



MATHS

BOOKS - SHARAM PUBLICATION

QUESTION PAPER 2010

Exercise

1. What is the derivative of $\sec^{-1} x$ with respect of x ?



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2. What is the least value of n such that

$\frac{d^n}{dx^n} (1 + x + x^2)^m = 0$ where m is a non-negative integer?



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3. Write the set of points, where the function

$f(x) = x^3$ has relative (local) extreme.



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4. Write in one sentence why you cannot apply Rolle's theorem to the function $f(x)=|x|$ in the interval $[-1,1]$



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



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6. What is the value of

$$\int \frac{d}{dx} f(x) dx - \frac{d}{dx} \int f(x) dx?$$



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7. If $\int_1^2 f(x) dx = \lambda$ then what is the value of

$$\int_1^2 f(3-x) dx?$$



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8. What is the value of $\int_0^1 \frac{dx}{1+x^2}$?



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9. Write the order and the degree of the following differential equation.

$$\frac{d^3y}{dx^3} = \left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^4 + y$$



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10. Write the particular solution of

$$\frac{dy}{dx} = (1 + x)^4, y = 0 \text{ when } x = -1.$$



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11. How many directions a null vector has ?



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12. For what value of λ the vectors

$2\lambda\hat{i} + \hat{j} + 3\lambda\hat{k}$ and $\lambda\hat{i} - 4\hat{j} + 2\hat{k}$. Are

perpendicular to each other.



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13. Write the equation of the plane passing through the point $(1, -2, 3)$ and perpendicular to the y -axis.



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14. Write the solution of the following LPP

$$\text{Maximise } Z = 2x + 3y$$

Subject to $x, y \geq 0, x + y \leq 1$.



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15. If ω is a complex cube root of 1, then for what value of λ the determinant

$$\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \lambda & 1 \\ \omega^2 & 1 & \omega \end{vmatrix} = 0?$$



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16. If $[1 \ 2 \ 3]A = [0]$ then what is the order of the matrix.



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17. If $P(A) = \frac{1}{2}$ and $P(A \cap B) = \frac{1}{3}$ then what is the probability of $(A - B)^C$?



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18. If $f(x) = \sin x$ and $g(x) = x^3$. Then find the value of $(f(x)g(x))^m$ at $x = \frac{\pi}{2}$



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19. Answer with reasons, whether the following function has a relative (local) maximum at $x = 2$ or not.

$$f(x) = \begin{cases} x & 0 \leq x < 1 \\ 1 & 1 \leq x \leq 2 \\ 3 - x & 2 < x \leq 3 \end{cases}$$



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20. Interpret Lagrange's mean value theorem geometrically.



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21. the points on the curve $y^2 = x$ where the tangents makes an angle of $\frac{\pi}{4}$ with X - axis is



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22. Integrate: $\int \sin^4 x \cos^3 x dx$



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23. Evaluate: $\int_0^{\frac{3}{2}} [x^2] dx.$



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24. Find the area bounded by the curve $x = y^2$ and the straight lines $x = 0, y = 1.$



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25. Find the differential equation whose general solution is $c_1x^2 + c_2y = 1$ where c_1, c_2 are arbitrary constants.



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26. Find the particular solution of the following differential equation :

$$\frac{dy}{dx} + \frac{1 + y^2}{1 + x^2} = 0, y(-1) = -\sqrt{3}$$



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27. Find an integrating factor of the differential equation $(x + \tan y) dy = \tan y dx$.



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28. If the position vectors of the points A, B, C are $2\hat{i} + \hat{j} - \hat{k}$, $3\hat{i} - 2\hat{j} + \hat{k}$ and $\hat{i} + 4\hat{j} - 3\hat{k}$ respectively, then prove that A, B, C are collinear.



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29. Find the scalar projection of the vector

$$\vec{a} = 3\hat{i} + 6\hat{j} + 9\hat{k} \text{ on } \vec{b} = 2\hat{i} + 2\hat{j} - \hat{k}.$$



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30. Find the value of λ such that the following vectors are coplanar:

$$-\hat{i} + \lambda\hat{j} - \lambda\hat{k}, 2\hat{i} + 4\hat{j} + 5\hat{k}, -2\hat{i} + 4\hat{j} - 4\hat{k}$$

.



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31. Bisecting the line segment joining $(-1, 4, 3)$ and $(5, -2, -1)$ at right angles.



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32. Prove that the line

$\frac{x-1}{2} = \frac{y+2}{-3} = \frac{z-3}{1}$ lies on the plane

$$7x + 5y + z = 0$$



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33. If one end of a diameter of the sphere $x^2 + y^2 + z^2 - 2x + 4y - 6z - 11 = 0$ is $(-1, 2, 4)$ then find the coordinates of the other end.



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34. Show that feasible region for the following constraints in a graph $2x + y \leq 4, x \geq 0, y \geq 0$.



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35. If a system of equations $\lambda x + 3y = 0$

$x + (\lambda - 2)y = 0$ has infinitely many

solutions, then find the values of λ .



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36. Find the inverse of the following :

$$\begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$$



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37. If the sets A and B have m and n elements respectively, then how many functions can be defined from A and B ? Answer with reasons.



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38. If A and B are any two events and $A \subset B$, then prove that $P(A) \leq P(B)$



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39. If a die is thrown twice in succession, then find the probability that the sum of numbers obtained is 8.



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40. Find $\frac{dy}{dx}$ if $x = y^x + \tan^{-1} x$.



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41. if $y = e^{\cos^{-1} x}$ then find $\frac{dy}{dx}$.



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42. Show that the rectangle of maximum area that can be inscribed in a given circle is a square.



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43. Determine: $\lim_{x \rightarrow 0} \frac{x \cos x}{\sin x}$.



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44. Integrate: $\int \sin 4x dx$



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45. Evaluate $\int \frac{dx}{(x+1)\sqrt{1-x^2}}$



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46. $\int_0^\pi \frac{x dx}{1 + \sin x}$



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47. Find the solution of the following differential equations:

$$(2x+y+1)dx+(4x+2y-1)dy=0$$



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48. If the vertices A,B,C of a triangle ABC are at $(1,1,2), (2,2,3), (3,-1,-1)$ respectively, then using vector method find the area of the triangle.



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49. Find the distance of the point $(1, -2, 3)$ from the plane $x - y + z = 5$, measured parallel to the line $\frac{x}{2} = \frac{y}{3} = \frac{z}{-6}$



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50. Find the equation of the sphere inscribed in a tetrahedron whose faces are $x = 0, y = 0, z = 0$ and $2x + 2y + z = 1$.



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51. Solve the following LPP graphically.

$$\text{Maximize: } z = 5x + 3y$$

$$\text{Subject to } 3x + 5y \leq 15$$

$$5x + 2y \leq 10$$

$$x, y \geq 0$$



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52. If a, b and c are all positive real, then prove

that minimum value of determinant

$$\begin{vmatrix} a^2 + 1 & ab & ac \\ ab & b^2 + 1 & bc \\ ac & bc & c^2 + 1 \end{vmatrix} = 1 + a^2 + b^2 + c^2$$



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

$$x - y + z = 4$$

$$2x + y - 3z = 0$$

$$x + y + z = 2$$



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