RAMAKRISHNA MISSION VIDYAMANDIRA

Belur Math, Howrah – 711 202

ADMISSION TEST – 2013

MATHEMATICS (Honours)

Date : 17-06-2013 **Full Marks : 50**

Time : 1.30 p.m – 3.30 p.m

2 marks for a correct answer & -1 for a wrong answer
(Calculator, Cell Phones are not allowed)

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.

1. The value of $^{47}C_4 + \sum_{r=1}^{5} 52 - {}^{r}C_3$ is

   a) 277025 b) 270725 c) 507227 d) 275027

2. If $\sin^{-1}(\frac{2}{3}) = \frac{\alpha}{2}$ and $\tan^{-1}9 = \frac{\beta}{2}$ then the value of $\sin^{-1}\frac{4\sqrt{5}}{9} + \tan^{-1}\frac{9}{40}$ is

   a) $\alpha+\beta$ b) $\alpha-\beta$ c) $\pi+(\alpha-\beta)$ d) none of those

3. In a triangle PQR, $\angle R = \frac{\pi}{4}$. If tan(P/3) and tan(Q/3) are the roots of the equation $ax^2 + bx + c = 0$ then

   a) a + b = c b) b + c = 0 c) a + c = b d) b = c

4. Four dice are rolled. The number of possible outcomes in which at least one die shows 2 is

   a) 1296 b) 625 c) 671 d) 1023

5. Let $f(x) = \log_2(|\sin x| + |\cos x|)$. The range of f(x) is

   a) [-1, 0] b) $[0, \frac{1}{2}]$ c) $[-\frac{1}{2}, 0]$ d) [0, 1]

6. Which of the following functions have inverse defined on their ranges?

   a) $f(x) = x^2,\ x \in \mathbb{R}$ b) $f(x) = x^3,\ x \in \mathbb{R}$

   c) $f(x) = \sin x,\ 0 < x < 2\pi$ d) none of these

7. $(2\sqrt{3}+4)\sin x + 4\cos x$ lies in the interval

   a) (-4, 4) b) $(-2\sqrt{5}, 2\sqrt{5})$

   c) $(-2+\sqrt{5}, 2+\sqrt{5})$ d) $\left(-2(2+\sqrt{5}), 2(2+\sqrt{5})\right)$

8. The number of ways can you divide a pack of 52 cards into 4 sets, three of them having 17 cards each and the fourth just one card is

a) $\frac{52!}{(17!)^2}$ b) $\frac{52!}{17!\,3!}$ c) $\frac{52!\,3!}{(17!)^3}$ d) $\frac{52!}{(17!)^3\,3!}$

9. If ABCDEF be a regular hexagon then $\overrightarrow{AD}+\overrightarrow{EB}+\overrightarrow{FC}$ is equal to

a) $\vec{0}$ b) $2\overrightarrow{AB}$ c) $3\overrightarrow{AB}$ d) $4\overrightarrow{AB}$

10. If $A_n=\{x:2+\frac{1}{n}\le x\le 10-\frac{1}{n}, n\in N\}$, then the set $A_1\ UA_2\ UA_3\ U.....UA_nU.....$ is

a) $\{x : 2<x<10\}$ b) $\{x:2\le x<10\}$

c) $\{x:2<x\le 10\}$ d) $\{x:2\le x\le 10\}$

11. A line cuts the x-axis at A(7, 0) and the y-axis at B(0, -5). A variable line PQ is drawn perpendicular to AB cutting the x-axis at P and the y-axis at Q. If AQ and BP intersect at R, the locus of R is

a) $x^2 + y^2 + 7x - 5y = 0$ b) $x^2 + y^2 - 7x + 5y = 0$

c) $5x - 7y = 35$ d) none of these

12. If K>0, $|Z|=|W|=K$ and $\alpha=\frac{Z-\overline{W}}{K^2+Z\overline{W}}$ then $\mathrm{Re}(\alpha)$ equals

a) 0 b) $\frac{K}{2}$ c) K d) none of these

13. If $f(x)=\frac{\sin[x]}{[x]}, [x]\neq 0$

$=0, \quad [x]=0,$

where [x] is the greatest integer function, then $\lim_{x\to 0} f(x)$ is equal to

a) 1 b) 0 c) -1 d) none of these

14. Let $f(x) = \frac{\log_e(1+ax)-\log_e(1-bx)}{x}$, $x\neq 0$. The value to be assigned to f(x) at x = 0 so that f(x) is continuous at x = 0, is

a) a - b b) a + b c) $\log_e(ab)$ d) none of these

15. If $f(x) = \log (x + \sqrt{1+x^2})$ then f(x) is

a) periodic b) even function

c) odd function d) none of these

16. Let $f(x) = \begin{vmatrix} x^3 & \sin x & \cos x \\ 6 & -1 & 0 \\ p & p^2 & p^3 \end{vmatrix}$, where p is a constant.

Then $\frac{d^3}{dx^3}\{f(x)\}$ at x = 0 is

a) p b) $p + p^2$ c) $p + p^3$ d) independent of p

17. The angle between the tangents to the curves y = sinx and y = cosx at a point of intersection is

a) $\frac{\pi}{4}$ b) $\tan^{-1}(2\sqrt{2})$ c) $\tan^{-1}(\frac{1}{2\sqrt{2}})$ d) none of these

18. If $p(x) = a_0 + a_1x^2 + a_2x^4 + ... + a_nx^{2n}$ be a polynomial in $x \in \mathbb{R}$ with $0<a_1<a_2< ....<a_n$, then p(x) has

a) exactly one minimum b) exactly one maximum
c) one minimum and one maximum d) none of these

19. If $\phi(x) = f(x) + xf'(x)$ then $\int \phi(x)\,dx$ is equal to

a) (x +1) f(x) + c b) (x – 1) f(x) + c
c) x f(x) + c d) none of these

20. $\lim\limits_{n\to\infty} \frac{1}{n} \sum\limits_{r=1}^{2n} \frac{r}{\sqrt{n^2+r^2}}$ equals to

a) $\sqrt{5}+1$ b) $\sqrt{5}-1$ c) $\sqrt{2}-1$ d) $\sqrt{2}+1$

21. If the line y = mx bisects the area enclosed by the lines x = 0, y = 0, x = $\frac{3}{2}$ and the curve $y = 1 + 4x – x^2$, then m is equal to

a) $\frac{13}{6}$ b) $\frac{6}{13}$ c) 2 d) none of the these

22. If $y(x+y^3)dx = x(y^3-x)dy$ be the differential equation of a curve which passes through the point (1, 2), then the equation of the curve is

a) $y^2 + 2x - 5xy = 0$ b) $y^3 + 2x^2 - 5xy = 0$
c) $y^3 + 2x - 5x^2y$ d) none of these

23. If $x\frac{dy}{dx} + y = x\frac{\phi(xy)}{\phi'(xy)}$, then $\phi(xy)$ is equal to (k is an arbitrary constant)

a) $k\,e^{x^2/2}$ b) $k\,e^{y^2/2}$ c) $k\,e^{xy/2}$ d) none of these

24. Three identical dice are rolled. The probability that the same number will appear on each of them is

a) $\frac{1}{6}$ b) $\frac{1}{36}$ c) $\frac{1}{18}$ d) $\frac{3}{28}$

25. The letters of the word ASSASSIN are written down at random in a row. The probability that no two S occur together is

a) $\frac{1}{35}$ b) $\frac{1}{15}$ c) $\frac{1}{14}$ d) none of these