MATHS

BOOKS - FULL MARKS MATHS (TAMIL ENGLISH)

SAMPLE PAPER - 20 (UNSOLVED)

Part I I Choose The Correct Answer Answer All The Questions

1. A = $\begin{bmatrix} \frac{3}{5} & \frac{4}{5} \\ x & \frac{3}{5} \end{bmatrix}$ and $A^T = A^{-1}$, then the value of x is

A. $\frac{-4}{5}$

B. $\frac{-3}{5}$

C. $\frac{3}{5}$

D. $\frac{4}{5}$

Answer: A

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2. If z is non zero complex number, such that 2i $z^2 = \bar{z}$, then |z| is

A. $\frac{1}{2}$

B. 1

C. 2

D. 3

Answer: A

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3. Which of the following is not true?

A. $\overline{z_1 + z_2} = \overline{z_1} + \overline{z_2}$

B. $\overline{z_1 z_2} = \overline{z_1}\,\overline{z_2}$

C. $Re(z) = \frac{\overline{z_1} + z}{2}$

D. $Im(z) = \frac{\bar{z} - z}{2i}$

Answer: D

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4. If $0 \leq \theta \leq \pi$ and the system of equations x+(sin $\theta)y - (\cos\theta)z = 0, (\cos\theta)x - y + z = 0, (\sin\theta)x + y - z = 0$ has a non -trivial solution then θ is

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

B. $\frac{3\pi}{4}$

C. $\frac{5\pi}{4}$

D. $\frac{\pi}{4}$

Answer: D

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5. If $\sin^{-1} x + \sin^{-1} y = \frac{2\pi}{3}$, then $\cos^{-1} x + \cos^{-1} y$ is equal to

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

B. $\frac{\pi}{3}$

C. $\frac{\pi}{6}$

D. π

Answer: B

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6. $\sin\left(\tan^{-1} x\right) |x| < 1$ is equal to

A. $\frac{x}{\sqrt{1-x^2}}$

B. $\frac{1}{\sqrt{1-x^2}}$

C. $\frac{1}{\sqrt{1+x^2}}$

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

Answer: D

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7. The equation of the circle passing through the foci ellispe $\frac{x^2}{16} + \frac{y^2}{9} = 1$ having centre at (0,3) is

A. $x^2 + y^2 - 6y = 0$

B. $x^2 + y^2 - 6y - 7 = 0$

C. $x^2 + y^2 - 6y - 5 = 0$

D. $x^2 + y^2 - 6y + 5 = 0$

Answer: B

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8. The eqquation of the directrices of $25x^2 + 9y^2 = 225$ are ..... .

A. $x = \pm \frac{4}{25}$

B. $x = \pm \frac{25}{4}$

C. $y = \pm \frac{4}{25}$

D. $y = \pm \frac{25}{4}$

Answer: D

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9. The angle between the lines $\frac{x-2}{3} = \frac{y+1}{-2}, z = 2$ and $\frac{x-1}{1} = \frac{2y+3}{3}, \frac{z+5}{2}$ is

A. $\frac{\pi}{6}$

B. $\frac{\pi}{4}$

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

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

Answer: D

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10. The unit normal vector to the plane 2x - y + 2z = 5 are .....

A. $2\vec{i} - \vec{j} + 2\vec{k}$

B. $\frac{1}{3}\left(2\vec{i} - \vec{j} + 2\vec{k}\right)$

C. $-\frac{1}{3}\left(2\vec{i} - \vec{j} + \vec{k}\right)$

D. $\pm\frac{1}{3}\left(2\vec{i} - \vec{j} + 2\vec{k}\right)$

Answer: D

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11. The abscissa of the point on the curve $f(x) = \sqrt{8 - 2x}$ at which the slope of the tangent is -0.25 ?

A. -8

B. -4

C. -2

D. 0

Answer: B

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12. If x_0 is the x - coordinate of the point of inflection of a curve $y = f(x)$ then (second derivative exists) ..... .

