MATHS

BOOKS - FULL MARKS MATHS (TAMIL ENGLISH)

SAMPLE PAPER - 16

Part I

1. If P = $\begin{vmatrix} 1 & x & 0 \\ 1 & 3 & 0 \\ 2 & 4 & -2 \end{vmatrix}$ is the adjoint of 3×3 matrix A and |A|=4, then x is

A. 15

B. 12

C. 14

D. 11

Answer:

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2. If P = $\begin{vmatrix} 1 & x & 0 \\ 1 & 3 & 0 \\ 2 & 4 & -2 \end{vmatrix}$ is the adjoint of 3×3 matrix A and |A|=4, then x is

A. consistent and has infinitely many solution

B. consistent and has a unique solution

C. consistent

D. inconsistent

Answer:

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3. The principal argument of $\dfrac{3}{-1+i}$ is

A. $-\dfrac{5\pi}{6}$

B. $\dfrac{-2\pi}{3}$

C. $\frac{-3\pi}{4}$

D. $\frac{-\pi}{2}$

Answer:

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4. If z $=\frac{\left(\sqrt{3}+i\right)^3(3i+4)^2}{(8+6i)^2}$, then |z| is equal to

A. 0

B. 1

C. 2

D. 3

Answer:

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5. If find g are polynomials of derrees m and n respectively, and if h(x) = $(f^{\circ}g)$(x), then the degree of h is

A. mn

B. m + n

C. m^n

D. n^m

Answer:

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6. The equation $\tan^{-1}x - \cot^{-1}x = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$ has

A. no solution

B. unique solution

C. two solutions

D. infinite number of solutions

Answer:

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7. $\sin^{-1}\left(3\frac{x}{2}\right) + \cos^{-1}\left(3\frac{x}{2}\right)$ = ...

A. $\frac{3\pi}{2}$

B. 6 x

C. 3 x

D. $\frac{\pi}{2}$

Answer:

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8. Tangents are drawn to the hyperbola $\frac{x^2}{9} - \frac{y^2}{4}$ parallel to the straight line 2x - y= 1 . One of the points of contact of tangents on the hyperbola is

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A. $\left(\frac{9}{2\sqrt{2}}\frac{1}{\sqrt{2}}\right)$

B. $\left(\frac{-9}{2\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

C. $\left(\frac{9}{2\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

D. $(3\sqrt{3}, -2\sqrt{2})$

Answer:

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9. The vertices of the ellipse $16x^2 + 25y^2 = 400$ are ....

A. $(\pm 3, 0)$

B. $(0, \pm 3)$

C. $(0, \pm 5)$

D. $(\pm 5, 0)$

Answer:

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10. If the volume of the parallelpiped with $\vec{a} \times \vec{b}, \vec{b} \times \vec{c}, \vec{c} \times \vec{c} \times \vec{a}$ as coterminous edges is 8 cubic units, then the volume of the parallelepiped with $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{b} \times \vec{c}\right), \left(\vec{b} \times \vec{c}\right) \times \left(\vec{c} \times \vec{a}\right)$ and $\left(\vec{c} \times \vec{a}\right) \times \left(\vec{a}\right.$

as coterminous edges is,

A. 8 cubic units

B. 512 cubic units

C. 64 cubic units

D. 24 cubic units

Answer:

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11. If

$$\vec{d} = \vec{a} \times \left(\vec{b} \times \vec{c}\right) + \vec{b} \times \left(\vec{c} \times \vec{a}\right) + \vec{c} \times \left(\vec{a} \times \vec{b}\right), \text{ then}$$

A. $\vec{u}$ is a unit vector

B. $\vec{u} = \vec{a} + \vec{b} + \vec{c}$

C. $\vec{u} = \vec{0}$

D. $\vec{u} \neq \vec{0}$

Answer:

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12. The maximum value of the functions $x^2 e^{-2x}$, $x > 0$ is ....

