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Undergraduate Admission Test: Mathematics Honours

Full Marks : 75 **Time : 1 hour**

Each question has only one correct answer

Each question carries 3 marks for correct answer and (–1) mark for wrong answer.

(The symbols have their usual meanings)

1. The period of $\sin^2\theta$ is

a. π^2
b. π
c. π^3
d. $\frac{\pi}{2}$

2. The solution of $\sin x + \cos x = 1$ is

a. $x = 2n\pi$
b. $x = 2n\pi + \frac{\pi}{2}$
c. $x = n\pi + (-)^n \frac{\pi}{4} - \frac{\pi}{4}$
d. None of these.

3. If the lengths of the sides of triangle are 3, 5, 7, then the largest angle of the triangle is

a. $\frac{\pi}{2}$
b. $\frac{5\pi}{6}$
c. $\frac{2\pi}{3}$
d. $\frac{3\pi}{4}$

4. The remainder left out when $8^{2n} - (62)^{2n+1}$ is divided by 9 is

a. 2
b. 7
c. 8
d. 9

5. The solution of the following linear programming problem:

Minimise, $z = 200x + 500y$

subject to the constraints:

$x + 2y \geq 10, 3x + 4y \leq 24, x \geq 0, y \geq 0$ is

a. z = 2300, at $(4, 3)$
b. z = 2100, at $(4, 3)$
c. z = 2300, at $(3, 4)$
d. z = 2100, at $(3, 4)$

6. The number of complex numbers z such that

$|z-1| = |z+1| = |z-i|$ equals

a. 0
b. 1
c. 2
d. None of these.

7. From a group of 9 peoples, 4 have to be selected. In how many ways can the 4 peoples be selected so that one of them is always in the team?

a. 45
b. 49
c. 54
d. 56

8. The third term of geometric progression is 4, the product of the first 5 term is

a. 4^3
b. 4^4
c. 4^5
d. None of these

9. The straight lines $x + y = 0, 3x + y - 4 = 0, x + 3y - 4 = 0$ form a triangle which is

a. isosceles
b. equilateral
c. right angled
d. none of these

10. The two circles $x^2 + y^2 = ax$ and $x^2 + y^2 = 1$ touch each other if

a. $a = 2$
b. $|a| = 2$
c. $2|a| = 1$
d. $|a| = 1$

11. If $f: \mathbb{R} \to \mathbb{R}$ is a differentiable function such that $f(x + y) = f(x)f(y)$ for all x, y and $f(5) = 2, f'(0) = 3$, then $f'(5)$ is

a. 0
b. 1
c. 6
d. 2

12. Consider the relations R_1 and R_2 defined as $a\, R_1 b \Leftrightarrow a^2+b^2=1$ for all a, $b \in \boldsymbol{R}$ and $(a, b)\, R_2\, (c, d) \Leftrightarrow a+d=b+c$ for all $(a, b), (c, d) \in N \times N$. Then

a. R_1 and R_2 both are equivalence relations
b. only R_1 is an equivalence relation
c. only R_2 is an equivalence relation
d. neither R_1 nor R_2 is an equivalence relation

13. In a frequency distribution, the mean and median are 21 and 22 respectively, then its mode is approximately

a. 20.5
b. 22.0
c. 24.0
d. 25.5

14. Let $E = \{1,2,3,4\}$ and $F = \{1,2\}$, then the number of onto functions from E to F is

a. 14
b. 16
c. 12
d. 08

15. If $3^x = 4^{x-1}$, then $x =$

a. $\frac{2\log_3 2}{2\log_3 2-1}$

b. $\frac{1}{2-\log_2 3}$

c. $\frac{2}{1-\log_4 3}$

d. $\frac{2\ \log_2 3}{2\log_2 3-1}$

16. Find the value of $\sin\,(2\tan^{-1}(0.75)$

a. 0.75
b. 1.5
c. 0.96
d. 0.5

17. If A is a square matrix such that $A^2 = A$, then $(I - A)^3 + A$ is equal to

a. I
b. O
c. I – A
d. I + A

18. Which of the following function differentiable at $x = 0$?

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

19. The absolute maximum value of $y = x^3 - 3x + 2$ in $0 \le x \le 2$ is

a. 0
b. 2
c. 4
d. 6

20. Let $f: (-1\ 1) \to \mathbb{R}$ be a continuous function. If $\int_0^{\sin x} f(t)dt = \frac{\sqrt{3}}{2}x$, then $f\left(\frac{\sqrt{3}}{2}\right) =$

a. $\frac{\sqrt{3}}{2}$

b. $\sqrt{3}$

c. $\sqrt{\frac{3}{2}}$

d. $\frac{1}{2}$

21. The area bounded by the curves $y = |x^2 - 1|$ and $y = 1$ is

a. $\frac{2}{3}(\sqrt{2} + 1)$

b. $\frac{4}{3}(\sqrt{2} - 1)$

c. $2(\sqrt{2} - 1)$

d. $\frac{8}{3}(\sqrt{2} - 1)$

22. If $\frac{dy}{dx} = \frac{xy}{x^2+y^2}$ with $y(1) = 1$, then a value of x satisfying $y(x) = e$ is

a. $\sqrt{3}e$

b. $\frac{\sqrt{3}}{2}e$

c. $\sqrt{2}e$

d. $\frac{e}{\sqrt{2}}$

23. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are unit vectors, then

$$\left|\vec{a}-\vec{b}\right|^2 + \left|\vec{b}-\vec{c}\right|^2 + |\vec{c}-\vec{a}|^2 \quad \text{does not exceed}$$

a. 4
b. 9
c. 8
d. 6

24. The shortest distance between the lines $\frac{x+7}{-6} = \frac{y-6}{7} = z$ and

$\frac{7-x}{2} = y - 2 = z - 6$ is

a. $2\sqrt{29}$
b. 1
c. $\sqrt{\frac{37}{29}}$
d. $\frac{\sqrt{29}}{2}$

25. Two numbers are selected randomly from the integers $\{1, 2, \ldots, 9\}$. If the sum of the chosen two integers is even, then the probability that both the numbers are odd will be

a. $\frac{2}{9}$
b. $\frac{5}{8}$
c. $\frac{3}{8}$
d. $\frac{1}{9}$