MATHS

BOOKS - CHHAYA PUBLICATION MATHS (BENGALI ENGLISH)

QUESTION PAPER -2018

Hs 2018

1. Suppose R be the set of all real numbers and the mapping $f: R \rightarrow R$ is defined by $f(x) = 2x^2 - 5x + 6$. Find the value of $f^{-1}(3)$.

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2. If $\sin^{-1} x = \tan^{-1} y$, then show that, $\frac{1}{x^2} - \frac{1}{y^2} = 1$.

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3. Without expanding the determinant, prove that $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = (a-b)(b-c)(c-a).$

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4. If A is an ivertible matrix of order $3 \times 3$and |A| = 6, then find the value of |adj.A|.

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5. If the function $f(x) = \begin{cases} \frac{1-\cos(ax)}{x^2} & \text{when } x \neq 0 \\ 1 & \text{when } x = 0 \end{cases}$ be continuous at x=0, then find the value of a.

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6. If $ye^y = x$, prove that, $\frac{dy}{dx} = \frac{y}{x(1+y)}$.

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7. If $> 0, y > 0 \text{ and } xy = 25$, then find the minimum value of $x + y$.

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8. A particle moves along the parabola $y^2 = 4x$. Find the coordinates of the point on the parabola, where the rate of increment of abscissa is twice the rate of increment of the ordinate.

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9. Varify Langrange's mean value theorem in the inteval $4 \leq x \leq 6$ for the function $f(x) = x^2 + 2x + 3$.

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10. Evalute: $\int \frac{(x+1)e^{x}}{\cos^{2}(xe^{x})}dx$.

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11. If the three vectors $\vec{a}, \vec{b}, \vec{c}$ are such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$ and $|\vec{a}|=3, |\vec{b}|=4, |\vec{c}|=5$, then show that $\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}=-25$.

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12. Find the equation of the plane passing through the intersection of the planes $2x+y+2z=9$ and $4x-5y-4z=1$ and through the point (3,2,-1).

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13. If $P\left(\frac{A}{B}\right) = 0.8, P\left(\frac{B}{A}\right) = 0.6 \text{ and } P(A^c \cup B^c) = 0.7$, then find the value of $P(A \cup B)$.

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14. An unbiased coin is tossed 6 times. Using binomial distribution, find the probability of getting at least 5 heads.

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15. A relation R is defined on the set of natural numbers N as follows: $R = \{(x, y) \mid x, y \in N \text{ and } 2x + y = 41\}$. Show that R is neither reflexive nor symmetric nor transitive.

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16. Prove that, $\tan\left(\frac{\pi}{4} + \frac{1}{2}\cos^{-1}\frac{a}{b}\right) + \tan\left(\frac{\pi}{4} = \frac{1}{2}\cos^{-1}\frac{a}{b}\right) = \frac{2b}{a}$.

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17. Express the marix $A = \begin{vmatrix} 3 & 2 & 3 \\ 4 & 5 & 3 \\ 2 & 4 & 5 \end{vmatrix}$ as the sum of a symmetric matrix and a skew-symmetric matrix.

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18. Solve, by the inverse matrix method: $2x - 3y + 3z = 1, 2x + 2y + 3z = 2, 3x - 2y + 2z = 3.$

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19. If $\begin{vmatrix} x-1 & 1 & 1 \\ 1 & x+1 & 1 \\ -1 & 1 & x+1 \end{vmatrix} = 0$, find the value of x.

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20. Prove that , $\begin{vmatrix} -bc & b^2+bc & c^2+bc \\ a^2+ac & -ac & c^2+ac \\ a^2+ab & b^2+ab & -ab \end{vmatrix} = (ab+bc+ca)^3.$

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21. If $y = \frac{\sin^{-1} x}{\sqrt{1-x^2}}$, then show that $(1-x^2)\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} - y = 0.$

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22. Find the derivative of $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$ with repect to $\tan^{-1}\left(\frac{2x\sqrt{1-x^2}}{1-2x^2}\right)$ at x=0.

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23. Evalute $\int \frac{x^4+1}{x^6+1} dx.$

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24. Evalute: $\int \frac{dx}{\cos x + \sqrt{3} \sin x}$.

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25. Solve $x \frac{dy}{dx} = y + x \tan\left(\frac{y}{x}\right)$, given that $y = \frac{\pi}{2}$, when x=1.

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26. Solve : $\left(1 - x^2\right) \frac{dy}{dx} - xy = 1$.

