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MATHS

BOOKS - CHHAYA PUBLICATION MATHS (BENGALI ENGLISH)

QUESTIONS PAPER -2019

Hs 2019

1. Solve : $2\sin^{-1}x = \cos^{-1}x, 0 < x < 1$

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2. Let A={1,2,3}. Define a relation which is reflexive and symmetric but not transitive.

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3. $A = \begin{pmatrix} 8 & 0 \\ 4 & -2 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & -2 \\ -5 & 1 \end{pmatrix}$, find another matrix X where 2A+3X=5B.

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4. If $\begin{vmatrix} 2 & 3 \\ 4 & 5 \end{vmatrix} = \begin{vmatrix} x & 3 \\ 2x & 5 \end{vmatrix}$, find the value of x.

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5. If $y = \sin^{-1} \frac{2x}{1+x^2}$, find $\frac{dy}{dx}$.

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6. $f(x) = 5 - |x - 1|$. Find the maximum value of $f(x)$, also find the value of x for which f(x) is maximum.

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7. If $x > 0$, then show that $\log(1+x) > \frac{x}{1+x}$.

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8. Find the differential equation of the circles which touch the x-axis at the origin.

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9. If $f(2) = 4$, $f'(2) = 4$, then evalute $\lim_{x \to 2} \frac{xf(2) - 2f(x)}{x - 2}$.

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10. Evalute : $\int_1^2 \frac{xdx}{(x+1)(x+2)}$.

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11. Show that A(2,3,-4),B(1,-2,3) and C(3,8,-11) are collinear.

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12. If $\vec{a} = 5\hat{i} - \hat{j} - 3\hat{k}$ and $\vec{b} = \hat{i} + 3\hat{j} - 5\hat{k}$, show that $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are perpendicular to each other.

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13. If P(A)=a and P(B)=b, then show that P(A/B) $\leq \frac{a}{b}$.

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14. If a and b are constants, then show that $var(ax + b) = a^2 var(x)$.

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15. R_1 and R_2 are two equivalence relation defined on set $A(\neq \phi)$. Show that $R_1 \cap R_2$ is an equivalence relation.

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16. If $\tan^{-1} x + \tan^{-1} y + \tan^{-1} z = \frac{\pi}{2}$ and $x + y + z = \sqrt{3}$, then show that x=y=z.

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17. Show that, the matrix A = $\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ satisfies the equation $A^2 - 4A - 5I_3 = 0$ and hence find A^{-1}.

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18. If $A = \begin{pmatrix} i & -i \\ -i & i \end{pmatrix}$ and $B = \begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$, then show that $A^8 = 128B$.

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19. Show that

$$\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = abc\left(1 + \frac{1}{a} + \frac{1}{b} + \frac{1}{c}\right), (abc \neq 0).$$

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20. Using Cramer's rule solve the questins:

$3x + y + z = 10, x + y - z = 0, 5x - 9y = 1.$

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21. If $\cos y = x\cos(a + y), (a \neq 0)$, then show that $\frac{dy}{dx} = \frac{\cos^2(a+y)}{\sin a}$.

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22. If $x = \sin t, y = \sin kt (k \neq 0,$ constant) then show that $(1 - x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + k^2y = 0.$

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23. Evalute : $\int \sqrt{1 + \sec x} dx.$

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24. Evalute : $\int \frac{dx}{(x-1)\sqrt{x^2-1}}.$

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25. $(e^x + 1)ydy - (y^2 + 1)e^x dx = 0$, given y=0 when x=0`

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26. Solve : $(xdy - ydx)y \sin \frac{y}{x} = (ydx + xdy)x \cos \frac{y}{x}$.

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27. $\vec{a}, \vec{b}, \vec{c}$ be three vectors such that $\vec{a} + \vec{b} + \vec{c} = 0$ and $\left|\vec{a}\right| = 1, \left|\vec{b}\right| = 4, \left|\vec{c}\right| = 2.$ Evalute $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$.

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28. If sum of two unit vectors be a unit vector, then show that difference of those two vectors is $\sqrt{3}$.

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29. Using integral calculus, find the area of $\frac{x^2}{2} + \frac{y^2}{1} = 1$.

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30. Prove that : $\int_1^3 \frac{dx}{x^2(x+1)} = \frac{2}{3} + \frac{\log(2)}{3}$.

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31. $A_1, A_2, \ldots\ldots . A_n$ are independent and $P(A_i) = 1 - q_i (i = 1, 2, \ldots . n)$. Show that $P(A_1 \cup A_2 \cup \ldots . \cup A_n) = 1 - q_1 \cdot q_2 \ldots . q_n$.

