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JEE Main – 2018 (CBT) Exam
Test Date: 15/04/2018
Test Time: 9:30 AM – 12:30 PM
Set: II

Part – C (Mathematics)

Q61: An aeroplane flying at a constant speed, parallel to the horizontal ground, $\sqrt{3}$ km above it, is observed at an elevation of 60º from a point on the ground. If, after five seconds , its elevation from the same point, is 30º, then the speed (in km/hr) of the aeroplane, is :

Options: (1) 720 (2) 1500 (3) 750 (4) 1440

Q62: A box 'A' contains 2 white , 3 red and 2 black balls. Another box 'B' contains 4 white , 2 red and 3 black balls. If two balls are drawn at random, without replacement, from a randomly, selected box and one ball turns out to be white while the other ball turns out to be red, then the probability that both balls are drawn from box 'B' is :

Options: (1) $\frac{7}{8}$ (2) $\frac{9}{16}$ (3) $\frac{7}{16}$ (4) $\frac{9}{32}$

Q63: If a right circular cone, having maximum volume , is inscribed in a sphere of radius 3 cm, then the curved surface area (in cm^2) of this cone is :

Options: (1) $8\sqrt{2}\pi$ (2) $6\sqrt{2}\pi$ (3) $8\sqrt{3}\pi$ (4) $6\sqrt{3}\pi$

Q64: If β is one of the angles between the normals to the ellipse $x^2 + 3y^2 = 9$ at the points $(3\cos\theta, \sqrt{3}\sin\theta)$ and $(-3\sin\theta, \sqrt{3}\cos\theta)$; $\theta \in \left(0, \frac{\pi}{2}\right)$; then $\frac{2\cot\beta}{\sin 2\theta}$ is equal to :

Options: (1) $f\,\frac{1}{\sqrt{3}}$ (2) $\frac{\sqrt{3}}{4}$ (3) $\frac{2}{\sqrt{3}}$ (2) $\sqrt{2}$

Q65: If $\left(\frac{x-4}{x+2}\right) = 2x + 1$, $(x \in R - \{1, -2\})$, then $\int f(x)dx$ is equal to : (where C is a constant of integration)

Options: (1) $12\log_e|1-x| - 3x + C$ (2) $-12\log_e|1-x| - 3x + C$
(3) $12\log_e|1-x| + 3x + C$ (4) $-12\log_e|1-x| + 3x + C$

Q66: If $\lambda \in R$ is such that the sum of the cubes of the roots of the equation, $x^2 + (2-\lambda)x + (10-\lambda) = 0$ is minimum, then the magnitude of the difference of the roots of this equation is :

Options: (1) $4\sqrt{2}$ (2) 20 (3) $2\sqrt{5}$ (4) $2\sqrt{7}$

Q67: Two parabolas with a common vertex and with axes along x-axis and y-axis, respectively, intersect each other in the first quadrant. If the length of the latus rectum of each parabola is 3 , then the equation of the common tangent to the two parabolas is :

Options: (1) $3(x + y) + 4 = 0$ (2) $8(2x + y) + 3 = 0$ (3) $x + 2y + 3 = 0$ (4) $4(x + y) + 3 = 0$

Q68: If f(x) = $\begin{vmatrix} \cos x & x & 1 \\ 2\sin x & x^2 & 2x \\ \tan x & x & 1 \end{vmatrix}$, then

$\lim_{x \to 0} \frac{f'(x)}{x}$

Options: (1) does not exist
(2) exists and is equal to – 2
(3) exists and is equal to 0
(4) exists and is equal to 2.

