# MATHS

## BOOKS - FULL MARKS MATHS (TAMIL ENGLISH)

## SAMPLE PAPER -11 (UNSOLVED)

**Part I**

**1.** If A, B and C are invertible matrices of some order, then which one of the following is not true?

A. adj A = |A|$A^{-1}$

B. adj (AB) = (adj A) (adj B)

C. det $A^{-1} = (\det A)^{-1}$

D. $(\mathrm{ABC})^{-1} = C^{-1}B^{-1}A^{-1}$

**Answer: A::B::D**

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**2.** $z_1, z_3,$ and $z_3$ are complex numbers such that $z_1 + z_2 + z_3 = 0$ and $|z_1| = |z_2| = |z_3|$ = 1 then $z_1^2 + z_2^2 + z_3^3$

A. 3

B. 2

C. 1

D. 0

**Answer:**

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**3.** If a + ib = (8 - 6i) - (2i - 7) then the values of a and b are ..... .

A. 8, - 15

B. 8, 15

C. 15, 9

D. 15, - 8

**Answer: A**

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**4.** If $\rho$ (A) = $\rho$ ([A|B]), then the system AX = B of linear equations is

A. consistent and has a unique solution

B. consistent

C. consistent and has infinitely many solution

D. inconsistent

**Answer: C**

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**5.** $\sin^{-1}\frac{3}{5} - \cos^{-1}\frac{12}{13} + \sec^{-1}\frac{5}{3} - \cos ec^{-1}\frac{13}{12}$ is equal to

A. $2\pi$

B. $\pi$

C. 0

D. $\tan^{-1}\frac{12}{65}$

**Answer:**

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**6.** If $\sin^{-1}\frac{x}{5} + \cos ec^{-1}\frac{5}{4} = \frac{\pi}{2}$, then the value of x is

A. 4

B. 5

C. 2

D. 3

**Answer: C**

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**7.** The circle $x^2 + y^2 = 4x + 8y + 5$ intersects the line 3x -4y =m at two distinct points if

A. $15 < m < 65$

B. $35 < m < 85$

C. $-85 < m < -35$

D. $-35 < m < 15$

**Answer: A::C**

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**8.** The equation of the tangent at (3,-6) to the parabola $y^2$ = 12x is ..... .

A. x - y - 3 = 0

B. x + y - 3 = 0

C. x - y + 3 = 0

D. x + y + 3 =0

**Answer: C**

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**9.** If direction cosines of a line are $\frac{1}{c}, \frac{1}{c}, \frac{1}{c}, \quad \text{then.}$

A. c = $\pm 3$

B. c = $\pm\sqrt{3}$

C. $c < 0$

D. $0 < c < 1$

**Answer: C**

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**10.** Find the point on the curve $6y = x^3 + 2$ at which y-coordinate changes 8 times as fast as x-coordinate is:

A. (4,11)

B. (4,-11)

C. (-4,11)

D. (-4,-11)

**Answer: A::D**

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**11.** $\lim_{x \to 0} \frac{x}{\tan x}$ is ..... .

A. 1

B. $-1$

C. 0

D. $\infty$

**Answer: A**

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**12.** If $v(x, y) = \log(e^x + e^y)$, then $\frac{\partial v}{\partial x} + \frac{\partial v}{\partial y}$ is equal to

A. $e^x + e^y$

B. $\frac{1}{e^x + e^y}$

C. 2

D. 1

**Answer: A**

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**13.** The curve $y^2 = (x - 1)(x - 2)^2$ is not defined for ..... .