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32. Eight unbiased coins tossed simultaneously. Find the probability of getting exactly five heads and at least five heads.

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33. A manufacturer produces two models A and B of a product. Each piece of model A requires 9 labour hours for fabricating and 1 labour hour for finishing. Each piece of model B requires 12 Labour hours for fabricating and finishing the maximum labour hours available are 180 and 30 respectively. The company makes a profit of Rs 8000 on each piece of model A and Rs 12000 on each piece of model B . Formulate an L.P.P. So as to maximize his profit.

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34. x^x decreases in the interval

A. $(0, e)$

B. $(0, 1)$

C. $\left(0, \frac{1}{e}\right)$

D. none of these

Answer:

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35. $ax^2 + by^2 = 1$ and $Ax^2 + By^2 = 1$ meet each other orthogonally. $(a \neq A, b \neq B, aB - bA \neq 0)$. Show that $\frac{1}{a} - \frac{1}{b} = \frac{1}{A} - \frac{1}{B}$.

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36. Solve : $\left(1 + x^2\right) dy - 2xydx = \cot x dx$.

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37. Find maximum and minimum values of $\frac{x^2 - x + 1}{x^2 + x + 1}$ using Calculus.

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

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39. Find the equation of the plane which passes through (-2,1,3) and also through the intersection of the planes $2x - 7y + 4z = 0$ and $3x - 5y + 4z + 11 = 0$.

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40. Find the point on the line $\frac{x+2}{2} = \frac{y+1}{2} = \frac{z-3}{2}$ at a $3\sqrt{2}$ units from the point (1,2,3).

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Hs 2019 Part B

1. The domain for which the functions $f(x) = 3x^2 - 2x$ and $g(x) = 3(3x - 2)$ are equal, will be

A. $\left\{1, \frac{2}{3}\right\}$

B. $\{1, 3\}$

C. $\left\{\frac{2}{3}, 3\right\}$

D. $\left\{\frac{2}{3}, 0\right\}$

Answer: C

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2. The value of $\tan\left\{\frac{\pi}{2} - \tan^{-1}\left(\frac{1}{3}\right)\right\}$ is equal to

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

B. 3

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

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

Answer: B

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3. If two rows or two columns of a determinant are indentical then value of the determinant is

A. 0

B. 2

C. -1

D. 1

Answer: A

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4. If $f(-x) = -f(x)$, then the value of $\int_{-a}^{a} f(x)dx$ is equal to

A. 2a

B. a

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

D. 0

Answer: D

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5. If $y = \tan^{-1}\frac{5-x}{1+5x}$, then value of $\frac{dy}{dx}$ is

A. $-\frac{1}{1+x^2}$

B. $\frac{1}{1+x^2}$

C. 5

D. $\frac{5}{1+x^2}$

Answer: A

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6. The rate of increase of a side of a square is 1 cm/sec. The rate of increase of area of the square, when length of a side of the square is 2 cm, is

A. 4 cm^2/sec

B. 8 cm^2/sec

C. 1 cm^2/sec

D. 2 cm^2/sec

Answer: A

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7. $\vec{a} = \hat{i} + 3\hat{j} - \hat{k}$ and $\vec{b} = 2\hat{i} + 6\hat{j} + \lambda\hat{k}$. If $\vec{a}$ and $\vec{b}$ vectors are parallel, then the value of λ is

A. 3

B. -6

C. -3

D. -2

Answer: D

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8. The angles between the two planes $x - y + 2z = 9$ and $2x + y + z = 7$ is

A. 30°

B. 45°

C. 60°

D. 90°

Answer: C

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9. If $P(A) = \frac{3}{7}, P(B) = \frac{4}{7}$ and $P(A \cap B) = \frac{2}{9}$, then the value of P(A/B) is equal to

A. $\frac{7}{18}$

B. $\frac{14}{27}$

C. $\frac{5}{18}$

D. $\frac{4}{9}$

Answer: A

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10. A coin is tossed 10 times. The probility of getting head 6 times is

A. ${}^{10}C_5 \cdot \frac{1}{2^{10}}$

B. ${}^{10}C_3 \cdot \frac{1}{2^{10}}$

C. ${}^{10}C_4 \cdot \frac{1}{2^{10}}$

D. ${}^{10}C_8 \cdot \frac{1}{2^{10}}$

Answer: C

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Wbjee 2019

1. $\lim_{x \to 0+} (x^n \ln x), n > 0$

A. does not exist

B. exists and is zero

C. exists and is 1

D. exists and is e^{-1}

Answer: B

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2. If $\int \cos x \log\left(\tan \frac{x}{2}\right) = \sin x \log\left(\tan \frac{x}{2}\right) + f(x)$ then f(x) is equal to