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27. If three vetors $\vec{a}, \vec{b}$ and $\vec{c}$ of magnitudes 3,4 and 5 respectively are such that each vectors is perpendicular to the sum of the orher two vectors, then prove that $\left|\vec{a} + \vec{b} + \vec{c}\right| = 5\sqrt{2}$.

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28. Let $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}$, $\vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$. Find a vector $\vec{d}$ which is perpendicular to both the vectors $\vec{a}$ and $\vec{b}$ and $\vec{c} \cdot \vec{d} = 18$.

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29. Evalute : $\lim_{n \to \infty} \left[\frac{1^2}{n^3 + 1^3} + \frac{2^2}{n^3 + 2^3} + \frac{3^2}{n^3 + 3^3} + \dots\dots\dots + \frac{1}{2n}\right]$.

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30. Evalute: $\int_0^{\pi} \frac{x \sin x}{1 + \cos^2 x} dx$.

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31. A bag contains 8 white and 7 black balls and another bag contains 5 white and 4 black balls. A ball is drawn at random from the first bag and put it into second bag. Now if a ball is drawn at random from the second bag. Find the probability that the ball drawn is white.

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32. If X and Y are two independent variables, then prove that $var(aX + bY) = a^2 var(X) + b^2 var(Y)$, where a and b are constants.

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33. One kg of food X contains 6 units of Vitamin A and 7 units of Vitamin B. One kg of food Y contains 8 units of Vitamin A and 12 units of Vitamin B. Cost of each kg of food X and food Y are Rs. 12 and Rs. 20 respectively. The daily minimum requirement of Vitamin A and Vitamin B are 100 units and 120 units respectively. How much food X and food Y are to be mixed so that the cost will be minimum? Formulate the problem as a linear programming problem.

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34. Solve the following linear programming problem by graphical method ans find the minimum value of Z. $Z = 6x + 10y$ subject to the constrains, $x + 2y \geq 10$, $2x + 2y \geq 12$, $3x + y \geq 8$, $x, y \geq 0$.

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35. A circular ink blot grows at the rate of 2 $\frac{cm^2}{\sec}$. Find the rate at which the radius is increasing after $2\frac{6}{11}$ seconds.

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36. Using definite integral, find the area bounded by the straight line $2x + y = 4$ and the curve $y = 4 - x^2$.

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37. If the straight line $lx+my+n=0$ be a normal to the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$, then by the application of calculus, prove that $\frac{a^2}{l^2}-\frac{b^2}{m^2}=\frac{(a^2+b^2)^2}{n^2}$.

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38. SOLVE :$y\frac{dy}{dx}=1$

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39. Find the vector equation of the plane at a distance $\frac{6}{\sqrt{29}}$ unit from the origin and perpendicular to the vector $\widehat{2i}-\widehat{3j}+\widehat{4k}$. Also convert this equation in Cartesian form.

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40. Find the equation of the line which is perpendicular to both of the lines $\frac{x}{2} = \frac{y}{1} = \frac{z}{3}$ and $\frac{x-3}{-1} = \frac{y-2}{3} = \frac{z+5}{5}$ and passing through the point (1,2,3).

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41. If X be the random variable of the number of points obtained in a single throw of an unbiased die, then the value of $\overline{X}$ will be

A. 7

B. 14

C. $\frac{7}{2}$

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

Answer: C

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42. If A and B are two independent events and $P(A)=\frac{3}{6}$ and $P(A\cap B)=\frac{4}{9}$ then the value of P(B) will be

A. $\frac{5}{9}$

B. $\frac{8}{9}$

C. $\frac{5}{27}$

D. $\frac{20}{27}$

Answer: D

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43. The projection of the vector $\overrightarrow{a}=2\hat{i}-\hat{j}+\hat{k}$ on the vector $\overrightarrow{b}=\hat{i}-2\hat{j}+\hat{k}$ will be

A. $\frac{5}{\sqrt{6}}$ unit

B. $\frac{2}{\sqrt{6}}$ unit

C. $\frac{3}{\sqrt{5}}$ unit

D. $\frac{4}{\sqrt{5}}$ unit

Answer: A

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44. The straight line $\frac{x-3}{2}=\frac{y+4}{0}=\frac{z-2}{5}$ is perpendicular to

A. x-axis

B. y-axis

C. z-axis

D. both x-axis and z-axis

Answer: B

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45. If the straight line y=my+1 be the tangent of the parabola $y^2 = 4x$at the point (1,2), then the value of m will be

