# RAMAKRISHNA MISSION VIDYAMANDIRA

**Belur Math, Howrah – 711 202**

## ADMISSION TEST – 2017

## MATHEMATICS (Honours)

Date : 14-06-2017 **Full Marks : 50** Time: 11·00 a.m. – 12·00 noon

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**Instructions for the candidate**

*Answer all the questions given below. Each question carries **2 marks** for correct answer and **–1 mark** for wrong answer. Tick (✓) the correct option. The tick must be very clear —— if it is smudgy or not clear, no marks will be awarded. **Calculator is not allowed.***

Name of the student : _____

Application No. : _____

Signature of the invigilator : _____

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1. Equation of the ellipse with x and y axes as its major and minor axes respectively, passing through the point (–3, 1) and with eccentricity $\sqrt{\frac{2}{5}}$ is

   a) $3x^2+5y^2=32$, b) $6x^2+10y^2=32$, c) $5x^2+3y^2=32$, d) none of these.

2. The locus of the point of intersection of the straight lines $\frac{tx}{a}+\frac{y}{b}-t=0$ & $\frac{x}{a}-\frac{ty}{b}+1=0$ is

   a) a circle, b) a parabola, c) an ellipse, d) none of these.

3. If one of the diameters of the circle A with equation $x^2+y^2-2x-6y+6=0$ is a chord to the circle B with centre (2, 1) then the radius of the circle B is

   a) $\sqrt{3}$, b) $\sqrt{2}$, c) 3, d) 2.

4. $99^{th}$ term of the series 2 + 7 + 14 + 23 + 34 + ..... is

   a) 9999, b) 9998, c) 10000, d) none of these.

5. The sum of all natural numbers between 0 and 100 which are not divisible by 5 is

   a) 4000, b) 4050, c) 1050, 4005.

6. If $\vec{a},\vec{b},\vec{c},\vec{d}$ are unit vectors such that $(\vec{a}\times\vec{b})\cdot(\vec{c}\times\vec{d})=1$ and $\vec{a}\cdot\vec{c}=\frac{1}{2}$ then

   a) $\vec{a},\vec{b},\vec{c}$ are non-coplanar, b) $\vec{b},\vec{c},\vec{d}$ are non-coplanar,

   c) $\vec{b},\vec{d}$ are non-parallel, d) $\vec{a},\vec{d}$ are parallel and $\vec{b},\vec{c}$ are parallel.

7. If $I=\int_{-1}^{2}|x\sin\pi x|\,dx$ then I equals

   a) $\frac{1}{\pi}$, b) $\frac{2}{\pi}$, c) $\frac{4}{\pi}$, d) $\frac{5}{\pi}$.

8. Let f be a non-negative function defined on the interval [0,1]. If $\int_0^x \sqrt{1-\{f'(t)\}^2}\,dt = \int_0^x f(t)dt$, $0 \le x \le 1$ and f(0) = 0 then

a) $f\left(\frac{1}{2}\right) < \frac{1}{2}$ and $f\left(\frac{1}{3}\right) > \frac{1}{3}$, b) $f\left(\frac{1}{2}\right) > \frac{1}{2}$ and $f\left(\frac{1}{3}\right) > \frac{1}{3}$,

c) $f\left(\frac{1}{2}\right) < \frac{1}{2}$ and $f\left(\frac{1}{3}\right) < \frac{1}{3}$, d) $f\left(\frac{1}{2}\right) > \frac{1}{2}$ and $f\left(\frac{1}{3}\right) < \frac{1}{3}$.

9. If $I = \int_{\frac{1}{e}}^{e} |\log x| \frac{dx}{x^2}$, then I equals

a) $2\left(1-\frac{1}{e}\right)$, b) 2, c) $\frac{2}{e}$, d) 0.

10. Let $f : \mathbb{R} \to \mathbb{R}$ be defined by $f(x) = 2x + \sin x$ for $x \in \mathbb{R}$. Then f is

a) one-one and onto, b) one-one but not onto,

c) onto but not one-one, d) neither one-one nor onto.