A. c

B. c-x

C. c+x

D. 2x+c

Answer: B

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3. $y = \int \cos\left\{2\tan^{-1}\sqrt{\frac{1-x}{1+x}}\right\}dx$ is a equation of a family of

A. straight lines

B. circles

C. ellipses

D. parabolas

Answer: D

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4. The value of integration $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \left(\lambda|\sin x| + \frac{\mu \sin x}{1+\cos x} + \gamma\right)dx$

A. is independent of λ only

B. is independent of μ only

C. is independent of γ only

D. depends of $\lambda, \mu \text{ and } \gamma$

Answer: B

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5. The value of $\lim_{x \to 0} \frac{1}{x}\left[\int_y^a e^{\sin^2 t} dt - \int_{x+y}^a e^{\sin^2 t} dt\right]$ is equal to

A. $e^{\sin^2 y}$

B. $e^{2 \sin y}$

C. $e^{|\sin y|}$

D. $e^{\cos ec^2 y}$

Answer: A

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6. If $\int 2^{2^x} \cdot 2^x dx = A \cdot 2^{2^x} + c$, then A=

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

B. $\log 2$

C. $(\log 2)^2$

D. $\frac{1}{(\log 2)^2}$

Answer: D

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7. The value of the integral $\int_{-1}^{1} \left\{ \frac{x^{2015}}{x^2 + \cos x} \right\} dx$ is equal to

A. 0

B. $1 - e^{-1}$

C. $2e^{-1}$

D. $2\left(1-e^{-1}\right)$

Answer: A

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8.

$$\lim_{n\to\infty}\frac{3}{n}\left\{1+\sqrt{\frac{n}{n+3}}+\sqrt{\frac{n}{n+6}}+\sqrt{\frac{n}{n+9}}+\ldots\ldots+\sqrt{\frac{n}{n+3(n-}\right.$$

A. does not exist

B. 1

C. 2

D. 3

Answer: C

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9. The general solution of the differential equation $\left(1+e^{\frac{x}{y}}\right)dx+\left(1-\frac{x}{y}\right)e^{\frac{x}{y}}dy=0$ is

A. $x-ye^{\frac{x}{y}}=c$

B. $y-xe^{y}=c$

C. $x+ye^{\frac{x}{y}}=c$

D. $y+xe^{y}=c$

Answer: C

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10. General solution of $(x+y)^2\frac{dy}{dx}=a^2, a\neq 0$ is

A. $\frac{x}{a}=\tan\frac{y}{a}+c$

B. $\tan xy=c$

C. $\tan(x+y)=c$

D. $\tan\frac{y+c}{a}=\frac{x+y}{a}$

Answer: D

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11. Let P(4,3) be a point on the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$. If the normal at P intersects the x-axis at (16,0), then the eccentriclty of the hyperbola is

A. $\frac{\sqrt{5}}{2}$

B. 2

C. $\sqrt{5}$

D. $\sqrt{3}$

Answer: B

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12. If the radius of a spherical balloon increases by 0.1%, then its volume increases approximately by

A. $0.2\,\%$

B. $0.3\,\%$

C. $0.4\,\%$

D. $0.05\,\%$

Answer: B

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13. Let A be a square matrix of order 3 whose all entries are 1 and let I_3 be the identity matrix of order 3. Then the matrix $A - 3I_3$ is

A. invertible

B. orthogonal

C. non-invertible

D. real skew symmetric matrix

Answer: C

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14. If M is any square matrix of order 3 over R and if M' be the transpose of M, then $adj(M') - (adjM)'$ is equal to

A. M

B. M'

C. null matrix

D. indentity matrix

Answer: C

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15. If $A = \begin{pmatrix} 5 & 5x & x \\ 0 & x & 5x \\ 0 & 0 & 5 \end{pmatrix}$ and $\left|A^2\right| = 25$, then $|x|$ is equal to

A. $\frac{1}{5}$

B. 5

C. 5^2

D. 1

Answer: A

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16. Let A and B be two square matrices of order 3 and $AB = O_3$, wher O_3 denotes the null matrix of order 3. Then,

A. must be $A = O_3, B = O_3$

B. If $A \neq O_3$,must be $B \neq O_3$

C. If $A = O_3$,must be $B \neq O_3$

D. may be $A = \neq O_3, B = O_3$

Answer: D

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17. Let: $R \to R$ be defined by $f(x) = x^2 - \frac{x^2}{1+x^2}$ for all $x \in R$. Then