A. 1

B. 2

C. -1

D. -2

Answer: A

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46. The value of $\int e^{a\log e^x} dx$ will be

A. $\frac{1}{a} e^{a\log e^x} + c$

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

C. $ax^{a-1} + c$

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

Answer: D

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47. If $f(x)=\frac{\sin x}{x}(x\neq 0)$ is continuous at x=0, then the value of f(0) will be

A. 0

B. 1

C. π

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

Answer: B

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48. If A is a square matrix of order 3×3, then the value of $|KA|$ will be

A. $K|A|$

B. $K^2|A|$

C. $K^3|A|$

D. $3K|A|$

Answer: C

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49. Let A={1,2,3} and R be a relation defined on A, such that, R{(1,2),(2,1)}, then the relation R will be

A. reflexive

B. symmetric

C. transitive

D. None of these

Answer: B

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50. The principal value of $\tan^{-1}(-\sqrt{3})$ is

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

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

C. $-\frac{\pi}{4}$

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

Answer: D

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Wbjee

1. The approximate value of $\sin 31^{\circ}$ is

A. > 0.5

B. > 0.6

C. < 0.5

D. < 0.4

Answer: A

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2. Let $f_1(x) = e^x, f_2(x) = e^{f_1(x)}, \ldots\ldots\ldots, f_{n+1}(x) = e^{f_n(x)}$ for all $n \geq 1$. Then for any fixed n, $\dfrac{d}{dx} f_n(x)$ is

A. $f_n(x)$

B. $f_n(x) f_{n-1}(x)$

C. $f_n(x) f_{n-1}(x) \ldots\ldots f_1(x)$

D. $f_n(x) \ldots\ldots f_1(x) e^x$

Answer: C

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3. $f(x) = |x|$ is increasing in

A. $(-\infty, \infty)$

B. $(-\infty, 0)$

C. $(0, \infty)$

D. $(-\infty, -1)$

Answer: C

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4. Let $f(x) = 3x^{10} - 7x^8 + 5x^6 - 21x^3 + 3x^2 - 7.$ Then $\lim_{h \to 0} \frac{f(1-h) - f(1)}{h^3 + 3h}$

A. does not exist

B. $\frac{50}{3}$

C. $\frac{53}{3}$

D. $\frac{22}{3}$

Answer: C

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5. Let $f:[a, b] \rightarrow R$ be such that f is differentiable in (a,b), f is continuous at x=a and x=b and moreover f(a)=0f(b). Then

A. there exists at least one point c in (a,b) such that f'(c)=f(c)

B. $f'(x) = f(x)$ does not hold at any point in (a,b)

C. at every point of (a,b), $f'(x) > f(x)$

D. at every point of (a,b), $f'(x) < f(x)$

Answer: A

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6. Let $f: R \to R$ be a twice continuously differentiable function such that $f(0) = f(1) = f'(0) = 0$. Then

A. $f''(0) = 0$

B. $f''(c) = 0 \text{ for some } c \neq R$

C. if $c \neq 0$, then $f''(c) \neq 0$

D. $f'(x) > 0$ for all $x \neq 0$

Answer: B

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7. If $\int e^{\sin x}\left[\frac{x \cos^3 x - \sin x}{\cos^2 x}\right]dx = e^{\sin x} \cdot f(x) + c$, where c is constant of integration, then f(x)=

A. $\sec x - x$

B. $x - \sec x$

C. $\tan x - x$

D. $x - \tan x$

Answer: B

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8. If $\int f(x) \sin x \cos x dx = \frac{1}{2(b^2 - a^2)} \log f(x) + c$, where c is the constant of integration, then f(x)=

A. $\frac{2}{(b^2 - a^2)\sin 2x}$

B. $\frac{2}{| \in |2x}$

C. $\frac{2}{(b^2 - a^2)\cos 2x}$

D. $\frac{2}{ab \cos 2x}$

Answer: C

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9. If $M=\int_0^{\frac{\pi}{2}}\frac{\cos x}{x+2}dx,\ N=\int_0^{\frac{\pi}{4}}\frac{\sin x\cos x}{(x+1)^2}dx$, then the value of M-N is

A. π

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

C. $\frac{2}{\pi-4}$

D. $\frac{2}{\pi+4}$

Answer: D

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10. The value of the integral $I=\int_{\frac{1}{2014}}^{2014}\frac{\tan^{-1}x}{x}dx$ is

