MATHS

BOOKS - ML KHANNA

EXAMINATION PAPER-2014 (IIT-JEE-MAIN)

Multiple Choice Question

1. If $X = \{4^n - 3n - 1 : n \in N\} and Y = \{9(n-1) : n \in N\}$, where N is the set of natural numbers, then $X \cup Y$ is equal to (1) N (2) Y - X (3) X (4) Y

A. N

B. Y - X

C. X

D. Y

Answer: D

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2. Three positive numbers form an increasing GP. If the middle term in this GP is doubled, then new numbers are in AP. Then, the common ratio of the GP is

A. $\sqrt{2}+\sqrt{3}$

B. $3+\sqrt{2}$

C. $2-\sqrt{3}$

D. $2+\sqrt{3}$

Answer: D

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3. If $(10)^9 + 2(11)^1(10)^8 + 3(11)^2(10)^7 + .. + 10(11)^9 = k(10)^9$, then k is equal to (1) $\frac{121}{10}$ (2) $\frac{441}{100}$ (3) 100 (4) 110

A. $\frac{121}{10}$

B. $\frac{441}{100}$

C. 100

D. 110

Answer: C

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4. The locus of the foot of prependicular drawn from the center of the ellipse $x^2 + 3y^2 = 6$ on any tangent to it is

A. $\left(x^2 - y^2\right)^2 = 6x^2 + 2y^2$

B. $\left(x^2 - y^2\right)^2 = 6x^2 - 2y^2$

C. $\left(x^2 + y^2\right)^2 = 6x^2 + 2y^2$

D. $\left(x^2+y^2\right)^2=6x^2-2y^2$

Answer: C

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5. The angle between the lines whose direction cosines satisfy the equations $l+m+n=0$ and $l^2=m^2+n^2$ is (1) $\frac{\pi}{3}$ (2) $\frac{\pi}{4}$ (3) $\frac{\pi}{6}$ (4) $\frac{\pi}{2}$

A. $\frac{\pi}{3}$

B. $\frac{\pi}{4}$

C. $\frac{\pi}{6}$

D. $\frac{\pi}{2}$

Answer: A

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6. The slope of the line touching the parabolas $y^2 = 4x$ and $x^2 = -32y$ is

A. $\frac{1}{2}$

B. $\frac{3}{2}$

C. $\frac{1}{8}$

D. $\frac{2}{3}$

Answer: A

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7. If x = - 1 and x =2 are exterme points of the function y=a $\log x + bx^2 + x$, then-

A. $\alpha = -6, \beta = \frac{1}{2}$

B. $\alpha = -6, \beta = -\frac{1}{2}$

C. $\alpha = 2, \beta = -\frac{1}{2}$

D. $\alpha = 2, \beta = \frac{1}{2}$

Answer: C

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8. The image of the line $\frac{x-1}{3} = \frac{y-3}{1} = \frac{z-4}{-5}$ in the plane $2x - y + z + 3 = 0$ is the line (1) $\frac{x+3}{3} = \frac{y-5}{1} = \frac{z-2}{-5}$ (2) $\frac{x+3}{-3} = \frac{y-5}{-1} = \frac{z+2}{5}$ (3) $\frac{x-3}{3} = \frac{y+5}{1} = \frac{z-2}{-5}$ (3) $\frac{x-3}{-3} = \frac{y+5}{-1} = \frac{z-2}{5}$

A. $\frac{x+3}{3} = \frac{y-5}{1} = \frac{z-2}{-5}$

B. $\frac{x+3}{-3} = \frac{y-5}{-1} = \frac{z-2}{5}$

C. $\frac{x-3}{3} = \frac{y+5}{1} = \frac{z-2}{-5}$

D. $\frac{x-3}{-3} = \frac{y+5}{-1} = \frac{z-2}{5}$

Answer: A

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9. Let C be the circle with centre at (1, 1) and radius = 1. If T is the circle centred at (0, y), passing through origin and touching the circle C externally, then the radius of T is equal to (1) $\frac{\sqrt{3}}{\sqrt{2}}$ (2) $\frac{\sqrt{3}}{2}$ (3) $\frac{1}{2}$ (3) $\frac{1}{4}$

A. $\frac{\sqrt{3}}{\sqrt{2}}$

B. $\frac{\sqrt{3}}{2}$

C. $\frac{1}{2}$

D. $\frac{1}{4}$

Answer: D

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10. The area of the region described by $A = \left\{(x, y) : x^2 + y^2 \leq 1 \text{ and } y^2 \leq 1 - x\right\}$ is :