A. f is one-one but not onto mapping

B. f is onto but not one-one mapping

C. f is both one-one and onto.

D. f is neither one-one onto

Answer: D

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18. Let the relation p be defined on R as apb iff $1 + ab > 0$. Then

A. p is reflexive only

B. p is equivalence relation

C. p is reflexive and transitive but not symmetric

D. p is reflexive and symmetric but not transitive

Answer: D

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19. A problem in mathematics is given to 4 students whose chances of solving individually are $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ and $\frac{1}{5}$. The probability that the problem will be solved at least by once students is

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

B. $\frac{3}{5}$

C. $\frac{4}{5}$

D. $\frac{3}{4}$

Answer: C

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20. If X is a random variable such that $\sigma(X) = 2.6, \quad \text{then} \quad \sigma(1 - 4X)$ is equal to,

A. 7.8

B. -10.4

C. 13

D. 10.4

Answer: D

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21. The direction ration of the normal to the plane passing through the points (1,2,-3),(-1,-2,1) and parallel to $\frac{x-2}{2} = \frac{y+1}{3} = \frac{z}{4}$ is

A. $(2, 3, 4)$

B. $(14, -8, -1)$

C. $(-2, 0, -3)$

D. $(1, -2, -3)$

Answer: B

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22. The equation of the plane, which bisects the line joining the points (1,2,3) and (3,4,5) at right angles is

A. $x + y + z = 0$

B. $x + y - z = 9$

C. $x + y + z = 9$

D. $x + y - z + 9 = 0$

Answer: C

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23. The limit of the interior angle of the regular polygon of n sides as $n \to \infty$ is

A. π

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

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

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

Answer: A

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24. Let $f(x) > 0$ for all x and $f'(x)$ exists for all x. If f is the inverse function of h and $h'(x) = \frac{1}{1 + \log x}$. Then $f'(x)$ will be

A. $1 + \log(f(x))$

B. $1 + (f(x))$

C. $1 - \log(f(x))$

D. $\log(f(x))$

Answer: A

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25. Consider the function $f(x)\cos x^2$. Then

A. f is of period 2π

B. f is of period $\sqrt{2\pi}$

C. f is not periodic

D. f is of period π

Answer: C

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26. $\lim_{x \to 0+} (e^x + x)^{\frac{1}{x}}$

A. does not exist

B. 1

C. e^2

D. 2

Answer: C

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27. Let f(x) be a derivable function $f'(x) > f(x) \quad \text{and} \quad f(0) = 0$. Then

A. $f(x) > 0 \quad \text{for all} \quad x > 0$

B. $f(x) < 0 \quad \text{for all} \quad x > 0$

C. no sign of $f(x)$ can be ascertained

D. $f(x)$ is a constant function

Answer: A

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28. Let $f:[1,3] \to R$ be a continuous function that is differentiable in $(1,3)$ and $f'(x) = |(f(x))|^2 + 4$ for all $x \in (1,3)$. Then,

A. $f(3) - f(1) = 5$ is true

B. $f(3) - f(1) = 5$ is false

C. $f(3) - f(1) = 7$ is false

D. $f(3) - f(1) < 0$only at one point (1,3)

Answer: B::C

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29. Let $a = \min\left(x^2 + 2x + 3 : x \in R\right)$ and $b = \lim_{\theta \to 0} \frac{1 - \cos\theta}{\theta^2}$. Then $\sum_{r=0}^{n} a^r b^{n-r}$ is

A. $\frac{2^{n+1}-1}{3\cdot 2^n}$

B. $\frac{2^{n+1}+1}{3\cdot 2^n}$

C. $\frac{4^{n+1}-1}{3\cdot 2^n}$

D. $\frac{1}{2}(2^n-1)$

Answer: C

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30. Let $a > b > 0$ and $I(n) = a^{\frac{1}{n}} - b^{\frac{1}{n}}, J(n) = (a-b)^{\left(\frac{1}{n}\right)}$ for all $n \geq 2$. Then

A. $I(n) < J(n)$

B. $I(n) > J(n)$

C. $I(n) = J(n)$

D. $I(n) = J(n) = 0$

Answer: A

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31. If A and B are independent events , then $P\left(\frac{B}{A}\right)$=

A. $P(A)$

B. $\frac{P(B)}{P(A)}$

C. $P(B)$

D. $P(A)P(B)$

Answer: C

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32. The position vectors of the points A,B,C and D are $3\hat{i}-2\hat{j}-\hat{k}, 2\hat{i}-3\hat{j}+2\hat{k}, 5\hat{i}-\hat{j}+2\hat{k}$ and $4\hat{i}-\hat{j}+\lambda\hat{k}$ respectively. If the points A,B,C and D lie on a plane, the value of λ is