A. $\frac{\pi}{4}\log 2014$

B. $\frac{\pi}{2}\log 2014$

C. $\pi \log 2014$

D. $\frac{1}{2} \log 2014$

Answer: B

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11. Let $I = \int_{\pi/4}^{\pi/3} \frac{\sin x}{x} dx$. Then

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

B. $4 \leq I \leq 2\sqrt{30}$

C. $\frac{\sqrt{3}}{8} \leq I \leq \frac{\sqrt{2}}{6}$

D. $1 \leq I \leq \frac{2\sqrt{3}}{\sqrt{2}}$

Answer: C

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12. The value of $I = \int_{\frac{\pi}{2}}^{\frac{5\pi}{2}} \frac{e^{\tan^{-1}(\sin x)}}{e^{\tan^{-1}(\sin x)} + e^{\tan^{-1}(\cos x)}} dx$, is

A. 1

B. π

C. e

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

Answer: B

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13. The value of $\lim_{n \to \infty} \frac{1}{n}\left[\sec^2\frac{\pi}{4n} + \sec^2\frac{2\pi}{4n} + \ldots. + \sec^2\frac{n\pi}{4n}\right]$ is

A. $\log e^2$

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

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

D. e

Answer: C

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14. The differential equation representing the family of curves $y^2 = 2c(x + \sqrt{c})$ where $c > 0$ is a parameter, is of order and degree as follows: (A) order 1, degree 3 (B) order 2, degree 2 (C) order 1, degree 2 (D) order 1, degree 1

A. order 2

B. degree 2

C. degree 3

D. degree 4

Answer: C

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15. Let $y(x)$ be a solution of $(1+x^2)\frac{dy}{dx}+2xy-4x^2=0$ and $y(0)=-1$. Then $y(1)$ is equal to

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

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

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

D. -1

Answer: C

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16. The law or motion of a body moving along a straight line is $x=\frac{1}{2}vt$, x being its distance from a fixed point on the line at time t and v is its velocity there. Then

A. acceleration f varies directly with x

B. acceleration f varies inversely with x

C. acceleration f is constant

D. acceleration f varies directly with t

Answer: A

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17. Number of common tangents of $y = x^2$ and $y = -x^2 + 4x - 4$ is

A. 1

B. 2

C. 3

D. 4

Answer: B

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18. If $\begin{vmatrix} -1 & 7 & 0 \\ 2 & 1 & -3 \\ 3 & 4 & 1 \end{vmatrix} = A \text{ then} \begin{vmatrix} 13 & -11 & 5 \\ -7 & -1 & 25 \\ -21 & -3 & 15 \end{vmatrix}$ is

A. A^2

B. $A^2 - A + I^3$

C. $A^2 - 3A + I_3$

D. $3A^2 + 5A - 4I_3$

Answer: A

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19. If $a_r = (\cos 2r\pi + i \sin 2r\pi)^{\frac{1}{9}}$, then the value of $\begin{vmatrix} a_1 & a_2 & a_3 \\ a_4 & a_5 & a_6 \\ a_7 & a_8 & a_9 \end{vmatrix}$.

A. 1

B. -1

C. 0

D. 2

Answer: C

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20. If $S_r = \begin{vmatrix} 2r & x & n(n+1) \\ 6r^2-1 & y & n^2(2n+3) \\ 4r^3-2nr & z & n^3(n+1) \end{vmatrix}$, then the value of $\sum_{r=1}^{n} S_r$ is independent of

A. x only

B. y only

C. n only

D. x,y,z and n

Answer: D

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21. If the following three linear equations have a non-trivial solution, then $x + 4ay + az = 0, x + 3by + bz = 0, x + 2cy + cz = 0$

A. a,b,c are in AP

B. a,b,c are in GP

C. a,b,c are in HP

D. a+b+c=0

Answer: C

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22. On R, a relation p is defined by xpy if and only if x-y is zero or irrational. Then

A. p is equivalence relation

B. p is reflexive but neither symmetric nor transitive

C. p is reflexive and symmetric but not transitive

D. p is symmetric and transitive but not reflexive

Answer: C

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23. $\int \frac{dx}{\sec x + \cos x}$

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24. If $f: R \to R$ be defined by $f(x) = e^x$ and $g: R \to R$ be defined by $g(x) = x^2$. The mapping $g \circ f: R \to R$ be defined by $(g \circ f)(x) = g[f(x)] A ax \ne R$, then