A. $\frac{\pi}{2} + \frac{4}{3}$

B. $\frac{\pi}{2} - \frac{4}{3}$

C. $\frac{\pi}{2} - \frac{2}{3}$

D. $-\frac{\pi}{2} + \frac{2}{3}$

Answer: A

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11. Let PS be the median of the triangle with vertices P(2,2), Q(6,-1) an R(7,3). The equation of the line passing through (1,-1) and parallel to PS is

A. $4x - 7y - 11 = 0$

B. $2x + 9y + 7 = 0$

C. $4x + 7y + 3 = 0$

D. $2x - 9y - 11 = 0$

Answer: B

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12. Let a, b, c and d be non-zero numbers. If the point of intersection of the lines $4ax + 2ay + c = 0$ and $5bx + 2by + d = 0$ lies in the fourth quadrant and is equidistant from the two axes then (1) $2bc - 3ad = 0$ (2) $2bc + 3ad = 0$ (3) $3bc - 2ad = 0$ (4) $3bc + 2ad = 0$

A. $2bc - 3ad = 0$

B. $2bc + 3ad = 0$

C. $3bc - 2ad = 0$

D. $3bc + 2ad = 0$

Answer: C

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13. If the coefficients of x^3 and x^4 in the expansion of $(1 + ax + bx^2)(1 - 2x)^{18}$ in powers of x are both zero, then (a, b) is equal to (1) $\left(16, \frac{251}{3}\right)$ (3) $\left(14, \frac{251}{3}\right)$ (2) $\left(14, \frac{272}{3}\right)$ (4) $\left(16, \frac{272}{3}\right)$

A. $\left(16, \frac{251}{3}\right)$

B. $\left(14, \frac{251}{3}\right)$

C. $\left(14, \frac{272}{13}\right)$

D. $\left(16, \frac{272}{3}\right)$

Answer: D

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14. If $a \in R$ and the equation $-3(x-[x])^2+2(x-[x])+a^2=0$ (where [x] denotes the greatest integer x) has no integral solution, then all possible values of a lie in the interval (1) $(-1,0) \cup (0,1)$ (2) (1, 2) (3) $(-2,-1)$ (4) $(-\infty,-2) \cup (2,\infty)$

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15. If f and g are differentiable functions in [0, 1] satisfying $f(0)=2=g(1), g(0)=0$ and $f(1)=6$, then for some $c \in]0,1[$ (1)

$2f'(c) = g'(c)$ (2) $2f'(c) = 3g'(c)$ (3) $f'(c) = g'(c)$ (4) $f'(c) = 2g'(c)$

A. $2f'(c) = g'(c)$

B. $2f'(c) = 3g'(c)$

C. $f'(c) = g'(c)$

D. $f'(c) = 2g'(c)$

Answer: D

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16. The integral $\int\left(1+x-\frac{1}{x}\right)e^{x+\frac{1}{x}}dx$ is equal to (1) $(x-1)e^{x+\frac{1}{x}}+C$ (2) $xe^{x+\frac{1}{x}}+C$ (3) $(x+1)e^{x+\frac{1}{x}}+C$ (4) $-xe^{x+\frac{1}{x}}+C$

A. $(x-1)e^{x+\frac{1}{x}}+c$

B. $xe^{x+\frac{1}{x}}+c$

C. $(x+1)e^{x+\frac{1}{x}}+c$

D. $-xe^{x+\frac{1}{x}}+c$

Answer: B

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17. If g is the inverse of a function f and $f'(x)=\frac{1}{1+x^5}$, then g'(x) is equal to

A. $1+x^5$

B. $5x^4$

C. $\frac{1}{\left(1+g(x)^5\right)}$

D. $1+[g(x)]^5$

Answer: D

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18. If $f_k(x) = \frac{1}{k}\left(\sin x + \cos^k x\right)$ then $f_4(x) - f_6(x) =$ (A) $\frac{1}{12}$ (B) $\frac{5}{12}$ (C) $\frac{-1}{12}$ (D) $-\frac{5}{12}$

A. $\frac{1}{6}$

B. $\frac{1}{3}$

C. $\frac{1}{4}$

D. $\frac{1}{12}$

Answer: D

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19. Let the population of rabbits surviving at a time t be governed by the differential equation $\left(dp\frac{t}{dt} = \frac{1}{2}p(t) - 200.\right.$ If $p(0) = 100$, then p(t) equals (1) $400 - 300e^{t/2}$ (2) $300 - 200e^{-t/2}$ (3) $600 - 500e^{t/2}$ (4) $400 - 300e^{-t/2}$

