Section - C
MATHEMATICS

1. Let $f(x) = \left[\left(\tan x + \sin x\right)^2\right]$. Then

(a) $\lim\limits_{x\to\infty} f(x)$ **does not exist** (b) **f (x) is not continuous at x = 0**

(c) **f (x) is not differentiable at x = 0** (d) **f ′ (0) = 0**

2. The two curves $y = x^3 + ax - 1$ and $y = 6x^2 + b$ touch each other at a point having abscissca **1** when

(a) **a = 3, b = – 3** (b) **a = 9, b = 3** (c) **a = 0, b = – 6** (d) **a = 3, b = 9**

3. If $\int \frac{\left(x^2-1\right)dx}{\left(x^4+3x^2+1\right)\tan^{-1}\left(\frac{x^2+1}{x}\right)} = \log\left|\tan^{-1} f(x)\right| + C$, then :

(a) $f(x) = x^2 + 1$ (b) $f(x) = \frac{x^2+1}{2x}$

(c) $f(x) = \frac{x^2+1}{x}$ (d) $f(x) = \frac{1}{2}\left(x^2+1\right)$

4. If the function $f(x) = Pe^{2x} + Qe^x + Rx$ satisfies the condition

$f(0) = -1,\ f'(\log 2) = 31$ and $\int_0^{\log 4}\left(f(x) - Rx\right)dx = \frac{39}{2}$, then :

(a) **P = 5, Q = – 6, R = 3** (b) **P = – 5, Q = 6, R = 3**

(c) **P = – 5, Q = 6, R = 3** (d) **P = 3, Q = 2, R = 3**

5. Area included between $y = \frac{x^2}{4a}$ and $y = \frac{8a^3}{x^2+4a^2}$ is :

(a) $\frac{a^2}{3}(6\pi - 4)$ (b) $\frac{a^2}{3}(4\pi + 3)$

(c) $\frac{a^2}{3}(8\pi + 3)$ (d) **None of these**

6. If **A** and **B** are two sets, then $A \cap (A \cup B)^+$ equals :

(a) **A** (b) **B** (c) ϕ (d) **None**

7. $f(x) = x^2[x]$:

(a) **increases in (0 , 1)** (b) **decreases in (0 , 1)**

(c) **increases in (–1 , 0)** (d) **None of these**

8. If $y = e^x + \sin x$, then d^2x / dy^2 is equal to :

(a) $e^x - \sin x$ (b) $-(e^x + \cos x)^{-2}$

(c) $-(e^x - \sin x)\ (e^x + \cos x)^{-2}$ (d) $(\sin x - e^x)(\cos x + e^x)^-$

9. The sum to **n** terms of the series $\frac{1}{2}+\frac{3}{4}+\frac{7}{8}+\frac{15}{16}+.....$ is :

(a) $n-1-2^{-n}$ (b) **1** (c) $n-1+2^{-n}$ (d) $1+2^{-n}$

10. Two finite sets have **m** and **n** elements. The total number of subsets of first set is **56** more than the total number of subsets of the second set. Then :

(a) $m=3, n=6$ (b) $m=6, n=3$

(c) $m=5, n=6$ (d) **None of these**

11. A set **A** has **3** elements and another set **B** has **6** elements. Then :

(a) $3 \le n(A \cup B) \le 6$ (b) $3 \le n(A \cup B) \le 9$

(c) $6 \le n(A \cup B) \le 9$ (d) $0 \le n(A \cup B) \le 9$

12. If $g = \{(1,1),(2,3),(3,5),(4,7)\}$ is a function described by the formula, $g(x) = \alpha x + \beta$ then what values should be assigned to α and β ?

(a) $\alpha = 1, \beta = 1$ (b) $\alpha = 2, \beta = -1$

(c) $\alpha = 1, \beta = -2$ (d) $\alpha = -2, \beta = -1$

13. The roots α and β of the quadratic equation $px^2 + qx + r = 0$ are real and of opposite signs. The roots of $\alpha(x-\beta)^2 + \beta(x-\alpha)^2 = 0$ are :