A. $g \circ f$ is bijective but f is not injective

B. $g \circ f$ is injective and g is injective

C. $g \circ f$ is injective nut g is not bijective

D. $g \circ f$ is injective and g is surjective

Answer: C

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25. In order to get a head at least once with probility ≥ 0.9, the minimum number of times a unbiased coin needs to be tossed is

A. 3

B. 4

C. 5

D. 6

Answer: B

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26. A student appears for tests, I,II and III. The student is successful if he passes in tests I,II or I,III. The probabilities of the student passing in tests

I,II and III are respectively p,q and $\frac{1}{2}$. If the probability of the student to be successful is $\frac{1}{2}$. Then

A. $p(1+q) = 1$

B. $q(1+p) = 1$

C. $pq = 1$

D. $\frac{1}{p} + \frac{1}{q} = 1$

Answer: A

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27. If $0 \leq A \leq \frac{\pi}{4}$, then $\tan^{-1}\left(\frac{1}{2}\tan 2A\right) + \tan^{-1}(\cot A) + \tan^{-1}\left(\cot^3 A\right)$ is equal to

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

B. π

C. 0

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

Answer: B

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28. The angle between a pair of tangents drawn from a point P to the circle $x^2 + y^2 + 4x - 6y + 9\sin^2\alpha + 13\cos^2\alpha = 0$ is 2α. The equation of the locus of the point P is

A. $x^2 + y^2 + 4x + 6y + 9 = 0$

B. $x^2 + y^2 - 4x + 6y + 9 = 0$

C. $x^2 + y^2 - 4x - 6y + 9 = 0$

D. $x^2 + y^2 + 4x - 6y + 9 = 0$

Answer: D

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29. A point P lies on a line through Q(1,-2,3) and is parallel to the line $\frac{x}{1} = \frac{y}{4} = \frac{z}{5}$. If P lies on the plane $2x + 3y - 4z + 22 = 0$, then segment PQ equal to

A. $\sqrt{42}$ units

B. $\sqrt{32}$ units

C. 4 units

D. 5 units

Answer: A

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30. The foot of the perpendicular drawn from the point (1,8,4) on the line joining the points (0,-11,4) and (2,-3,1) is

A. $(4, 5, 2)$

B. $(-4, 5, 2)$

C. $(4, -5, 2)$

D. $(4, 5, -2)$

Answer: D

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31. A ladder 20 ft long leans against a vertical wall. The top end slides downwards at the rate of 2 ft per second. The rate at which the lower end moves on a horizontal floor when it is 12 ft from the wall is

A. $\frac{8}{3}$

B. $\frac{6}{5}$

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

D. $\frac{17}{4}$

Answer: A

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32. For $0 \le p \le 1$ and for any positive a,b let $I(p) = (a+b)^p$, $J(p) = a^p + b^p$: then

A. $I(p) > J(p)$

B. $I(p) \le J(p)$

C. $I(p) < J(p)$ in $\left[0, \frac{p}{2}\right]$ and $I(p) > J(p)$ in $\left[\frac{p}{2}, \infty\right]$

D. $I(p) < J(p)$ in $\left[\frac{p}{2}, \infty\right]$ and $J(p) > I(p)$ in $\left[0, \frac{p}{2}\right]$

Answer: B

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33. Let $\overrightarrow{\alpha} = \hat{i} + \hat{j} + \hat{k}, \overrightarrow{\beta} = \hat{i} - \hat{j} - \hat{k}$ and $\overrightarrow{\gamma} = -\hat{i} + \hat{j} - \hat{k}$ be three vectors. A vector $\overrightarrow{\delta}$, in the plane of $\overrightarrow{\alpha}$ and $\overrightarrow{\beta}$, whose projection on $\overrightarrow{\gamma}$ is $\frac{1}{\sqrt{3}}$, is given by

A. $-\hat{i}-3\hat{j}-3\hat{k}$

B. $\hat{i}-3\hat{j}-3\hat{k}$

C. $-\hat{i}+3\hat{j}+3\hat{k}$

D. $\hat{i}+3\hat{j}-3\hat{k}$

Answer: B

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34. Let $\vec{\alpha}, \vec{\beta}, \vec{\gamma}$ be three unit vectors such that $\vec{\alpha}\cdot\vec{\beta}=\vec{\alpha}\cdot\vec{\gamma}=0$ and the angle between $\vec{\beta}$ and $\vec{\gamma}$ is 30°. Then $\vec{\alpha}$ is