A. $f(x_0) = 0$

B. $f'(x_0) = 0$

C. $f''(x_0) = 0$

D. $f''(x_0) \neq 0$

Answer: C

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13. If $g(x, y) = 3x^2 - 5y + 2y^2$, $x(t) = e^t$ and $y(t) = \cos t$, then $\frac{dg}{dt}$ is equal to

A. $6e^{2t} + 5\sin t - 4\cos t \sin t$

B. $6e^{2t} - 5\sin t + 4\cos t \sin t$

C. $3e^{2t} + 5\sin t + 4\cos t \sin t$

D. $3e^{2t} - 5\sin t + 4\cos t \sin t$

Answer: A

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14. The differential of y if $y = \sin 2x$ is ..... .

A. $2\cos 2x$

B. $2\cos 2x dx$

C. $-2\cos 2x dx$

D. $\cos 2x dx$

Answer: B

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15. The value of $\int_0^{\frac{2}{3}} \frac{dx}{\sqrt{4-9x^2}}$ is

A. $\frac{\pi}{6}$

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

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

D. π

Answer: A

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16. If n is even then $\int_0^{\pi/2} \cos^n x dx$ is ..... .

A. $\frac{n}{n-1} \cdot \frac{n-2}{n-3} \cdot \frac{n-4}{n-5} \cdots \frac{\pi}{2}$

B. $\frac{n-1}{n}.\frac{n-3}{n-2}.\frac{n-5}{n-4}.\ldots.\frac{1}{2}\frac{\pi}{2}$

C. $\frac{n}{n-1}.\frac{n-2}{n-3}.\frac{n-4}{n-5}.\ldots\frac{2}{2}.1$

D. $\frac{n-1}{n}.\frac{n-2}{n-2}.\frac{n-5}{n-4}.\ldots\frac{2}{3}.1$

Answer: B

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17. The solution of the differential equation $2x\frac{dy}{dx}-y=3$ represents

A. straight lines

B. circles

C. parabola

D. ellipse

Answer: C

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18. Two coins are to be flipped. The first coin will land on heads with probability 0.6, the second with probability 0.5. Assume that the results of the flips are independent, and let X equal the total number of heads that result. The value of E[X] is

A. 0.11

B. 1.1

C. 11

D. 1

Answer: B

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19. Let X have a Bernoulli distribution with mean 0.4, then the variance of (2X-3) is

A. 0.24

B. 0.48

C. 0.6

D. 0.96

Answer: D

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20.

p	q	$(p \wedge q) \rightarrow \neg p$
T	T	(a)
T	F	(b)
F	T	(c)
F	F	(d)

Which one of the following is correct for the truth value of $(p \vee q) \rightarrow -p$?

A. $\begin{matrix} (a) & (b) & (c) & (d) \\ T & T & T & T \end{matrix}$

B. $\begin{matrix} (a) & (b) & (c) & (d) \\ F & T & T & T \end{matrix}$

C. $\begin{matrix}(a) & (b) & (c) & (d)\\ F & F & T & T\end{matrix}$

D. $\begin{matrix}(a) & (b) & (c) & (d)\\ T & T & T & F\end{matrix}$

Answer: B

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Part Ii Ii Answer Any Seven Questions Questions No 30 Is Compulsory

1. Find the rank of the following matrices by row reduction method :

$$\begin{bmatrix} 3 & -8 & 5 & 2 \\ 2 & -5 & 1 & 4 \\ -1 & 2 & 3 & -2 \end{bmatrix}$$

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2. Obtain the Cartesian equation for the locus of z = x + iy in each of the cases:

$|z - 4| = 16$

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3. Show that the polynomial $9x^9 + 2x^5 - x^4 - 7x^4 - 7x^2 + 2$ has at least six imaginary roots.

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4. Solve the $\tan^{-1}\left(\frac{1-x}{1+x}\right) = \frac{1}{2}\tan^{-1} x$ for $x > 0$.

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5. Find the vertices, foci for the hyperbola $9x^2 - 16y^2 = 144$.

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6. Find the angle between the line $\vec{r} = \left(2\hat{i} - \hat{j} + 2\hat{k}\right) + t\left(\hat{i} + 2\hat{j} - 2\hat{k}\right)$ and the plane

$\vec{r} \cdot \left(6\hat{i} + 3\hat{j} + 2\hat{k}\right) = 8.$

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7. Evaluate : $\int_{-\pi/4}^{\pi/4} x^3 \sin^2 x dx$

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8. Find the constant C such that function $f(x) = \begin{cases} Cx^2 & 1 < x < 4 \\ 0 & \text{Otherwise} \end{cases}$ is a density function

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Part Iii Iii Answer Any Seven Questions Questions No 40 Is Compulsory

1. A chemist has one solution which is 50% acid and another solution which is 25 % acid. How much each should be mixed to make 10 litres of a 40 % acid solution ? (Use Cramer's rule to solve the problem).