Q69: The value of the integral $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin^4 x \left(1 + \log\left(\frac{2+\sin x}{2-\sin x}\right)\right) dx$ is :

Options: (1) $\frac{3}{4}$ (2) $\frac{3}{8}\pi$ (3) 0 (4) $\frac{3}{16}\pi$

Q70: n-digit number are formed using only three digit 2,5 and 7. The smallest value of n for which 900 such distinct numbers can be formed, is :

Options: (1) 9 (2) 7 (3) 8 (4) 6

Q71: If the tangents drawn to the hyperbola $4y^2 = x^2 + 1$ intersect the co-ordinates axes at the distinct points A and B, then the locus of the mid point of AB is :

Options: (1) $4x^2 - y^2 + 16x^2y^2 = 0$
(2) $x^2 - 4y^2 + 16x^2y^2 = 0$
(3) $x^2 - 4y^2 - 16x^2y^2 = 0$
(4) $4x^2 - y^2 - 16x^2y^2 = 0$

Q72: If tan A and tanB are the roots of the quadratic equation, $3x^2 - 10x - 25 = 0$, then the value of $3\sin^2(A + B) - 10\sin(A + B).\cos(A + B) - 25\cos^2(A + B)$ is :

Options: (1) – 25 (2) 10 (3) – 10 (4) 25

Q73: Let y = y(x) be the solution of the differential equation $\frac{dy}{dx} + 2y = f(x)$, where f(x) = $\begin{cases} 1, & x \in [0,1] \\ 0, & \text{otherwise} \end{cases}$

If y(0) = 0, then $y\left(\frac{3}{2}\right)$ is :

Options: (1) $\frac{e^2-1}{e^3}$ (2) $\frac{1}{2e}$ (3) $\frac{e^2+1}{2e^4}$ (4) $\frac{e^2-1}{2e^3}$

Q74: If b is the first term of an infinite G.P. whose sum is five, then b lies in the interval :

Options: (1) $[10, \infty)$ (2) $(-\infty, -10]$ (3) $(-10, 0)$ (4) $(0, 10)$

Q75: Consider the following two binary relations on the set A = {a, b, c} :
R_1 = {(c,a), (b,b) , (a,c), (c,c), (b,c), (a,a)} and R_2 = {(a,b), (b,a), (c,c), (c,a), (a,a), (b,b), (a,c)}.
Then :

Options: (1) R_2 is symmetric but it is not transitive
(2) both R_1 and R_2 are not symmetric
(3) both R_1 and R_2 are transitive.
(4) R_1 is not symmetric but it is transitive

Q76: A circle passes through the points (2,3) and (4,5). If its centre lies on the line, $y - 4x + 3 = 0$, then its radius is equal to :

Options: (1) $\sqrt{5}$ (2) $\sqrt{2}$ (3) 1 (4) 2

Q77: In a triangle ABC, coordinates of A are (1,2) and the equations of the medians through B and C are respectively, $x + y = 5$ and $x = 4$. Then area of ΔABC (in sq. units) is :

Options: (1) 12 (2) 4 (3) 9 (4) 5

Q78: The set of all $\alpha \in R$, for which $w = \frac{1+(1-8\alpha)z}{1-z}$ is a purely imaginary number, for all $z \in C$ satisfying $|z| = 1$ and $\text{Re } z \neq 1$, is :

Options: (1) {0} (2) $\left\{0, \frac{1}{4}, -\frac{1}{4}\right\}$ (3) equal to R (4) an empty set

Q79: If $x_1, x_2, \ldots\ldots, x_n$ and $\frac{1}{h_1}, \frac{1}{h_2}, \ldots\ldots, \frac{1}{h_n}$ are two A.P. such that $x_3 = h_2 = 8$ and $x_8 = h_7 = 20$, then $x_5 \cdot h_{10}$ equals :

Options: (1) 3200 (2) 1600 (3) 2650 (4) 2560

Q80: If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are unit vectors such that $\vec{a} + 2\vec{b} + 2\vec{c} = 0$, then $|\vec{a} \times \vec{c}|$ is equal to :

Options: (1) $\frac{1}{4}$ (2) $\frac{15}{16}$ (3) $\frac{\sqrt{15}}{4}$ (4) $\frac{\sqrt{15}}{16}$