A. $2\left(\vec{\beta}\times\vec{\gamma}\right)$

B. $-2\left(\vec{\beta}\times\vec{\gamma}\right)$

C. $\pm 2\left(\vec{\beta}\times\vec{\gamma}\right)$

D. $\left(\vec{\beta}\times\vec{\gamma}\right)$

Answer: C

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35. The least positive integer n such that $\begin{pmatrix} \cos\left(\frac{\pi}{4}\right) & \sin\left(\frac{\pi}{4}\right) \\ -\sin\left(\frac{\pi}{4}\right) & \cos\left(\frac{\pi}{4}\right) \end{pmatrix}^n$ is an identity matrix of order 2 is

A. 4

B. 8

C. 12

D. 16

Answer: B

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36. Let p be a relation on N, the set of natural numbers, as $p = \{(x, y) \neq N \times N : 2x + y = 41\}$. Then

A. p is an equivalence relation

B. p is only reflexive relation

C. p is only symmetric relation

D. p is not transitive

Answer: D

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37. If the polynomial $f(x)=\begin{vmatrix}(1+x)^a & (2+x)^b & 1 \\ 1 & (1+x)^a & (2+x)^b \\ (2+x)^b & 1 & (1+x)^a\end{vmatrix}$, then the constant term of f(x) is

A. $2-3\cdot 2^b+2^{3b}$

B. $2+3\cdot 2^b+2^{3b}$

C. $2+3\cdot 2^b-2^{3b}$

D. $2-3\cdot 2^b-2^{3b}$

Answer: A

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38. Let $f(x) = \begin{cases} -2\sin x & \text{if } x \leq -\frac{\pi}{2} \\ A\sin x + B & \text{if } -\frac{\pi}{2} < x < \frac{\pi}{2} \\ \cos x & \text{if } x \geq \frac{\pi}{2} \end{cases}$. Then

A. f is discontinuous for all A and B

B. f is continuous for all A=-1 and B=-1

C. f is continuous for all A=1 and B=-1

D. f is continuous for all real values of A,B

Answer: B

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39. The normals to the curve $y = x^2 + 1$, drawn at the points with the abscissa $x_1 = 0, x_2 = -1$ and $x_3 = \frac{5}{2}$

A. are parallel to each other

B. are pairwise perpendicular

C. are concurrent

D. are not concurrent

Answer: C

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40. The equation $x \log x = 3 - x$

A. has no root in (1,3)

B. has exactly one root in (1,3)

C. $x \log - (3 - x) > 0$ in [1,3]

D. $x \log - (3 - x) < 0$ in [1,3]

Answer: B

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41. Let $I = \int_0^1 \frac{x^3 \cos 3x}{2 + x^2} dx$. Then

A. $-\frac{1}{2} < I < \frac{1}{2}$

B. $-\frac{1}{3} < I < \frac{1}{3}$

C. $-1 < I < 1$

D. $-\frac{3}{2} < I < \frac{3}{2}$

Answer: A::B::C::D

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42. A particle is in motion along a curve $12y = x^3$. The rate of change of its ordinate exceeds that of abscissa in

A. $-2 < x < 2$

B. $x = \pm 2$

C. $x < -2$

D. $x > 2$

Answer: C::D

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43. The area of the region lying above x-axis, and included between the circle $x^2 + y^2 = 2ax$ and the parabola $y^2 = ax, a > 0$is

A. $8\pi a^2$

B. $a^2\left(\frac{\pi}{4} - \frac{2}{3}\right)$

C. $\frac{16\pi a^2}{9}$

D. $\pi\left(\frac{27}{8} + 3a^2\right)$

Answer: B

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44. In a third order matrix A, a_{ij} denotes the element in the i-th row and j-th column. If $\begin{aligned} a_{ij} &= 0 \quad \text{for} \quad i = j \\ &= 1 \quad \text{for} \quad i > j \\ &= -1 \quad \text{for} \quad i < j \end{aligned}$ then the matrix is

A. skew symmetric

B. symmetric

C. not invertible

D. non-singular

Answer: A::C

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45. Let $f(x) = \cos\left(\frac{\pi}{x}\right), x \neq 0$ then assuming k as an integer,

A. f(x) increses in the interval $\left(\frac{1}{2k+1}, \frac{1}{2k}\right)$

B. f(x) decreses in the interval $\left(\frac{1}{2k+1}, \frac{1}{2k}\right)$

C. f(x) decreses in the interval $\left(\frac{1}{2k+2}, \frac{1}{2k+1}\right)$

D. f(x) increses in the interval $\left(\frac{1}{2k+2}, \frac{1}{2k+1}\right)$

Answer: A::C

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