MATHS

BOOKS - ARIHANT PUBLICATION

QUESTION PAPER 2019

Group A 10 Marks

1. If $\phi(x) = f(x) + f(1-x), f''(x) = 0$ for $0 \leq x \leq 1$, then is x $= \frac{1}{2}$ a point of maxima or minima of $\phi(x)$?

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2. If f is an odd function, then write the value of $\int_{-a}^{a} \frac{f(\sin x)}{f(\cos x) + f(\sin^2 x)} dx$

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3. Write the order of the differential equation whose solution is given by

$y = (c_1 + c_2)\cos(x + c_3) + c_4 e^{x + c_5}$

where c_1, c_2, c_3, c_4 and c_5 are arbitrary constants

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4. If $\vec{a} . \vec{b} = 0$, then write the value of $\vec{a} \times \left(\vec{b} \times \vec{c} \right)$

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5. Write the value of k such that the line $\frac{x-4}{1}=\frac{y-2}{1}=\frac{z-k}{2}$ lies on the plane $2x-4y+z=7$

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6. A R is a relation on set A such that $R=R^{-1}$, then write the type of the relation R.

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7. Write the value of $\cos^{-1}\cos\left(\frac{3\pi}{2}\right)$.

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8. IF

$$\begin{vmatrix} 1+x & x & x^2 \\ x & 1+x & x^2 \\ x^2 & x & 1+x \end{vmatrix} = a + bx + cx^2 + dx^3 + ex^4 + fx^5$$

then write the value of a.

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9. Let A and B be two mutually exclusive events such that $P(A) = \frac{1}{2}$ and $P(B) = \frac{1}{3}$. Write the value of $P(A \cap B)$

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10. If $f'(2^+) = 0$ and $f'(2^-) = 0$, then is $f(x)$ continuous at $x = 2$?

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Group B 60 Marks

1. Prove that $\cos^{-1}\left(\frac{b + a\cos x}{a + b\cos x}\right) = 2\tan^{-1}\left(\sqrt{\frac{a-b}{a+b}}\tan\frac{x}{2}\right)$

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2. Two types of food X and Y are mixed to prepare a mixture in such a way that the mixture contains at least

10 units of vitamin A, 12 units of vitamin B and 8 units of vitamin C. These vitamins are available in 1 kg of food as per the table given below

	Vitamin		
Food	A	B	C
X	1	2	3
Y	2	2	1

1 kg of food X costs ₹ 16 and 1 kg of food Y costs ₹ 20 . Formulate the LPP so as to determine the least cost of the mixture containing the required amount of vitamins

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3. Construct the multiplication table X_7 on the set {1, 2, 3, 4, 5, 6}. Also find the inverse element of 4 if it exists.

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4. Let R be the relation on the set R of real numbers such that aRb iff a-b is and integer. Test whether R is an equivalence relation. If so find the equivalence class of $1 \text{and} \frac{1}{2}$ wrt. This equivalence relation.

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5. Solve for x, $2\tan^{-1}(\cos x) = \tan^{-1}(2\text{cosec}x)$.

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6. Find the probability distribution of

number of heads in three tosses of a coin.

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7. If $A = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 1 & 3 \\ -2 & 5 & 3 \end{bmatrix}$ then verify that A+A is symmetric and A-A is skew-symmetric.

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8. If $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix}$, show that $A^3 - 23A - 40I = 0$

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9. Solve the following : $\begin{bmatrix} x+1 & \omega & \omega^2 \\ \omega & x+\omega^2 & 1 \\ \omega^2 & 1 & x+\omega \end{bmatrix}$ =0

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10. A person takes 4 tests in succession. The probability of his passing the first test is p, that of his passing each succeeding test is p or $\frac{p}{2}$ depending on his passing or failing the preceding test, Find the probabilty of his passing

just three tests.

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11. Find the point on the curve $x^2 + y^2 - 4xy + 2 = 0$ where the normal is paralell to the x-asis.

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12. Find the intervals in which the function $y = \frac{\ln x}{x}$ is increasing and decreasing.