A. $\frac{1}{e}$

B. $\frac{1}{2e}$

C. $\frac{1}{e^2}$

D. $\frac{4}{e^4}$

Answer:

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13. If $u(x, y) = x^2 + 3xy + y - 2019$, then $\left(\frac{\partial u}{\partial x}\right)_{4 \quad -5}$ is equal to

A. -4

B. -3

C. -7

D. 13

Answer:

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14. The differential on y of the function $y = x^{\frac{1}{4}}$ is ....

A. $\frac{1}{4}x^{\frac{3}{4}}$

B. $\frac{1}{4}x^{-\frac{3}{4}}$d x

C. $x^{\frac{3}{4}}$ dx `

D. 0

Answer:

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15. The curve $a^2y^2 = x^2(a^2 - x^2)$ is symmetrical about

A. x - axis only

B. y-axis only

C. both the axix

D. both the axis and origin

Answer:

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16. The value of $\int_0^1 \left(\sin^{-1} x\right)^2 dx$ is

A. $\frac{\pi^2}{4} - 1$

B. $\frac{\pi^2}{4} + 2$

C. $\frac{\pi^2}{4} + 1$

D. $\frac{\pi^2}{4} - 2$

Answer:

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17. The integrating factor of the differential equation $\frac{dy}{dx} + P(x)y = Q(x)$ is x, then $P(x)$

A. x

B. $\frac{x^2}{2}$

C. $\frac{1}{x}$

D. $\frac{1}{x^2}$

Answer:

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18. The number of arbitrary constants in the general solutions of order n and $n+1$ are respectively

A. $n-1, n$

B. $n, n+1$

C. $n+1, n+2$

D. $n+1, n$

Answer:

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19. Four buses carrying 160 students from the same school arrive at a football stadium. The buses carry, respectively, 42, 36, 34, and 48 students. One of the students is randomly selected. Let X denote the number of students that were on the bus carrying the randomly selected student. Let Y denote the number of students on that bus. Then E[X] and E[Y] respectively are

A. 50 , 40

B. 40 , 50

C. 40.75 , 40

D. 41, 41

Answer:

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20. Which one is the inverse of the statement $(p \vee q) \to (p \wedge q)$?

A. $(p \wedge q) \rightarrow (p \vee q)$

B. $-(p \vee q) \rightarrow (p \wedge q)$

C. $(-p \vee -q) \rightarrow (-p \wedge -q)$

D. $(-p \wedge -q) \rightarrow (-p \vee -q)$

Answer:

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Part Ii

1. By matrix multiplication from that $M = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ is orthogonal.

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2. If ω is a complex cube root of unity, then $\frac{a+b\omega+c\omega^2}{c+a\omega+b\omega^2}+\frac{c+a\omega+b\omega^2}{a+b\omega+c\omega^2}+\frac{b+c\omega+a\omega^2}{b+c\omega+a\omega^5}=$

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3. Formulate into a mathematical problem to find a number such that when its cube root is added to it, the result is 6.

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4. Find the length of Latus rectum of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1.$

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5. Find the acute angle between the planes $\vec{r}.\left(2\hat{i}+2\hat{j}+2\hat{k}\right)=11$ and 4x-2y + 2z =15

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6. Obtain the Maclaurin's series expansion for the function e^{2x}

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7. Let us assume that the the the shape of a soap bubble is a sphere . Use linear approximation to approximate the increase in the surface area of a soap bubble as its radius increases from 5 cm to 5.2 cm also calculate the percentage error.

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8. Evaluate the following :

$$\int_0^{\frac{\pi}{2}} \sin^3\theta\cos^5\theta d\theta$$

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9. Show what $y = ae^{-3x} + b$, where a and b are arbitary constants, is a solution of the differential equation $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} = 0$

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10. Find the value of $\sec^{-1}\left(-\frac{2\sqrt{3}}{3}\right)$

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Part Iii

1. Find the inverse of the non-singular matrix A = $\begin{bmatrix} 0 & 5 \\ -1 & 6 \end{bmatrix}$, by Gauss Jordan method.

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2. The complex numbers u, v and w are related by $\frac{1}{u} = \frac{1}{v} + \frac{1}{w}$. If v = 3 -4i and w = 4 + 3i , find u in rectangular form.

