MATHS

BOOKS - FULL MARKS MATHS (TAMIL ENGLISH)

SAMPLE PAPER 03

Part I

1. If $(AB)^{-1} = \begin{bmatrix} 12 & -17 \\ -19 & 27 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 1 & -1 \\ -2 & 3 \end{bmatrix}$ then B^{-1} =

A. $\begin{bmatrix} 2 & -5 \\ -3 & 8 \end{bmatrix}$

B. $\begin{bmatrix} 8 & 5 \\ 3 & 2 \end{bmatrix}$

C. $\begin{bmatrix} 3 & 1 \\ 2 & 1 \end{bmatrix}$

D. $\begin{bmatrix} 8 & -5 \\ -3 & 2 \end{bmatrix}$

Answer: A

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2. If z is a complex number such that z $\in \mathbb{C}\backslash\mathbb{R}$, and z + $\frac{1}{z} \in \mathbb{R}$, then |z| is

A. 0

B. 1

C. 2

D. 3

Answer: B

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3. Let A $= \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ and $4B = \begin{bmatrix} 3 & 1 & -1 \\ 1 & 3 & x \\ -1 & 1 & 3 \end{bmatrix}$.

If B is the inverse of A, then the value of x is

A. 2

B. 4

C. 3

D. 1

Answer: B

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4. 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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5. The eccentricity of the ellispse $(x-3)^2 + (y-4)^2 = \frac{y^2}{9}$ is

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

B. $\frac{1}{3}$

C. $\frac{1}{3\sqrt{2}}$

D. $\frac{1}{\sqrt{3}}$

Answer: B

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6. The directrix of the parabola $y^2 = 4x$ is ..... .

A. y = -1

B. x= -1

C. y= 1

D. x = 1

Answer: B

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7. The angle between the line $\vec{r} = \left(\hat{i} + 2\hat{j} - 3\hat{k}\right) + t\left(2\hat{i} + \hat{j} - 2\hat{k}\right)$ and the plane $\vec{r} \cdot \left(\hat{i} + \hat{j}\right) + 4 = 0$ is :

A. 0°

B. 30°

C. 45°

D. 90°

Answer: C

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8. The d.c.s. of a vector whose direction ratios are 2, 3, -6 are ..... .

A. $\left(\frac{2}{7}, \frac{3}{7}, \frac{6}{7}\right)$

B. $\left(\frac{2}{49}, \frac{3}{49}, \frac{-6}{49}\right)$

C. $\left(\frac{\sqrt{2}}{7}, \frac{\sqrt{3}}{7}, \frac{-\sqrt{6}}{7}\right)$

D. $\left(\frac{2}{7}, \frac{3}{7}, \frac{6}{7}\right)$

Answer: A

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9. A balloon rises straight up at 10m/s. An observer is 40 m away from the spot where the balloon left the ground. Find the rate of change of the balloon's angle of elevation in radian per second when the balloon is 30 metres above the ground.

A. $\frac{1}{25}\text{radians}/\sec$

B. $\frac{4}{25}\text{radians}/\sec$

C. $\frac{1}{5}\text{radians}/\sec$

D. $\frac{1}{3}\text{radians}/\sec$

Answer: B

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10. The asymptote to the curve $y^2(2+x) = x^2(6-x)$ is

A. x=2

B. x = -2

C. x=6

D. x = -6

Answer: B

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11. The change in the surface area $S = 6x^2$ of a cube when the edge length varies from x_0 to $x_0 + dx$ is

A. $12x_0 + dx$

B. $12x_0dx$

C. $6x_0dx$

D. $6x_0 + dx$

Answer: B

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12. The differential of y if y=sin 2x is

A. 2 cos 2x

B. 2 cos 2x.dx

C. -2 cos 2x.dx

D. cos2x.dx

Answer: B

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13. The value of $\int_{-4}^{4}\left[\tan^{-1}\left(\frac{x^2}{x^4+1}\right)+\tan^{-1}\left(\frac{x^4+1}{x^2}\right)\right]dx$ is

