MATHS

BOOKS - SHARAM PUBLICATION

QUESTION PAPER 2016

Exercise

1. Write that condition of Rolle's theorem which is violated by the function $f(x) = |x - 1|$ in $[0, 2]$.

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2. Write the value of:

$$\int_0^{\frac{\pi}{2}} \frac{\sin x}{\sin x + \cos x}(dx) - \int_0^{\frac{\pi}{2}} (\cos x)(\sin x + \cos x)(dx)$$

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3. If p and q are the order and degree of the differential equation $y\left(\frac{dy}{dx}\right)^2 + x^2\frac{d^2y}{dx^2} + xy = \sin x$, then choose the correct statement out of

$p < q$

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4. If p and q are the order and degree of the differential equation $y\left(\frac{dy}{dx}\right)^2 + x^2\frac{d^2y}{dx^2} + xy = \sin x$, then choose the

correct statement out of

$p = q$

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5. If p and q are the order and degree of the differential equation $y\left(\frac{dy}{dx}\right)^2 + x^2\frac{d^2y}{dx^2} + xy = \sin x$, then choose the correct statement out of

$p < q$

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6. If $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = 2$ and $\vec{a} \cdot \vec{b} = 0$, then write the value of $\left|\vec{a} \times \vec{b}\right|$.

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7. Write the distance between parallel planes $2x - y + 3z = 4$ and $2x - y + 3z = 18$.

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8. Write the equation of the sphere concentric with the sphere $x^2 + y^2 + z^2 - 4x - 2x - 2y + 2z - 30 = 0$ and passing through the origin.

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9. If A is a 4×5 matrix and B is a matrix such that $A^T B$ and BA^T both are defined, then write the order of B.

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10. If ${}^{n}C_{r} = {}^{n}P_{r}, r \neq 1$, then write the value of r.

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11. A binomial distribution has mean 4 and variance 3. Write the number of trials.

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12. Find $\frac{dy}{dt}$, when $y = \sin^{-1}\left(2\frac{\sqrt{t^2-1}}{t^2}\right)$

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13. Find $\frac{dy}{dx}$, if $x^m y^n = \left(\frac{x}{y}\right)^{m+n}$

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14. If $x = a\sec\theta, y = b\tan\theta$, then prove that $\frac{d^2y}{dx^2} = -\frac{b^4}{a^2y^3}$

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15. If $u = x^3 - 3xy^2$, show that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$=0

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16. Find the intervals where the following functions are (a) increasing and (b) decreasing. $y = \sin x + \cos x, x \in [0, 2\pi]$

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17. Find the following limits: $\lim_{x \to 0+} \frac{\ln\tan x}{\ln\sin 2x}$

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18. The radius of a spherical soap bubble is increasing at the rate of 0.2 cm / sec. Find the rate of increase of its surface area, when the radius is 7 cm. (π = 3.141 approx)

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19. If $f'(x) = e^x + \frac{1}{1+x^2}$ and $f(0) = 1,$ then find f(x).

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20. Evaluate $\int (\log x)^2 dx$

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21. Evaluate: $\int \frac{2x+9}{(x+3)^2} dx$

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22. $\int_0^1 \frac{x^5(4-x^2)}{\sqrt{1-x^2}} dx$

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23. Evaluate $\int \frac{\sin x \cos x}{\sin^2 x - 2\sin x + 3} dx$

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24. Solve $dy + e^{-y} \sin x dx = 0.$

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

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26. Prove that

$|a+b| \leq |a|+|b|$

State when equality will hold,

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27. Find the area of the triangle ABC with vertices A(1,2,4), B(3,1,-2) and C(4,3,1) by vector method.

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28. The projection of a line segment $\overline{OP}$, through origin O, on the co-ordinate axes are 6, 2, 3. Find the length of the line segment OP and its direction cosines.

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29. passing through the point $(-1, 3, 2)$ perpendicular to the planes $x + 2y + 2z = 5$ and $3x + 3y + 2z = 8$.