11. For the circle $x^2 + y^2 = r^2$, the value of r for which the area enclosed by the tangents drawn from the point (6,8) to the circle and the chord of contact is maximum is

a) 10, b) 5, c) $5\sqrt{2}$, d) none of these.

12. Which of the following function is differentiable at x = 0?

a) $\cos(|x|) + |x|$, b) $\cos(|x|) - |x|$, c) $\sin(|x|) + |x|$, d) $\sin(|x|) - |x|$.

13. Let $\mathbb{Q}, \mathbb{R}, \mathbb{R} - \mathbb{Q}$ denote respectively the set of all rational numbers, real numbers and irrational numbers. Suppose $p \in \mathbb{R} - \mathbb{Q}$ and $\mathbb{Q} + p = \{x + p : x \in \mathbb{Q}\}$. Then

a) $\mathbb{Q} \cup (\mathbb{Q} + p) = \mathbb{R}$, b) $\mathbb{Q} + p = \mathbb{R} - \mathbb{Q}$ if p is transcendental,

c) $\mathbb{Q} + p = \mathbb{R} - \mathbb{Q}$ if p is algebraic, d) $\mathbb{Q} + p$ is a proper subset of $\mathbb{R} - \mathbb{Q}$.

14. Let $|X| = 4$, $|Y| = 3$. The number of surjective maps from X to Y is

a) 24, b) 30, c) 36, d) none of these.

15. Let the relation $\rho$ be defined on $\mathbb{Z}$ (the set of all integers) by '$a \rho b$ iff $ab \ge 0$; $a, b \in \mathbb{Z}$'. Then $\rho$ is

a) Reflexive but neither symmetric nor transitive, b) Reflexive and symmetric but not transitive,

c) Reflexive and transitive but not symmetric, d) An equivalence relation.

16. Let A be any 2×2 matrix and B be its adjoint. Then the determinant of the product matrix AB is

a) 1, b) det A, c) $(\det A)^2$, d) none of these.

17. Let A and B be two matrices of order 2×2. If they have a common row and same determinant, then which one of the following statements is true?

a) A = B, b) adjoint of A = adjoint of B,

c) det (AB) = $(\det(A))^2$, d) det (A+B) = det A + det B.

18. The smallest number whose square exceeds the number by 2 is

a) 1, b) 2, c) –1, d) –2.

19. The sum of two prime numbers is 61. The sum of their squares is

a) 2195, b) 2875, c) 3485, d) none of these.

20. The determinant of the matrix $A = \begin{bmatrix} x^2+x & x^3+x^2 & x^4+x^3 \\ x^2 & x^3 & x^4 \\ x^2-x & x^3-x^2 & x^4-x^3 \end{bmatrix}$, $x \in \mathbb{R}$ is

a) a polynomial in x of degree 7, b) 0,

c) a polynomial in x of degree 9, d) none of these.

21. If $E_1$ and $E_2$ are the events associated to a random experiment and if $E_1$ implies $E_2$, then

a) $P(E_1) < P(E_2)$, b) $P(E_1) \le P(E_2)$, c) $P(E_1) \ge P(E_2)$, d) $P(E_1) > P(E_2)$.

22. The probability of drawing a card which is either a spade or a king from a well-shuffled pack of cards is

a) $\frac{1}{26}$, b) $\frac{17}{52}$, c) $\frac{1}{52}$, d) $\frac{4}{13}$.

23. The area of the region bounded by the curves $y = x^2$ and $x = y^2$ is

a) $\frac{1}{2}$, b) $\frac{1}{3}$, c) $\frac{1}{4}$, d) none of these.

24. The curves $x^2 - y^2 = 8$, xy = 3 intersect at an angle

a) $\frac{\pi}{3}$, b) $\frac{\pi}{2}$, c) $\frac{\pi}{4}$, d) none of these.

25. The maximum value of $\left(\frac{1}{x}\right)^x$ is

a) $\left(\frac{1}{e}\right)^e$, b) $e^e$, c) $e^{\frac{1}{e}}$, d) none of these.

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