Q81: A variable plane passes through a fixed point (3,2,1) and meets x, y and z axes at A, B and C respectively . A plane is drawn parallel to yz - plane through A, a second plane is drawn parallel zx-plane through B and a third plane is drawn parallel to xy-plane through C. Then the locus of the point of intersection of these three planes, is :

Options: (1) $\frac{3}{x} + \frac{2}{y} + \frac{1}{z} = 1$ (2) $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = \frac{11}{6}$

(3) $x + y + z = 6$ (4) $\frac{x}{3} + \frac{y}{2} + \frac{z}{1} = 1$

Q82: Let A be a matrix such that $A \cdot \begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}$ is a scalar matrix and $|3A| = 108$. Then A^2 equals :

Options: (1) $\begin{bmatrix} 4 & 0 \\ -32 & 36 \end{bmatrix}$ (2) $\begin{bmatrix} 36 & -32 \\ 0 & 4 \end{bmatrix}$ (3) $\begin{bmatrix} 36 & 0 \\ -32 & -32 \end{bmatrix}$ (4) $\begin{bmatrix} 4 & -32 \\ 0 & 36 \end{bmatrix}$

Q83: The area (in sq. units) of the region $\{x \in R : x \geq 0, y \geq 0, y \geq x - 2 \text{ and } y \leq \sqrt{x}\}$, is :

Options: (A) $\frac{13}{3}$ (2) $\frac{8}{3}$ (3) $\frac{10}{3}$ (4) $\frac{5}{3}$

Q84: If $x^2 + y^2 + \sin y = 4$, then the value of $\frac{d^2y}{dx^2}$ at the point (–2, 0) is :

Options: (1) – 34 (2) 4 (3) – 2 (4) – 32

Q85: An angle between the plane, $x + y + z = 5$ and the line of intersection of the planes, $3x + 4y + z - 1 = 0$ and $5x + 8y + 2z + 14 = 0$, is :

Options: (1) $\cos^{-1}\left(\sqrt{\frac{3}{17}}\right)$ (2) $\cos^{-1}\left(\frac{3}{\sqrt{17}}\right)$ (3) $\sin^{-1}\left(\frac{3}{\sqrt{17}}\right)$ (4) $\sin^{-1}\left(\sqrt{\frac{3}{17}}\right)$

Q86: Let $S = \{(\lambda, \mu) \in R \times R : f(t) = (|\lambda|e^{|t|} - \mu) \cdot \sin(2|t|), t \in R$, is a differentiable function$\}$. Then S is a subset of :

Options: (1) $(-\infty, 0) \times R$ (2) $R \times [0, \infty)$ (3) $[0, \infty) \times R$ (4) $R \times (-\infty, 0)$

Q87: Let S be the set of all real values of k for which the system of linear equations

$x + y + z = 2$

$2x + y - 2 = 3$

$3x + 2y + kz = 4$

Has a unique solution. Then S is :

Options: (1) equal to $R - \{0\}$ (2) an empty set

(3) equal to R (4) equal to {0}

Q88: If n is the degree of the polynomial, $\left[\frac{2}{\sqrt{5x^3+1} - \sqrt{5x^3-1}}\right]^8 + \left[\frac{2}{\sqrt{5x^3+1} + \sqrt{5x^3-1}}\right]^8$ and m is the coefficient of x^n in it, then the ordered pair (n,m) is equal to :

Options: (1) $(8, 5(10)^4)$ (2) $(12, 8(10)^4)$ (3) $(12, (20)^4)$ (4) $(24, (10)^8)$

Q89: The mean of a set of 30 observations is 75. If each observations is multiplied by a non-zero number λ and then each of them is decreased by 25, their mean remains the same. Then λ is equal to :

Options: (1) $\frac{4}{3}$ (2) $\frac{1}{3}$ (3) $\frac{10}{3}$ (4) $\frac{2}{3}$

Q90: If $(p \wedge \sim q) \wedge (p \wedge r) \rightarrow \sim p \vee q$ is false, then the truth values of p, q and r are, respectively :

Options: (1) T,T,T (2) F,T,F (3) T,F,T (4) F,F,F