A. 0

B. 1

C. 2

D. -4

Answer: D

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33. Find value of $\sin^{-1}\left(\cos\left(\frac{33\pi}{5}\right)\right)$

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34. The system of equations $\lambda x + y + 3z = 0, 2x + \mu y - z = 0, 5x + 7y + z = 0$ has infinitely many solutions in R. Then

A. $\lambda = 2, \mu = 3$

B. $\lambda = 1, \mu = 2$

C. $\lambda = 1, \mu = 3$

D. $\lambda = 3, \mu = 1$

Answer: C

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35. Let $f: X \to Y$ and A,B are non-void subsets of Y, then

A. $f^{-1}(A) - f^{-1}(B) \supset f^{-1}(A - B)$ but the opposite does not hold

B. $f^{-1}(A) - f^{-1}(B) \subset f^{-1}(A - B)$ but the opposite does not hold

C. $f^{-1}(A - B) = f^{-1}(A) - f^{-1}(B)$

D. $f^{-1}(A - B) = f^{-1}(A) \cup f^{-1}(B)$

Answer: C

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36. Let S,T,U be three non-void sets and $f: S \to T$, $g: T \to U$ be so that $g \circ f: S \to U$ is surjective. Then

A. g and f are both sujective

B. g is surjective, f may not be so

C. f is surjective, g may not be so

D. f and g both may not be surjective

Answer: A

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37. Let $f(x) = x^4 - 4x^3 + 4x^2 + c, c \in R$, Then

A. f(x) has infinitely many zeroes in (1,2) for all c

B. f(x) has exactly one zero in (1,2) if $-1 < c < 0$

C. f(x) has double zeroes in (1,2) if $-1 < c < 0$

D. whatever be the value ofc,f(x) has non zero in (1,2)

Answer: B

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38. The graphs of the polynomial $x^2 - 1$ and cosx intersect

A. at exactly two points

B. at exactly 3 points

C. at least 4 but at finitely many points

D. at infinitely many points

Answer: A

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39. A point is in motion along a hyperbola $y = \frac{10}{x}$ so that its abscissa increases uniformly at a rate of 1 unit per second. Then, the rate of change of its ordinate, when the point passes through (5,2)

A. increases at the rate of $\frac{1}{2}$unit per second

B. decreases at the rate of $\frac{1}{2}$unit per second

C. decreases at the rate of $\frac{2}{5}$unit per second

D. increases at the rate of $\frac{2}{5}$unit per second

Answer: C

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40. Let $I_n = \int_0^1 x^n \tan^{-1} x dx$. Then prove that $(n+1)I_n + (n-1)I_{n-2} = \frac{\pi}{2}$

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41. Two particles A and B move from rest along a straight line with constant accelerations f and h respectively. If A takes m seconds more than B and describes n units more than that of B acquiring the same speed, then

A. $(f+h)m^2 = fhn$

B. $(f-h)m^2 = fhn$

C. $(h-f)n = \frac{1}{2}fhm^2$

D. $\frac{1}{2}(f+h)n = fhm^2$

Answer: C

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42. The area bounded by $y = x + 1$ and $y = \cos x$ and the x-axis, is

A. 1 sq. unit

B. 3/2 sq. unit

C. 1/4 sq. unit

D. 1/8 sq. unit

Answer: B

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43. Let $A = \begin{pmatrix} 3 & 0 & 3 \\ 0 & 3 & 0 \\ 3 & 0 & 3 \end{pmatrix}$. Then the roots of the equation $\det(A - \lambda I_3) = 0$ are

A. $3, 0, 3$

B. $0, 3, 6$

C. $1, 0, -6$

D. $3, 3, 6$

Answer: B

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44. f and g be differentiable on the interval I and let $a, b \in I, a < b$. Then

A. If $f(a) = 0 = f(b)$, the equation $f'(x) + f(x)g'(x) = 0$ is solvable in (a,b).

B. If $f(a) = 0 = f(b)$, the equation $f'(x) + f(x)g'(x) = 0$ may not be solvable in (a,b).

C. If $g(a) = 0 = g(b)$, the equation $g'(x) + kg(x) = 0$ is solvable in (a,b),$k \in R$.

D. If $g(a) = 0 = g(b)$, the equation $g'(x) + kg(x) = 0$ may not be solvable in (a,b),$k \in R$.

Answer: A::C

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45. Find the period of the function

$f(x) = \sin\left(\frac{\pi x}{3}\right) + \cos\left(\frac{\pi x}{2}\right).$

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