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2. If $\omega \neq 1$ is a cube root of unity, show that

(i) $\left(1-\omega+\omega^2\right)^6+\left(1+\omega-\omega^2\right)^6=128$

(ii) $(1+\omega)\left(1+\omega^2\right)\left(1+\omega^4\right)\left(1+\omega^8\right)\ldots 2nterms=1$

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3. It is known that the roots of the equation $x^3-6x^2-4x+24=0$ are in arithmetic progression. Find its roots.

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4. Find the domain of $\cos^{-1}\left(\frac{2+\sin x}{3}\right)$.

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5. 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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6. Find the intervals of monotonicity and local extrema of the function $f(x) = \frac{1}{1+x^2}$

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7. If $w(x, y) = x^3 - 3xy + 2y^2, x, y \in R$, find the linear approximation for w at (1,-1).

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8. Three fair coins are tossed simultaneously. Find the probability mass function for number of heads occurred.

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9. Shows that $p \leftrightarrow q = [-p \vee q] \wedge [(-q) \vee p]$

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10. If the equation of the ellipse is $\frac{(x-11)^2}{484} + \frac{y^2}{64} = 1$ (x and y are measured in centimeters) where to the nearest centimeter, should the patient's kidney stone be placed so that the reflected sound hits the kidney stone?

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Part Iv Iv Answer All The Questions

1. Solve the following system of linear equaltions, by Gaussian elimination method:

$4x + 3y + 6z = 25, x + 5y + 7z = 13, 2x + 9y + z = 1.$

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2. Find the inverse of each of the following by Gauss - Jordan method :

$$\begin{bmatrix} 1 & -1 & 0 \\ 1 & 0 & -1 \\ 6 & -2 & -3 \end{bmatrix}$$

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3. Find cube roots of $\sqrt{3} + i$.

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4. If

$a = \cos 2\alpha + i \sin 2\alpha, b = \cos 2\beta + i \sin 2\beta$ and $c = \cos 2\gamma + i \sin 2\gamma.$

Prove that.

(i) $\sqrt{abc} + \frac{1}{\sqrt{abc}} = 2\cos(\alpha + \beta + \gamma)$

(ii) $\frac{(a^2b^2 + c^2)}{abc} = 2\cos 2(\alpha + \beta - \gamma)$

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5. 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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6. Show that the set G of all rational numbers except -1 satisfies closure, associative, identify and inverse property with respect to the operation $*$ given by $a * b = a + b + ab$ for all $a, b \in G$.

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7. If w(x,y) $= 6x^3 - 3xy + 2y^2, x = e^s, y = \cos s \in R$, find $\frac{dw}{ds}$, and evaluate at s=0.

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8. A pair of fair dice is rolled once . Find the probability mass function to get the number of fours .

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9. If $a_1, a_2, a_3, \ldots . a_n$ is an arithmetic progression with common difference d. Prove that $\tan\left[\tan^{-1}\left(\frac{d}{1+a_1a_2}\right)+\tan^{-1}\left(\frac{d}{1+a_2a_3}\right)+\ldots+\tan^{-1}\left(\frac{d}{1+a_na_{n-1}}\right.\right.$

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10. Find the local maximum and local minimum of $f(x)=2x^3+5x^2-4x$

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11. Evaluate the following integrals using properties of integration :

$$\int_0^1 \frac{\log(1+x)}{1+x^2} dx.$$

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12. Find the vertex, focus, directrix, and length of the latus rectum of the parabola $x^2 - 4x - 5y - 1 = 0$

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13. Assume that the rate at which radioactive nuclei decay is proportioanl to the number of such nuclei that are present in a given sample. In a certain sample $10\,\%$ of the original number of radioactive nuclei have undergone disintegration in a period of 100 years. What percentage of the original radioactive nuclei will remain after 1000 years.?

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14. Find the vector parametric, vector non-parametric and Cartesian form of the equation of the plane passing through the points (-1, 2, 0), (2, 2, -1) and parallel to the straight line $\frac{x-1}{1} = \frac{2y+1}{2} = \frac{z+1}{-1}$

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