A. $400 - 300e^{t/2}$

B. $300 - 200e^{-t/2}$

C. $600 - 500e^{t/2}$

D. $400 - 300e^{-t/2}$

Answer: A

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20. $\lim_{x \to 0} \frac{\sin\left(\pi \cos^2 x\right)}{x^2}$ is equal to

A. $\frac{\pi}{2}$

B. 1

C. $-\pi$

D. π

Answer: D

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21. The integral $\int_0^{\pi} \sqrt{1+4\sin^2\frac{x}{2}-4\sin\frac{x}{2}}dx$ equals

A. $\pi-4$

B. $\frac{2\pi}{3}-4-4\sqrt{3}$

C. $4\sqrt{3}-4$

D. $4\sqrt{3}-4-\frac{\pi}{3}$

Answer: D

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22. If $\left[\vec{a}\times\vec{b}\quad\vec{b}\times\vec{c}\quad\vec{c}\times\vec{a}\right]=\lambda\left[\vec{a}\quad\vec{b}\quad\vec{c}\right]^2$, then λ is equal to

A. 2

B. 3

C. 0

D. 1

Answer: D

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23. The statement $\sim(p \leftrightarrow \sim q)$ is

A. equvalent to $p \leftrightarrow q$

B. equivalent to $\sim p \leftrightarrow q$

C. a tautology

D. a fallacy

Answer: A

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24. A bird is sitting on the top of a vertical pole 20 m high and its elevation from a point O on the ground is $45o$. It flies off horizontally straight away from the point O. After one second, the elevation of the bird from O is reduced to $30o$. Then the speed (in m/s) of the bird is (1) $40\left(\sqrt{2}-1\right)$ (2) $40\left(\sqrt{3}-2\right)$ (3) $20\sqrt{2}$ (4) $20\left(\sqrt{3}-1\right)$

A. $40\left(\sqrt{2}-1\right)$

B. $40\left(\sqrt{3}-\sqrt{2}\right)$

C. $20\sqrt{2}$

D. $20\left(\sqrt{3}-1\right)$

Answer: D

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25. The variance of first 50 even natural numbers is (1) $\frac{833}{4}$ (2) 833 (3) 437 (4) $\frac{437}{4}$

A. $\frac{833}{4}$

B. 833

C. 437

D. $\frac{437}{4}$

Answer: B

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26. Let A and B be two events such that $P(\overline{A \cup B}) = \frac{1}{6}, P(A \cap B) = \frac{1}{4}$ and $P(\overline{A}) = \frac{1}{4}, where \overline{A}$ stands for the complement of the event A. Then the events A and B are

A. mutually exclusive and independent

B. equally likely but not independent

C. independent but not equally likely

D. independent and equally likely

Answer: C

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27. If z is complex number such that $|z| \geq 2$ then the minimum value of $\left|z + \frac{1}{2}\right|$

A. is equal to $\frac{5}{2}$

B. lies in the interval [1, 2]

C. is strictly greater than $\frac{3}{2}$

D. is strictly greater than $\frac{3}{2}$ but less than $\frac{5}{2}$

Answer: B

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28. If $\alpha, \beta \neq 0$, and $f(n) = \alpha^n + \beta^n$ and $|31 + f(1)1 + f(2)1 + f(1)1 + f(2)1 + f(3)1 + f(2)1 + f(3)1 + f(4)| =$

, then K is equal to (1) $\alpha\beta$ (2) $\frac{1}{\alpha\beta}$ (3) 1 (4) -1

A. $\alpha\beta$

B. $\frac{1}{\alpha\beta}$

C. 1

D. -1

Answer: C

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29. Let α and β be the roots of equation $px^2 + qx + r = 0, p \neq 0$.If p, q, r are in A.P. and $\left(\frac{1}{\alpha} + \frac{1}{\beta}\right) = 4$, then the value of $|\alpha - \beta|$

A. $\frac{\sqrt{61}}{9}$

B. $\frac{2\sqrt{17}}{9}$

C. $\frac{\sqrt{34}}{9}$

D. $\frac{2\sqrt{13}}{9}$

Answer: D

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30. If A is an 3×3 non-singular matrix such that $\forall' = A'A$ and $B = A^{-1}A'$, then BB equals (1) $I + B$ (2) I (3) B^{-1} (4) $\left(B^{-1}\right)'$

A. $I + B$

B. I

C. B^{-1}

D. $\left(B^{-1}\right)'$

Answer: B

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