MATHS

BOOKS - MODERN PUBLICATION

SAMPLE PAPER 2015

Exercise

1. Write the value of

$$\lim_{h \to 0} \frac{\tan^{-1}(1+h) - \tan^{-1} 1}{h}.$$

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2. Write the set of values of x for which the function f(x) = sinx - x is increasing.

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3. If $\int_2^3 f(z)dx = 9$, then write the value of $\int_2^3 f(\phi(z))d(\phi(z))$.

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4. Write the order of the differential equation of the system of ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1.$

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5. A line makes angles 60° and 45° with the positive direction of X-axis and Y-axis, respectively. What acute angle does it make with the Z-axis?

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6. Write the equation of the plane perpendicular to y-axis at the point (0,-2, 0).

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7. If (2,3,5) is one end of a diameter of the sphere $x^2 + y^2 + z^2 - 6x - 12y - 2z + 20 = 0$, then write coordinates of the other end of the diameter.

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8. If $\begin{bmatrix} 3 & 5 & 3 \\ 2 & 4 & 2 \\ \lambda & 7 & 8 \end{bmatrix}$ is a singular matrix, write the value of lambda.

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9. There are 4 letters and 4 directed envelopes. Write the number of ways such that two letters are kept in the right envelopes.

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10. Write the probability that two persons have the same birthday (considering the relevant year not to be a leap year).

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11. Find $\frac{dy}{dx}$, when $y^x = x^{\sin y}$

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12. Find $\frac{dy}{dx}$, when $y = e^x \ln x$.

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13. Show that $\frac{dy}{dx}$ is independent of t .

$\cos x = \sqrt{\frac{1}{1+t^2}}$ and $\sin y = \frac{2t}{1+t^2}$

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14. Verify Euler's theorem in the case of

$z = xy + \frac{(x+y)^4}{xy}$.

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15. Show that `2 sin x + than x ge 3x all x in (0, pi/20).

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16. Find the following limits:

$$\lim_{x \to 0+} \log_{\tan x} \tan 2x$$

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17. Find the approximate value of $\sqrt[6]{63}$.

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18. Evaluate : $\int x^2 \tan^{-1} x dx.$

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19. Evaluate $\int \frac{dx}{x \ln(x)\sqrt{(In(x))^2 - 4}}$

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20. Find the area of the circle

$x^2 + y^2 = 2ax.$

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21. Find the particular solution ofthe differential equation $\frac{d^2y}{dx^2} = 6x$ given that $y = 1$ and $\frac{dx}{dy} = 2$ when $x = 0.$

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22. Solve the following differential equation

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

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23. Solve the following differential equation :

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

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24. Prove that the lines joining the midpoints of consecutive sides of a quadrilateral form a parallelogram using vector method.

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25. Prove that : $\left[\left(\vec{a}\times\vec{b}\right)\left(\vec{b}\times\vec{c}\right)\left(\vec{c}\times\vec{a}\right)\right]=\left[\vec{a}\,\vec{b}\,\vec{c}\right]^2$.

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26. If $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular vectors of equal magnitude show that $\vec{a} + \vec{b} + \vec{c}$ is equally inclined to $\vec{a}, \vec{b}, \vec{c}$.

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27. Prove that the measure of the angle between two main diagonals of a cube is $\cos^{-1}\frac{1}{3}$.

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28. Find the equation of the plane through the points (1, 2, -3), (2,3, -4) and perpendicular to the plane x + y + z + 1 = 0.

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29. Find the perpendicular distance of the point $(-1, 3, 9)$ from the line $\frac{x-13}{5} = \frac{y+8}{-8} = \frac{z-31}{1}$

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30. Solve the following LPP graphically :

Minimize $Z = 6x_1 + 7x_2$

Subjected to $x_1 + 2x_2 \geq 1, x_1, x_2 \geq 0.$

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31. Find the feasible region the the following system of equations $2y - x \geq 0, 6y - 3x \leq 21, x \geq 0, y \geq 0.$

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32. Solve the following equations by cramer's rule : $7x + y + 1 = 0, x + 13y + 5 = 0.$

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33. If $A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$ then show that $A^k = \begin{bmatrix} 1+2k & -4k \\ k & 1-2k \end{bmatrix}, k \varepsilon N$

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34. If $A = \begin{bmatrix} 1 & -2 & 2 \\ 3 & 1 & -1 \end{bmatrix}$

$B \begin{bmatrix} 2 & 4 \\ 1 & 2 \\ 3 & -1 \end{bmatrix}$ verify

that $(AB)^T = B^T A^T$.

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35. How many four digits even numbers with distict digits can be formed out of the digits 0,1,2,3,4,5,6?

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36. In how many ways can 10 boys and 10 girls sit in a row so that no two boys sit together ?

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37. Find the fifth term in the expansion of

$$\left(6x - \frac{a^3}{x}\right)^{10}$$

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38. Two different digits are selected at random from the digits 1 through 9

If the sum is even, what is the probability that 3 is one of the digits selected?

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39. Suppose that the probability that your alarm goes off in the morning is 0.9. If the alarm goes off, the probability is 0.8 that you attend your 8 a.m. class. If the alarm does not go to off, the probability that you make your 8 a.m.class is 0.5. Find the probability that you make your 8 a.m. class.

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40. Find the tangent to the curve $y = \cos(x + y), 0 \leq x \leq 2\pi$ which is parallel to the line x + 2y = 0

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41. Evaluate $\int \frac{dx}{\cos x(1 + 2\sin x)}$

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42. If $\vec{a} = 2\hat{i} + \hat{j}$, $\vec{b} = -\hat{i} + 2\hat{k}$, $\vec{c} = 2\hat{i} + \hat{k}$. find $\vec{a} \times \left(\vec{b} \times \vec{c}\right)$ and also verify the formula $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \left(\vec{a}.\vec{c}\right)\vec{b} - \left(\vec{a}.\vec{b}\right)\vec{c}$

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43. A sphere of constant radius k passes through the origin and meets the coordinate axes at P,Q,R. Prove that centroid of the triangle PQR lies on the sphere $9(x^2+y^2+z^2)=4k^2$.

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44. Maximize $z=-10x+2y$

Subject to

$-x+y\geq-1, x+y\leq 6, y\leq 5, x, y\geq 0$

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45. Show that $C_1^2 + 2C_2^2 + 3C_3^2 + ... + {}^nC_n^2$ = $\frac{(2n-1!)}{\{(n-1)!\}^2}$

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46. From a box containing 32 bulbs out of which 8 are defective 4 bulbs are drawn at random successively one after anoter with replacement. Find the probability distribution of the number of defective bulds.

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