A. π

B. 2π

C. 3π

D. 4π

Answer: D

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14. $\int_a^b f(x)dx =$

A. $-\int_a^b f(x)dx =$

B. $-\int_b^a f(x)dx =$

C. $-\int_0^a f(x)dx =$

D. $2\int_0^b f(x)dx =$

Answer: B

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15. The integrating factor of the differential equation $\frac{dy}{dx} + y = \frac{1+y}{x}$ is

A. $\frac{x}{e^{\lambda}}$

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

C. λe^x

D. e^x

Answer: B

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16. The differential equation representing the family of curves $y = A\cos(x + B)$, where A and B are parameters, is

A. $\frac{d^2y}{dx^2} - y = 0$

B. $\frac{d^2y}{dx^2} + y = 0$

C. $\frac{d^2y}{dx^2} = 0$

D. $\frac{d^2x}{dy^2} = 0$

Answer: B

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17. A rod of length 2l is broken into two pieces at random. The probability density function of the shorter of the two pieces is

$$f(x) = \begin{cases} \frac{1}{l} & 0 < x \geq l \\ 0 & l \leq x < 2l \end{cases}$$

The mean and variance of the shorter of the two pieces are respectively

A. $\frac{l}{2}, \frac{l^2}{3}$

B. $\frac{l}{2}, \frac{l^2}{6}$

C. $l, \frac{t^2}{12}$

D. $\frac{l}{2}, \frac{t^2}{12}$

Answer: D

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18. A computer salesperson knows from his past experience that he sells computers to one in every twenty customers who enter the showroom. What is the probability that he will sell a computer to exactly two of the next three customers?

A. $\frac{57}{20^3}$

B. $\frac{57}{20^2}$

C. $\frac{19^3}{20^3}$

D. $\frac{57}{20}$

Answer: A

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19. The operation $*$ defined by $a * b = \frac{ab}{7}$ is not a binary operation on

A. $\mathbb{Q}^+$

B. $\mathbb{Z}$

C. $\mathbb{R}$

D. $\mathbb{C}$

Answer: B

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20. If X is a discrete random variable $P(X > a)$ is equal to

A. $P(X < a)$

B. $1 - P(X \leq a)$

C. $1 - P(X < a)$

D. 0

Answer: A

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Part Ii

1. State the reason for $\cos^{-1}\left[\cos\left(-\frac{\pi}{6}\right)\right] \neq -\frac{\pi}{6}$

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2. Find the equation of the tangent and normal to the circle $x^2 + y^2 = 25$ at P(-3,4)

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3. Determine whether the three vectors $2\hat{i} + 3\hat{j} + \hat{k}$, $\hat{i} - 2\hat{j} + 2\hat{k}$ and $3\hat{i} + \hat{j} + 3\hat{k}$ are coplanar.

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4. Find the intervals of monotonicities and hence find the local extremum for the following functions:

$$f(x) = \frac{x}{x-5}$$

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5. Find the linear approximation for $f(x) = \sqrt{1+x}, x \geq -1$, at $x_0 = 3$. Use the linear approximation to estimate f (3.2).

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6. Evaluate the following integrals using properties of integration :

$$\int_0^{2\pi} \sin^4 x \cos^3 x dx$$

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7. Solve the differential equations :

$$\frac{dy}{dx} = \sqrt{\frac{1-y^2}{1-x^2}}$$

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8. Suppose the amount of milk sold daily at a milk booth is distributed with a minimum of 200 litres and a maximum of 600 litres with probability density function

$$f(x) = \begin{cases} k & 200 \leq x \leq 600 \\ 0 & \text{otherwise} \end{cases}$$

Find

the value of k

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9. Let $*$ be defined on R by $(a * b) = a + b + ab - 7$. Is $*$ binary on R? If so, find $3 * \left(-\frac{7}{15} \right)$.

