RAMAKRISHNA MISSION VIDYAMANDIRA

Belur Math, Howrah – 711 202

ADMISSION TEST – 2018

MATHEMATICS (Honours)

Date : 20-06-2018 **Full Marks : 50** Time : 11.00 a.m – 12.00 noon

---

Instructions for the candidate

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

---

1. Suppose A and B are two sets such that $A\times B = B\times A$. Then

   a) $A = B$ b) $A\cap B=\phi$ c) $A\cap B\neq\phi$ d) either $A\subseteq B$ or $B\subseteq A$.

2. If $X=\{1,2,3\}$ then the number of maps from X to X which are neither injective nor surjective is

   a) 15 b) 18 c) 21 d) 24.

3. Let $\mathbb{Z}$ denote the set of all integers. If ρ is defined on $\mathbb{Z}$ by '$a\rho\, b$ iff $ab\geq 0$ for $a,b\in\mathbb{Z}$' then ρ is

   a) not reflexive b) not symmetric
   c) not transitive d) an equivalence relation.

4. Two fair dice are thrown. The probability that the product is divisible by 3 is

   a) $\frac{4}{9}$ b) $\frac{5}{9}$ c) $\frac{2}{3}$ d) $\frac{7}{9}$.

5. A matrix A of order 2×2 is considered, all of whose entries are 0 or 1. The probability that det A is non-negative is

   a) $\frac{13}{16}$ b) $\frac{11}{16}$ c) $\frac{9}{16}$ d) $\frac{7}{16}$.

6. If in a triangle ABC, $\cos A+2\cos B+\cos C=2$ then a, b, c are in

   a) A.P. b) G.P. c) H.P. d) none of these.

7. If $I=\int_{\pi/6}^{\pi/3}\frac{dx}{1+\sqrt{\tan x}}$, then I equals

   a) $\frac{\pi}{3}$ b) $\frac{\pi}{4}$ c) $\frac{\pi}{6}$ d) none of these.

8. If $\frac{9x}{\cos\theta}+\frac{5y}{\sin\theta}=56$ and $\frac{9x\sin\theta}{\cos^2\theta}-\frac{5y\cos\theta}{\sin^2\theta}=0$ then the value of $\left[(9x)^{2/3}+(5y)^{2/3}\right]^3$ is

   a) 3316 b) 3136 c) 3248 d) none of these.

9. If $\frac{3\pi}{4}<\alpha<\pi$, then $\sqrt{2\cot\alpha+\frac{1}{\sin^2\alpha}}$ is equal to

   a) $1+\cot\alpha$ b) $1-\cot\alpha$ c) $-1-\cot\alpha$ d) $-1+\cot\alpha$.

10. Let $f(x)=\frac{|x|}{x}$ if $x\neq 0$ and $f(0)=0$ and $a,b\in\mathbb{R}$ be such that $a<b$, then the value of $\int_a^b f(x)\ dx$ is

a) $b-a$ b) $a+b$ c) $|b|-|a|$ d) $\frac{1}{2}\left(b^2-a^2\right)$.

11. If A is the area bounded by the straight lines x = 0 and x = 2, and the curves $y=2^x$ and $y=2x-x^2$ then the value of $672\left(\frac{3}{\log 2}-A\right)$ is

a) 869 b) $4/3$ c) 836 d) none of these.

12. The value of $\lim_{t\to\infty} x(t)$ when $x(t)$ satisfies the differential equation $\frac{dx}{dt}+x=0$ with initial condition $x(0)=2$ is

a) 0 b) 2 c) 1 d) none of these.

13. The differential equation $ydx-2xdy=0$ represents a family of

a) straight lines b) parabolas c) circles d) catenaries.

14. If $\left(1-x+x^2\right)^n=a_0+a_1x+a_2x^2+\cdots+a_{2n}x^{2n}$ then $a_0+a_2+a_4+\cdots+a_{2n}$ equals

a) $\frac{3^n-1}{2}$ b) $\frac{3^n+1}{2}$ c) $3^n+\frac{1}{2}$ d) $3^n-\frac{1}{2}$.