A. $x \geq 1$

B. $x \geq 2$

C. $x < 2$

D. $x < 1$

**Answer: A**

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**14.** The value of $\int_0^1 x(1-x)^{99} dx$ is

A. $\frac{1}{1100}$

B. $\frac{1}{10100}$

C. $\frac{1}{10010}$

D. $\frac{1}{10001}$

**Answer: A**

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**15.** The differential equation of the family of curves $y = Ae^x + be^{-x}$, where A and B are arbitrary constant is

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

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

C. $\frac{dy}{dx} + y = 0$

D. $\frac{dy}{dx} - y = 0$

**Answer: B::D**

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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::D**

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**17.** 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: D**

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**18.** If in 6 trials, X is a binomial variate which follows the relation $9P(X=4)=P(X=2)$, then the probability of success is

A. 0.125

B. 0.25

C. 0.375

D. 0.75

**Answer: B**

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**19.** In the set R of real number $*$ is defined as follows. Which one of the following is not a binary operation on R?

A. a•b = min (a.b)

B. a•b = max (a,b)

C. a•b = a

D. a •b = $a^b$

**Answer: A::B**

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**20.** The dual of ~$(p \vee q) \vee [p \vee (p \wedge \sim r)]$ is

A. $\neg(p \wedge q) \wedge [p \vee (p \wedge \neg r)]$

B. $(p \wedge q) \wedge [p \vee (p \wedge \neg r)]$

C. $\neg(p \wedge q) \wedge [p \wedge (p \wedge r)]$

D. $\neg(p \wedge q) \wedge [p \wedge (p \vee \neg r)]$

**Answer:**

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Part Ii

**1.** Construct a cubic equation with roots 1,1 and -2

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**2.** If $\tan^{-1} x + \tan^{-1} y + \tan^{-1} z = \pi,$ show that x + y + z = xyz.

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**3.** Find the equation of the circlue with centre (2,-1) and passing through the point ( 3,6) in standard form.

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**4.** Prove that $\left(\vec{a} . \left(\vec{b} \times \vec{c}\right)\right)\vec{a} = \left(\vec{a} \times \vec{b}\right) \times \left(\vec{a} \times (c)\right).$

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**5.** Suppose $f(x)$ is a differentiable function for all x with $f'(x) \leq 29$ and $f(2) = 17$. What is the maximum value of f (7) ?

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**6.** In each of the following cases , determine whether the following function is homogeneous or not. If it is so , find the degree. (i) $f(x, y) = x^2y + 6x^3 + 7$ (ii) $h(x, y) = \dfrac{6x^2y^3 - \pi y^5 + 9x^4y}{2020x^2 + 2019y^2}$

(iii) $g(x, y, z) = \dfrac{\sqrt{3x^2 + 5y^2 + z^2}}{4x + 7y}$ (iv) $U(x, y, z) = xy + \sin\left(\dfrac{y^2 - 2z^2}{xy}\right)$

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**7.** Evaluate $\int_{-1}^{1} \log\left(\dfrac{3 - x}{3 + x}\right) dx.$

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**8.** Verify that function $y = ax^2 + bx + c$ is a solution of the differential equation $\frac{d^2y}{dx^2} = 2a$

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**9.** Verify (i) closure property (ii) commutative property and (iii) associati ve property of the following operation on the given set.

(a•b) = $a^b$, $\forall a, b \in \mathbb{N}$ (exponentiation property )

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**10.** The probability density function of X is given by $f(x) = \begin{cases} kxe^{-2x} & \text{for } x > 0 \\ 0 & \text{for } x \leq 0 \end{cases}$ Find the value of k.

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Part Iii

**1.** In a competitive examination, one mark is awarded for every correct answer while $\frac{1}{4}$ mark is deducted for every wrong answer. A student answered 100 questions and got 80 marks. How many questions did he answer correctly ? (Use Cramer's rule to solve the problem).

