RAMAKRISHNA MISSION VIDYAMANDIRA

Belur Math, Howrah – 711 202

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ADMISSION TEST – 2014

MATHEMATICS (Honours)

Date : 21-06-2014 **Full Marks : 50** Time: 11·00 a.m – 01·00 p.m

Instructions for the candidate

2 marks will be awarded to correct answer and **–1** for a wrong answer Candidates have to select the correct choice by **black/ blue** pen only in the **Optical Mark Recognition (OMR)** to be provided during the written test. Marking should be **dark** and should completely fill one blank box against the corresponding question number. Incomplete filling or multiple filling of boxes will reject the answer to that question. Once an answer is marked in OMR, there is no scope to alter the choice. Doing rough work or using erasers, blades, whiteners etc. on the Optical Mark Recognition (OMR) is strictly prohibited. Calculator should not be used

1. The sum of the series $1{\cdot}3+\frac{2{\cdot}4}{1{\cdot}2}+\frac{3{\cdot}5}{1{\cdot}2{\cdot}3}+\frac{4{\cdot}6}{1{\cdot}2{\cdot}3{\cdot}4}+\ldots$ is

   a) e b) 2e c) 3e d) 4e

2. If $(1+x)^n = c_0 + c_1x + c_2x^2 + \ldots + c_nx^n$, $s_n = \sum_{r=0}^{n}\frac{1}{c_r}$ and $t_n = \sum_{r=0}^{n}\frac{r}{c_r}$ then $\frac{t_n}{s_n} =$

   a) $\frac{n(n+1)}{2}$ b) $\frac{n}{2}$ c) $\frac{n+1}{2}$ d) $\frac{n(n-1)}{2}$

3. If the complex numbers z_1, z_2, z_3 satisfy $\frac{z_1-z_3}{z_2-z_3}=\frac{1-i\sqrt{3}}{2}$, then the triangle formed by z_1, z_2 and z_3 is

   a) right angled b) obtuse angled c) isosceles d) equilateral

4. Let F denote the family of ellipses whose centre is at the origin and major axis is the y-axis. Then the differential equation of the family F is

   a) $\frac{d^2y}{dx^2}+\frac{dy}{dx}\left(x\frac{dy}{dx}-y\right)=0$ b) $xy\frac{d^2y}{dx^2}-\frac{dy}{dx}\left(x\frac{dy}{dx}-y\right)=0$

   c) $xy\frac{d^2y}{dx^2}+\frac{dy}{dx}\left(x\frac{dy}{dx}-y\right)=0$ d) $xy\frac{d^2y}{dx^2}+x\frac{dy}{dx}-y=0$

5. Consider the following statements :

   i) If f(t) is an odd function, then $\int_a^x f(t)dt$ is always an even function;

   ii) If $\int_0^x f(t)dt$ is an odd function then f(t) is always an even function;

   Which of the statements given above is/are correct?

   a) only (i) is correct b) only (ii) is correct

   c) both (i) and (ii) are correct d) neither (i) nor (ii) is correct

6. The order of differential equations of all parabolas having directrix parallel to x-axis is

   a) 1 b) 2 c) 3 d) 4

7. The value of the integral $\int_{\frac{1}{e}}^{e}|\log_e x|\,dx$ is

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

8. ABCD is a quadrilateral; P and Q are the mid-points of BC and AD respectively. Then the value of $(\overrightarrow{AB}+\overrightarrow{DC})$ is

   a) $4\overrightarrow{QP}$ b) $3\overrightarrow{QP}$ c) $2\overrightarrow{QP}$ d) $\overrightarrow{QP}$

9. The number of ways can a committee of 5 women and 6 men be chosen from 10 women and 8 men if Mr. A refuses to serve on the committee if Mrs. B is a member, is
a) 4410 b) 882 c) 3582 d) 3528

10. The value of $\int_{\pi/6}^{\pi/3} \frac{dx}{1+\sqrt{\cot x}}$ is
a) $\frac{\pi}{6}$ b) $\frac{\pi}{3}$ c) $\frac{2\pi}{3}$ d) none of these

11. The range of the function $f(x) = \log_2 \frac{\sin x - \cos x + 3\sqrt{2}}{\sqrt{2}}$ is
a) (1,2) b) [1,2) c) (1,2] d) [1,2]