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13. If $y = e^{x^{e^{x^{e^x}}}}$, then find $\frac{dy}{dx}$.

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14. Find $\frac{d^2y}{dx^2}$ if x=a $\cos\theta$, $y = b\sin\theta$.

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15. Verify lagrange's Mean-Value theorem for

$F(x) = x^3 - 2x^2 - x + 3$ on [1,2]

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16. Find differential equation of the curve

$y = ae^{3x} + be^{5x}$.

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17. Obtain the general solution of the following differential equations.

$(x^2 + 7x + 12)dy + (y^2 - 6y + 5)dx = 0$

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18. Evaluate $\int \frac{(2x+1)dx}{(x^2+x+29)}$

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19. Evaluate : $\int_0^{\pi} \frac{\cos x dx}{(2-\sin x)(3+\sin x)}$

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20. Find the area of the region bounded by the curve $y = 6x - x^2$ and the x-axis.

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21. If l_1, m_1, n_1 and l_2, m_2, n_2 are the direction cosines of two mutually perpendicular lines show that the Direction Cosines of the line perpendicular to both of them are $m_1n_2 - n_1m_2, n_1l_2 - l_1n_2, l_1m_2 - m_1l_2$

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22. Find the point where the line $\frac{x-2}{1} = \frac{y}{-1} = \frac{z-1}{2}$ meets the plane $2x + y + z = 2.$

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23. Find a unit vector perpendicular to each of the vectors $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$, where $\vec{a}=\hat{i}+\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}+2\hat{j}+3\hat{k}$.

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24. Prove that $\left(\vec{a}\times\vec{b}\right)^2=a^2b^2-\left(\vec{a}.\vec{b}\right)^2$.

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25. Find the vector equation of a plane which is at a distance of 3 units from the origin , $2\hat{i}+3\hat{j}-6\hat{k}$ being a normal to the plane . Also get its cartesian equation

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Group C 30 Marks

1. If $e^{y/x} = \frac{x}{a+bx}$ then show that $x^3 \frac{d}{dx}\left(\frac{dy}{dx}\right) = \left(x\frac{dy}{dx} - y\right)^2$

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2. Show that the shrtest distance of the point (0, 8a) from the curve $ax^2 = y^3$ is $2a\sqrt{11}$.

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3. Determine the area common to the parabola $y^2 = x$ and the circle $x^2 + y^2 = 2x$.

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4. Find the solutions of the following differential equations :

$$y^2 + x^2 \frac{dy}{dx} = xy \frac{dy}{dx}$$

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5. Evaluate : $\int \frac{dx}{3 \cos x}$

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6. Show by vector method that the four points (6, 2, -1), (2, -1, 3), (-1, 2, -4) and (-12, -1, -3) are coplanar.

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7. Find the distance of the point $(1, -1, -10)$ from the line $\frac{x-4}{1} = \frac{y+3}{-4} = \frac{z+1}{7}$ measured parallelto the line $\frac{x+2}{2} = \frac{y-3}{-3} = \frac{z-4}{8}$

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8. If $\sin^{-1}\left(\frac{x}{a}\right) + \sin^{-1}\left(\frac{y}{b}\right) = \sin^{-1}\left(\frac{c^2}{ab}\right)$, then prove that $b^2x^2 + 2xy\sqrt{a^2b^2 - c^4} + a^2y^2 = c^4$

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9. Evaluate the following integrals :

$$\int x^2 \cos x dx$$

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10. Prove that $f: X \to Y$ is injective iff for all $\subset sA, BofX, f(A \cap B) = f(A) \cap f(B).$

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11. Examining consistency and solvability, solve the following equation by matrix method.

x-2y=3

3x+4y-z=-2

5x-3z=-1

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12. Out of the adult population in a village 50% are farmers, 30% do business and 20% are service holders. It is known that 10% of the farmers, 20% of the business holders and 50% of service holders are above poverty line. What is the probability that a member chosen from any one of the adult population, selected at random, is above poverty line?

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13. Find the inverse of the following matrices using elementary transformation:

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 4 \\ 1 & 0 & 2 \end{bmatrix}$$

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