15. The fourth, seventh and tenth terms of a G.P. are p, q and r respectively. Then

a) $p^2=q^2+r^2$ b) $r^2=p^2+q^2$ c) $p^2=qr$ d) $q^2=pr$.

16. A circle touches x axis at (3, 0) and has an intercept of 8 units on y axis. Then the equation of the circle is

a) $(x-3)^2+(y-5)^2=25$ b) $(x-3)^2+(y+5)^2=9$

c) $(x-5)^2+(y-3)^2=9$ d) $(x+5)^2+(y-3)^2=25$.

17. The length of the chord of the parabola $y^2=20x$ along the straight line $x-2y+4=0$ is

a) 60 units b) 75 units c) 80 units d) 96 units.

18. The co-ordinates of foci of an ellipse are (2, 0) and (–2, 0) and the latusrectum is 6 units. Then its equation is

a) $\frac{x^2}{12}+\frac{y^2}{4}=1$ b) $\frac{x^2}{16}+\frac{y^2}{12}=1$ c) $\frac{x^2}{12}+\frac{y^2}{8}=1$ d) $\frac{x^2}{4}+y^2=1$.

19. If $\vec{a}=\hat{i}-2\hat{j}$ and $\vec{b}=\hat{j}+\hat{k}$, then the component of $\vec{a}$ along $\vec{b}$ is

a) $-\hat{j}-\hat{k}$ b) $-\hat{j}+\hat{k}$ c) $\hat{j}-\hat{k}$ d) $\hat{i}+\hat{j}+\hat{k}$.

20. The equation of the plane through the point (2, 2, 3) and parallel to the vectors $\hat{i}-2\hat{j}+4\hat{k}$ and $3\hat{i}+2\hat{j}-5\hat{k}$ is

a) $2x-17y+8z=62$ b) $2x+17y+8z=62$ c) $2x+17y-8z=62$ d) none of these.

21. If $lx+my=1$ is normal to the parabola $y^2=4ax$ then

a) $al^3-2alm^2=m^2$ b) $al^3+(2al+1)m^2=0$ c) $al^3+2alm^2=m^2$ d) none of these.

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

a) $\left(\frac{1}{e}\right)^e$ b) $e^{\frac{1}{e}}$ c) $\left(\frac{1}{2e}\right)^{2e}$ d) none of these.

23. Let $f(x)$ and $g(x)$ be two differentiable functions on the interval $[a,b]$. Which of the following is true?

a) If $f'(x)=g'(x)$ for all $x\in[a,b]$, then $f(x)=g(x)$ for all $x\in[a,b]$

b) If $(f'(x))^2+(g'(x))^2=0$ for all $x\in[a,b]$, then f and g are constant functions on $[a,b]$

c) If $f'(x)g'(x)\le 0$ for all $x\in[a,b]$, and g is an increasing function on $[a,b]$, then f is also an increasing function on $[a,b]$

d) none of these.

24. Let $f(x)=\begin{cases} x\left(\dfrac{e^{\frac{1}{x}}-e^{-\frac{1}{x}}}{e^{\frac{1}{x}}+e^{-\frac{1}{x}}}\right) & , x\neq 0 \\ 0 & , x=0 \end{cases}$

Then

a) f is differentiable at $x = 0$

b) f is continuous at $x = 0$, but not differentiable at $x = 0$

c) f is not continuous at $x = 0$ d) f is increasing on $\mathbb{R}$.

25. Given the functions $f:\mathbb{R}\to\mathbb{R}$ and $g:\mathbb{R}\to\mathbb{R}$, state which of the following statements is false.

a) If f is differentiable on $\mathbb{R}$, then f is continuous on $\mathbb{R}$

b) If f is bounded and continuous on $\mathbb{R}$, then f is differentiable on $\mathbb{R}$

c) If the derivative of f vanishes at all points in $\mathbb{R}$, then f is a constant function

d) If f and g differ by a constant and f is differentiable, then f and g have same derivatives at all points.

—————— × ——————