MATHS

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EXAMINATION PAPER 2019

Group A

1. If f is an odd function, then evaluate
$$I=\int_{-a}^{a}\frac{f(\sin x)dx}{f(\cos x)+f\left(\sin^2 x\right)}$$

2. 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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3. If $\vec{a} = \vec{b} + \vec{c}$, then write the value of $\vec{a} \cdot \left(\vec{b} \times \vec{c}\right)$

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

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

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7. 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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8. 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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9. If $f'(2^{+}) = 0$ and $f'(2^{-}) = 0$, then is $f(x)$ continuous at $x = 2$?

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Group B

1. Prove that :

$$\cos^{-1}\left(\frac{b+a\cos x}{a+b\cos x}\right)$$

` =2"tan"^(-1)(sqrt((a-b)/(a+b)) "tan" x/2)

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2. Construct the multiplication table $\times_7$ on the set {1,2,3,4,5,6}. Also find the inverse element of 4 if it exists.

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

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5. Find the probability distribution of

number of heads in three tosses of a coin.

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6. 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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7. If $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix}$ then show that $A^3 - 23A - 40I = O$

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8. 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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9. 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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10. Find the point on the curve $x^2 + y^2 - 4xy + 2 = 0$, where the normal to the curve is parallel to the X-axis.

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

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

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

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14. Verify Lagrange.s mean value theorem for $f(x) = x^3 - 2x^2 - x + 3$ on [1, 2].

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15. Find differential equation of the curve $y = ae^{3x} + be^{5x}$.

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

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

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

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18. 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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19. 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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20. 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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21. Prove that $\left(\overrightarrow{a} \times \overrightarrow{b}\right)^2 = a^2b^2 - \left(\overrightarrow{a} . \overrightarrow{b}\right)^2$.

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22. 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

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. 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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6. 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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7. 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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8. 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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9. 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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10. 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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11. Find the inverse of the following matrix using elementary transformation : $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 4 \\ 1 & 0 & 2 \end{bmatrix}$

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