(a) **positive** (b) **negative** (c) **of opposite signs** (d) **non real**

14. The value of **x** for which $\sin(\cot^{-1}(1+x)) = \cos(\tan^{-1} x)$ is :

(a) **1/2** (b) **1** (c) **0** (d) **–1/2**

15. The equation $k \sin\theta + \cos 2\theta = 2k - 7$ possesses a solution if :

(a) $2 \le k \le 6$ (b) $K > 2$ (c) $k > 6$ (d) $k < 2$

16. The value of $\lim_{x \to 0} \frac{1-\cos^3 x}{x \to 0\ x \sin x \cos x}$ is :

(a) **2 / 5** (b) **3 / 5** (c) **3 / 2** (d) **3 / 4**

17. If $y = \sin^{-1}\frac{2x}{1+x^2}$, then which of the following is not correct ?

(a) $\frac{dy}{dx} = \frac{2}{1+x^2}$ for $|x| < 1$ (b) $\frac{dy}{dx} = \frac{-2}{1+x^2}$ for $|x| > 1$

(c) $\frac{dy}{dx} = 2$ for $x = -1$ (d) $\frac{dy}{dx}$ does not exist at $|x| = 1$

18. If $f(x) = \frac{1}{1-x}$, the number of points of discontinuity of $f\{f[f(x)]\}$ is :

(a) **2** (b) **1** (c) **0** (d) **infinite**

19. If the slope of the tangent at (x, y) to a curve passing through $\left(1, \frac{\pi}{4}\right)$ is given by , then $\frac{y}{x} - \cos^2\left(\frac{y}{x}\right)$ the equation of the curves is :

(a) $y = \tan^{-1} \log(e/x)$ (b) $y = e^{1+\cot(y/x)}$

(c) $y = x \tan^{-1} \log(e/x)$ (d) $y = e^{1+\tan(y/x)}$

20. If $y = \tan^{-1}\left(\frac{2^x}{1+2^{2x+1}}\right)$, then $\frac{dy}{dx}$ at $x = 0$ is :

(a) $-\frac{3}{5}\log 2$ (b) $\frac{2}{5}\log 2$ (c) $-\frac{3}{2}\log 2$ (d) **None**

21. Complex number **z** satisfies $|z - a + ia| = 1$ and has the least absolute value. Its absolute value is :

(a) $a\sqrt{2}-1$ (b) $a\sqrt{2}+1$ (c) **0** (d) **a**

22. Distance between lines represented by $x^2 + 2\sqrt{2}xy + 2y^2 + 4x + 4\sqrt{2}y + 1 = 0$:

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

23. If vertices of Δ are **(8 , –2), (2, –2) & (8 , 6)**, then find its orthocenter :

(a) **(8 , –2)** (b) **(8 , 6)** (c) **(2 , 2)** (d) **(–2 , 2)**

24. If $P\left(1+\frac{1}{\sqrt{2}}, 2+\frac{t}{\sqrt{2}}\right)$ be any point on a line, then the range of values of **t** for which the point **P** lies between the parallel lines $x + 2y = 1$ and $2x + 4y = 15$ is :

(a) $-\frac{4\sqrt{2}}{3} < t < \frac{5\sqrt{2}}{6}$ (b) $0 < t < \frac{5\sqrt{2}}{6}$

(c) $-\frac{4\sqrt{2}}{5} < t < 0$ (d) **None of these**

25. The four points of intersection of the lines $(2x - y + 1)(x - 2y + 3) = 0$ with the axes lie on a circle whose centre is at the point :

(a) $\left(-\frac{7}{4}, \frac{5}{4}\right)$ (b) $\left(\frac{3}{4}, \frac{5}{4}\right)$ (c) $\left(\frac{9}{4}, \frac{5}{4}\right)$ (d) $\left(0, \frac{5}{4}\right)$

26. If the parabola $x^2 = ay$ makes an intercept of length on the line $y - 2x = 1$, then $a =$

(a) **3** (b) – **2** (c) – **1** (d) **2**

27. Number of normals drawn from the point **(– 2 , 2)** to the parabola $y^2 - 2y - 2x - 1 = 0$ is :

(a) **one** (b) **two** (c) **three** (d) **zero**

28. If $\sqrt{3}(bx) + ay = 2ab$ touched the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ then eccentric angle is :

(a) **30°** (b) **45°** (c) **60°** (d) **90°**

29. The area of quadrilateral formed by focil of hyperbola $\frac{x^2}{4}-\frac{y^2}{3}=1$ & its conjugate hyperbola is :

(a) **14** (b) **24** (c) **12** (d) **10**

30. Consider the point **P (4 , 3)** and $\frac{x^2}{16}-\frac{y^2}{9}=1$. Which of the following is not true ?

(a) **Two tangents can be drawn from P** (b) **One tangent can be drawn from P**

(c) **P lines on out side the hyperbola** (d) **P lines on Asymptotes on Hyperbola**