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3. If the root of $x^3 + px^2 + qx + r = 0$ are in H.P. prove that $9pqr = 27r^2 + 2q^3$. Assume $p, q, r \neq 0$

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4. Find the value of

$$\cot^{-1}(1) + \sin^{-1}\left(\frac{-\sqrt{3}}{2}\right) - \sec^{-1}(-\sqrt{2})$$

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5. Find the absolute maximum and absolute minimum values of f on the given interval $f(x) = \frac{x}{x+1}$ [1 , 2]

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6. The time T, taken for a complete oscillation of a single pendulam with length l, is given by the equation $T = 2\pi\sqrt{\frac{l}{g}}$, where g is a constant. Find the approximate percentage error in the calculated value of T corresponding to an error of 2 percent in the value of l.

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7. Solve $e^x\sqrt{1-y^2}dx + \frac{y}{x}dy = 0$

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8. An urn contains 5 mangoes and 4 apples. Three fruits are taken at random. If the number of apples taken is a random variable, then find the values of the random variable and number of points in its inverse images.

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9. Show that $[\neg q \wedge p] \wedge q$ is a contradiction.

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10. Evaluate the following :

$$\int_0^{\frac{\pi}{2}} \sin^3\theta\cos^5\theta d\theta$$

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Part Iv

1. (a) Show that the equations $x+y+z=6, x+2y+3z=14, x+4y+7z=30$ are consistent and solve them .

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2. Verify (i) closure property (ii) commutative property (iii) associate property (iv) existence of identity and (v) existence of inverse for the opertion $\times 11$ on a subset A = {1 , 3 , 4 , 5 , 9} of the set of the remainders {0 , 1 , 2 , 3 , 4 , 5 , 6 , 7 , 8 , 9 , 10}.

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3. Prove that $(1+i)^n + (1-i)^n = 2^{\frac{n+2}{2}} \frac{\cos(n\pi)}{4}$

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4. Find the parametric form of vector equation, and Cartesian equations of the plane passing through the points $(2, 2, 1), (9, 3, 6)$ and perpendicular to the plane 2x + 6y + 6z = 9.

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5. Find a polynomial equation of minimum degree with rational coefficients, having $\sqrt{5}-\sqrt{3}$ as a root.

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6. If the probability mass function f(x) of a random variable X is

x	1	2	3	4
$f(x)$	$\frac{1}{12}$	$\frac{5}{12}$	$\frac{5}{12}$	$\frac{1}{12}$

find (i) its cumulative distribution hence find (ii) P (X $\leq$ 3) and , (iii) $P(X \geq 2)$

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7. Prove that : $\cos\left[\tan^{-1}\left\{\sin\left(\cot^{-1}x\right)\right\}\right]=\sqrt{\frac{x^2+1}{x^2+2}}$

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8. $(x^2 + y^2)dy = xydx$. It is given that $y(1) = 1$ and $y(x_0) = e$. Find the vale of x_0.

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9. At a water fountain , water attains a maximum height of 4m at horizontal distance of 0.5 m from its origin. If the path of water is a parabola, find the height of water at a horizontal distance of 0.75 m from the point or origin.

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10. Prove that the curves $y^2 = 4x$ and $x^2 = 4y$ divide the area of the square bounded by x = 0, x = 4 and y = 0 into three equal parts.

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11. If $\vec{a} = 2\vec{i} + 3\vec{j} - \vec{k}$, $\vec{b} = 2\vec{i} + 5\vec{k}$, $\vec{c} = \vec{j} - 3\vec{k}$, verify that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \left(\vec{a}.\vec{c}\right)\vec{b} - \left(\vec{a}.\vec{b}\right)\vec{c}$.

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12. Prove that the line $5x + 12y = 9$ touches the hyperbola $x^2 - 9y^2 = 9$ and find the point of contact.

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13. Prove that the ellipse $x^2 + 4y^2 = 8$ and the hyperbola $x^2 - 2y^2 = 4$ intersect orthogonally .

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14. Let W(x,y,z) $= x^2 - xy + 3\sin z, x, y, z \in R,$ Find the linear approximation at (2,-1,0).

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