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**2.** If $z = (\cos\theta + i\sin\theta)$, show that $z^n + (1)/(z^n) = 2\cos n\theta$ and z^(n)-(1)(z^(n))=2isinntheta

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**3.** Find the value of

$$\sin\left(\tan^{-1}\left(\frac{1}{2}\right) - \cos^{-1}\left(\frac{4}{5}\right)\right)$$

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**4.** Find centre, foci, vertices, and directrices of the following

$$\frac{x^2}{25} - \frac{y^2}{144} = 1$$

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**5.** Find the torque of the resultant of the three forces represented by $-3\vec{i} + 6\vec{j} - 3\vec{k}, 4\vec{i} - 10\vec{j} + 12\vec{k}$, and $4\vec{i} + 7\vec{j}$ acting at the point with position vector $8\vec{i} - 6\vec{j} - 4\vec{k}$, about the point with position vector $18\vec{i} + 3\vec{j} - 9\vec{k}$.

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**6.** Evaluate the following :

$$\int_0^{\frac{\pi}{2}} x^2 \cos 2x dx$$

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**7.** Verify that the function y =4 sin 3x is a solution of the differential equation $\frac{d^2y}{dx^2} + 9y = 0$

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**8.** In a hurdle race a player has to cross 10 hurdles . The probability that he will clear each hurdle is 5/6. What is the probability that he will knock down less than 2 hurdles ?

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**9.** Show that $[\neg p \vee \neg q] \vee p$ is a tautology.

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**10.** Solve the cubic equation : $2x^3 - 9x^2 + 10x = 3$

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## Part Iv

**1.** The prices of three commodities A,B and C are Rs x, y and z per unit respectively. A person P purchases 4 units of B and sells two units of A and 5 units of C. Person Q purchases 2 units of C and sells 3 units of A and one unit of B. Person R purchases one unit of A and sells 3 unit of B and one unit of C. In the process, PQ and R earn Rs 15,000, Rs 1,000 and Rs 4,000 respectively. Find the prices per unit of A,B and C. (Use matrix inversion method to solve the problem.)

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**2.** Solve :

$$\frac{1}{x}+\frac{2}{y}-\frac{1}{z}=1$$
$$\frac{2}{x}+\frac{4}{y}+\frac{1}{z}=5$$
$$\frac{3}{x}-\frac{2}{y}-\frac{2}{z}=0$$ Using Crammer's rule.

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**3.** If $z_1, z_2,$ and $z_3$ are three complex numbers such that $|z_1| = 1, \quad |z_2| = 2, \quad |z_3| = 3$ and $|z_1 + z_2 + z_3| = 1,$ show that $|9z_1z_2 + 4z_1z_3 + z_2z_3| = 6.$

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**4.** Solve : $12x^4 - 56x^3 + 89x^2 - 56x + 12 = 0$

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**5.** 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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**6.** Find the parametric form vector eqution and Cartesian equations of the plane passing through the points $(2, 2, 1), (1, -2, 3)$ and parallel to the straight line passing through the points $(2, 1, -3)$ and $(-1, 5, -8)$.

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**7.** Find the area of the region bounded by the curve $2 + x - x^2 + y = 0$, x-axis, $x = -3$ and x= 3

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

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**9.** A rod of length 1.2 m moves with its ends always touching the coordinate axes. The locus of a point Pon the rod, which is 0.3 m from the end in contact with x-axis is an ellipse. Find the eccentricity.

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**10.** Solve the following differential equations :

$$x\frac{dy}{dx} = y - x\cos^2\left(\frac{y}{x}\right)$$

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**11.** Evaluate : $\int_0^2 \left(x^2 + x + 2\right) dx$

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**12.** Sketch the curve y = $\frac{x^2 - 3x}{(x-1)}$

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**13.** A multiple choice examination has ten questions, each question has four distractors with exactly one correct answer. Suppose a student answers by guessing and it X denotes the number of correct answers, find (i) binomial distribution (ii) probability that the student will get seven correct answers (iii) the probability of getting at least one correct answer.

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**14.** W(x,y,z) = xy + yz + zx, x = u - v, y = uv, z = u + v, u, v $\in$ R. Find $\frac{\partial w}{\partial u}, \frac{\partial w}{\partial v}$ and evaluate then at $\left(\frac{1}{2}, 1\right)$.

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