12. If the function $f(x) = \begin{cases} \frac{\ell n(1+ax) - \ell n(1-bx)}{x} & , \quad x \neq 0 \\ k & , \quad x = 0 \end{cases}$
is continuous at x = 0, then the value of k is
a) $a - b$ b) $-a + b$ c) $a + b$ d) $-(a + b)$

13. If $f(x) = 2|x| + |x-2|$, then $f'(1)$ is
a) –1 b) 1 c) 0 d) 2

14. If $\ell x + my = 1$ be a normal to the parabola $y^2 = 4ax$ then
a) $a\ell^3 + 2a\ell m^2 = m^2$ b) $a\ell^3 - 2a\ell m^2 = m^2$ c) $a\ell^3 - 2a\ell m^2 + m = 0$ d) $-a\ell^3 + 2a\ell m = m^2$

15. If the curves $ax^2 + by^2 = 1$ and $a'x^2 + b'y^2 = 1$ cut orthogonally, then
a) $\frac{1}{b} + \frac{1}{b'} = \frac{1}{a} + \frac{1}{a'}$ b) $\frac{1}{b} - \frac{1}{b'} = \frac{1}{a} - \frac{1}{a'}$ c) $\frac{1}{b'} - \frac{1}{b} = \frac{1}{a} - \frac{1}{a'}$ d) $\frac{1}{a} + \frac{1}{b} + \frac{1}{a'} + \frac{1}{b'} = 0$

16. If the lines $\ell x + my + n = 0$, $mx + ny + \ell = 0$ and $nx + \ell y + m = 0$ are concurrent, then
a) $\ell - m + n = 0$ b) $-\ell + m + n = 0$ c) $\ell + m + n = 0$ d) $\ell + m - n = 0$

17. The area bounded by the curves $y = |x-1|$ and $y = 3 - |x|$ is
a) 1 sq. unit b) 3 sq. unit c) 2 sq. unit d) 4 sq. unit

18. The circumcentre of the triangle formed by the lines $x + y = 0$, $x - y = 0$ and $\ell x + my = 1$ is given by
a) $\left(\frac{\ell}{\ell^2 - m^2}, \frac{-m}{\ell^2 - m^2}\right)$ b) $\left(\frac{-\ell}{\ell^2 - m^2}, \frac{m}{\ell^2 - m^2}\right)$ c) $\left(\frac{\ell}{\ell^2 - m^2}, \frac{m}{\ell^2 - m^2}\right)$ d) $\left(\frac{-\ell}{\ell^2 - m^2}, \frac{-m}{\ell^2 - m^2}\right)$

19. If α, β be two different roots of the equation $a\cos\theta + b\sin\theta = c$, then the value of $\sin(\alpha + \beta)$ is
a) $\frac{2ab}{a^2 - b^2}$ b) $\frac{2ab}{a^2 + b^2}$ c) $\frac{-2ab}{a^2 - b^2}$ d) none of these

20. If n is an integer then the general solution of $\tan x - \cot x = \operatorname{cosec} x$ is
a) $(2n+1)\pi$ b) $2n\pi \pm \frac{\pi}{3}$ c) $(2n+1)\pi,\ 2n\pi \pm \frac{\pi}{3}$ d) none of these

21. Let $X = \{1,2,3,4,5\}$. The number of subsets of X containing more than one element is
a) 24 b) 25 c) 26 d) 27

22. The number of nonconstant maps from {1,2,3} to {1,2,3,4} is
a) 54 b) 60 c) 64 d) 72

23. The number of reflexive relations on the set {1,2,3} is
a) 32 b) 48 c) 64 d) 80

24. A problem is given to three students. The chances of solving the problem by them are $\frac{1}{2}, \frac{1}{3}$ and $\frac{1}{4}$. The probability of the solving the problem by exactly one of the students is

a) $\frac{7}{24}$ b) $\frac{11}{24}$ c) $\frac{13}{24}$ d) $\frac{17}{24}$

25. If $A = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$ then $A^2 - 3A + 5I_2$ is (I_2 is the identity matrix of order 2)

a) $\begin{pmatrix} 7 & 2 \\ 2 & 9 \end{pmatrix}$ b) $\begin{pmatrix} 2 & 7 \\ 2 & 9 \end{pmatrix}$ c) $\begin{pmatrix} 2 & 7 \\ 9 & 2 \end{pmatrix}$ d) $\begin{pmatrix} 7 & 2 \\ 9 & 2 \end{pmatrix}$

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FOR ROUGH WORK