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30. Prove that the lines $\frac{x+4}{3} = \frac{y+6}{5} = \frac{z-1}{-2}$ and $3x - 2y + z + 5 = 0 = 2x + 3y + 4z - 4$ are co-planar.

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31. Solve the following LPP graphically

Maximize, $Z = 20x + 30y$

Subject to $3x + 5y \leq 15$

$x, y \geq 0.$

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32. Find the feasible region of the following system

$2x + y \geq 6, x - y \leq 3, x \geq 0, y \geq 0$

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33. Show that $(a + 1)$ is a factor of $\begin{vmatrix} (a+1) & 2 & 3 \\ 1 & a+1 & 3 \\ 3 & -6 & a+1 \end{vmatrix}$

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34. Prove that the following.

$$\begin{bmatrix} a & b & c \\ x & y & z \\ p & q & r \end{bmatrix} = \begin{bmatrix} y & b & q \\ x & a & p \\ z & c & r \end{bmatrix} = \begin{bmatrix} x & y & z \\ p & q & r \\ a & b & c \end{bmatrix}$$

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35. If $A = \begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix}$, show that for no values of α, $A^2 = B$.

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36. How many 4 digit numbers each greater than 6000 can be formed with be digits 5, 6, 7 and 8?

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37. If $m = {}^{n}C_2$, prove that ${}^{n}C_2 = 3(n+1)C_4$.

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38. If the ratio of the 3rd term from the beginning to the 3rd term from the end in the expansion of $\left(1+\sqrt{2}\right)^n$ is $\frac{1}{8}$, then find the value of n.

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39. Let A and B be events with $P(A) = \frac{1}{3}, P(A \cup B) = \frac{3}{4}, P(A \cap B) = \frac{1}{4}$, find $P\left(A \cup B^C\right)$.

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40. If X follows a binomial distribution with parameter $n = 6$ and p with $4P(X = 4) = P(X = 2)$, find p.

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41. If $x = \frac{1 - \cos^2\theta}{\cos\theta}, y = \frac{1 - \cos^{2n}\theta}{\cos^n\theta}$ then show that $\left(\frac{dy}{dx}\right)^2 = n^2\left(\frac{y^2 + 4}{x^2 + 4}\right)$

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42. Shows that the triangle of greatest area that can be inscribed in a circle is equilateral.

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

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44. Find the solution of the following differential equations:

$x dy - y dx = \sqrt{x^2 + y^2} dx$

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45. Prove that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) + \vec{b} \times \left(\vec{c} \times \vec{a}\right) + \vec{c} \times \left(\vec{a} \times \vec{b}\right) = 0$ and hence prove that $\vec{a} \times \left(\vec{b} \times \vec{c}\right), \vec{b} \times \left(\vec{c} \times \vec{a}\right), \vec{c} \times \left(\vec{a} \times \vec{b}\right)$ are coplanar.

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46. A variable plane meets the coordinate axes at P, Q, R points. If the plane passes through a fixed point (a, b, c), prove that the centre of the shpere passing the origin and P, Q, R will lie on the surface $\frac{a}{x}+\frac{b}{y}+\frac{c}{z}=2$

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47. Solve the following LPP graphically : Maximize : $Z=5x_1+3x_2$ subject to : $3x_1+5x_2\leq 15$ $5x_1+2x_2\leq 10$ $x_1,x_2\geq 0$

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48. Solve the following system of equations by the matrix inversion method.

$x + y + z = 4$

$2x - y + 3z = 1$

and $3x + 2y - z = 1$

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49. Show that:

$$C_0C_r + C_1C_{r+1} + C_2C_{r+2} + \ldots + C_{n-r}C_n = \frac{(2n)!}{(n-r)!(n+r)!}$$

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50. Three persons hit a target with probability $\frac{1}{2}, \frac{1}{3}$ and $\frac{1}{4}$ respectively. If each one shoot at the target once,

find the probability that exactly one of them hits the target

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51. Three persons hit a target with probability $\frac{1}{2}, \frac{1}{3}$ and $\frac{1}{4}$ respectively. If each one shoot at the target once,

if only one of them hits the target what is the probability that it was the first person ?

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