



MATHS

BOOKS - SHARAM PUBLICATION

QUESTION PAPER 2019

Exercise

1. 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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2. Write the order of the differential equation whose solution is given by $y = (c_1 + c_2)\cos(x + c_3) + c_4e^{x+c_5}$

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

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4. 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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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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10.

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



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



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14. Find the probability distribution of number of heads in three tosses of a coin.



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15. 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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16. 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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17. 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 probability of his passing just three tests.



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18. Find the point on the curve $x^2 + y^2 - 4xy + 2 = 0$

where the normal is parallel to the x-axis.

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19. Find the intervals in which the function $y = \frac{\ln x}{x}$ is

increasing and decreasing.

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

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



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22. Verify Lagrange's Mean-Value theorem for

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



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23. Find differential equation of the curve

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



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

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



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



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



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27. 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 d.cs. 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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28. 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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29. Find a unit vector perpendicular to both of the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ where $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $b = \hat{i} + 2\hat{j} + 3\hat{k}$.

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30. Show that $\left(\vec{a} \times \vec{b}\right)^2 = a^2b^2 - \left(\vec{a} \cdot \vec{b}\right)^2$.

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31. 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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32. 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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33. Show that the shortest distance of the point $(0, 8a)$ from the curve $ax^2 = y^3$ is $2a\sqrt{11}$.

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

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

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36. Evaluate the following integrals $\int \frac{dx}{2 \cos^2 x + 3 \cos x}$

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37. 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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38. 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 parallel to the line $\frac{x+2}{2} = \frac{y-3}{-3} = \frac{z-4}{8}$

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39. 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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40. Maximize: $Z = 10x_1 + 12x_2 + 8x_3$

Subject to: $x_1 + 2x_2 \leq 30$

$5x_1 - 7x_3 \geq 12$

$$x_1 + x_2 + x_3 = 20$$

$$x_1, x_2 \geq 0$$



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41. Prove that $f: X \rightarrow Y$ is injective iff for all subsets A, B of X , $f(A \cap B) = f(A) \cap f(B)$.



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42. 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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43. 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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44. 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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