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10. Examine for the rational roots of

$x^8 - 3x + 1 = 0$

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Part Iii

1. Solve the following system of linear equaltions, using matrix in inversion method: $5x + 2y = 3, 3x + 2y = 5.$

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2. Given $(x_1 + iy_1)(x_2 + iy_2)\ldots(x_n + iy_n)$ = a + ib, show that

$$\left(x_1^2 + y_1^2\right)\left(x_2^2 + y_2^2\right)\left(x_3^2 + y_3^2\right)\ldots\left(x_n^2 + y_n^2\right) = a^2 + b^2$$

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3. Find the sum of squares of roots of the equation $2x^4 - 8x^3 + 6x^2 - 3 = 0$

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4. Find the non-parametric form of vector equation, and Cartesian equation vector equation, and Cartesian equation of the plane passing through the point (0, 1,-5) and parallel to the straight lines $\vec{r} = \left(\hat{i} = 2\hat{j} - 4\hat{k}\right) + s\left(2\hat{i} + 3\hat{j} + 6\hat{k}\right)$ and $\vec{r} = \left(\hat{i} = 3\hat{j} - 4\hat{k}\right) + t\left(\hat{i} + \hat{j} + \hat{k}\right)$

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5. Find 'C' of Lagrange's mean value theorem for the function $f(x) = x^3 - 5x^2 - 3x$ in [1, 3]

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6. Using differentials, find the approximate value of each of the up to 3 places of decimal.

$(255)^{\frac{1}{4}}$

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7. Find the area of the region bounded by the line 6x+5y=30,x-axis and the lines x=-1 and x=3.

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8. A six sided die is marked '2' on one face, '3' on two of its faces, and '4' on remaining three faces. The die is thrown twice. If X denotes the total score in two throws, find the

values of the random variable and number of points in its inverse images.

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9. Check whether the statement $p \to (q \to p)$ is a tautology or a contradiction without using the truth table.

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10. Solve $\left(1 - x^2\right) \frac{dy}{dx} + 2xy = x\sqrt{1 - x^2}$

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Part Iv

1. Solve the following system of homogeneous equations.

3x+2y+7z=0,4x-3y-2z=0, 5x+9y+23z=0

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2. Two cards are drawn with replacement from a well shufflied deck of 52 cards . Find the mean and variance for the number of aces .

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3. Show that $\left(\frac{19+9i}{5-3i}\right)^{15}-\left(\frac{8+i}{1+2i}\right)^{15}$ is purely imaginary

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4. Define an operation * on Q as follows: $a \cdot b = \left(\frac{a+b}{2}\right), a, b \in Q.$ Examine the closure, communative, and associative properties satisfied by $\cdot on Q.$

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5. Solve (x – 3) (x – 6) (x - 1) (x + 2) + 54 = 0.

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6. Find the local extrema of the function $f(x) = 4x^6 - 6x^4$

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7. Prove thate

$$\tan^{-1}\left(\frac{2}{11}\right)+\tan^{-1}\left(\frac{7}{24}\right)=\tan^{-1}\left(\frac{1}{2}\right)$$

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8. If $v(x,y)=\log\left(\frac{x^2+y^2}{x+y}\right)$, prove that $x\frac{\partial v}{\partial x}+y\frac{\partial v}{\partial y}=1.$

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9. Find the equations of the two tangents that can be drawn from (5,2) to the ellispse $2x^2+7y^2=14$

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10. Find the coordinates of the foot of the perpendicular and length of the perpendicular from the point $(4, 3, 2)$ to the plane x + 2y + 3z = 2.

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11. Solve

$$(x+y)^2 \frac{dy}{dx} = a^2$$

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12. A police jeep, approaching an orthogonal intersection from the northern direction, is chasing a speeding car that

has turned and moving straight east. When the jeep is 0.6 km north of the intersection and the car is 0.8 km to the east. The police deteremine with a radar that the distance between them and the cae is increasing at 20 km/hr. If the jeep is moving at 60 km/hr at the instant of measurement, what is the speed of the car?

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13. Let $w(x, y, z) = \frac{1}{\sqrt{x^2 + y^2 + z^2}} (x, y, z) \neq (0, 0, 0).$

Show that $\frac{\partial^2 w}{\partial x^2} + \frac{\partial^2 w}{\partial y^2} + \frac{\partial^2 w}{\partial z^2} = 0$

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14. Evaluate the following :

$$\int_0^{\frac{\pi}{2}} \frac{e^{-\tan x}}{\cos^6 x} dx$$

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