reflecting Ray with x-axis $\left(1-\frac{1}{\sqrt{3}},0\right)$

Q21 in an equilateral $\triangle ABC$ point A lies on the line $y-2x=2$ & points B & C are lying on the line $x+y=0$ Points B & C are symmetric with respect to origin. The area of $\triangle ABC$ $\frac{8}{\sqrt{3}}$

Q22 if $((p\wedge q)\vee r)\vee(p\wedge r)\longrightarrow(\sim q)\vee r$ is fallacy then what can be said about p, q & r

(a) p: true q: true r: false