

- 1) The logical equivalence of the Boolean expression $(p \wedge \sim q) \implies (q \vee \sim p)$ is equivalent to :
- a) $q \implies p$
 - b) $p \implies q$
 - c) $\sim q \implies p$
 - d) $p \implies \sim q$
- 2) Let a be a positive real number such that $\int_0^a e^{x-[x]} dx = 10e - 9$ where $[x]$ is the greatest integer less than or equal to x . Then a is equal to :
- a) $10 - \log_e (1 + e)$
 - b) $10 + \log_e 2$
 - c) $10 + \log_e 3$
 - d) $10 + \log_e (1 + e)$
- 3) The mean of 6 numbers is 6.5 and its variance is 10.25. If 4 numbers are 2, 4, 5 and 7, then find the other two.
- a) 10, 11
 - b) 3, 18
 - c) 8, 13
 - d) 1, 20
- 4) The value of the integral $\int_{-1}^1 \log_e (\sqrt{1-x} + \sqrt{1+x}) dx$ is equal to :
- a) $\frac{1}{2} \log_e 2 + \frac{\pi}{4} - \frac{3}{2}$
 - b) $2 \log_e 2 + \frac{\pi}{4} - 1$
 - c) $\log_e 2 + \frac{\pi}{2} - 1$
 - d) $2 \log_e 2 + \frac{\pi}{4} - \frac{1}{2}$
- 5) If the roots of the quadratic equation $x^2 + 3^{\frac{1}{4}}x + 3^{\frac{1}{2}} = 0$ are α and β , then the value of $\alpha^{96}(\alpha^{12} - 1) + \beta^{96}(\beta^{12} - 1)$
- a) $50 \cdot 3^{24}$
 - b) $51 \cdot 3^{24}$
 - c) $52 \cdot 3^{24}$
 - d) $104 \cdot 3^{24}$
- 6) Let $A = \begin{pmatrix} 2 & 3 \\ a & 0 \end{pmatrix}$, $a \in R$ can be written as $P + Q$ where P is a symmetric matrix and Q is a skew symmetric matrix. If $\det(Q) = 9$, then the modulus of the sum of all possible values of determinant of P is equal to :
- a) 36
 - b) 24
 - c) 45
 - d) 18

- 7) If z and ω are two complex numbers such that $|z\omega| = 1$ and $\arg z - \arg \omega = \frac{3\pi}{2}$, then $\arg\left(\frac{1-2\bar{z}\omega}{1+3\bar{z}\omega}\right)$ is :
(Here $\arg(z)$ denotes the principal argument of complex number z)
- $\frac{\pi}{4}$
 - $-\frac{3\pi}{4}$
 - $-\frac{\pi}{4}$
 - $\frac{3\pi}{4}$
- 8) In $\triangle ABC$, if $AB = 5$, $\angle B = \cos^{-1}\left(\frac{3}{5}\right)$ and the radius of circumcircle of triangle is 5 units, then the area (in sq. units) of $\triangle ABC$ is :
- $10 + 6\sqrt{2}$
 - $8 + 2\sqrt{2}$
 - $6 + 8\sqrt{3}$
 - $4 + 2\sqrt{3}$
- 9) Let $[x]$ denote the greatest integer $\leq x$, where $x \in R$. If the domain of the real valued function $f(x) = \sqrt{\frac{[x]-2}{[x]-3}}$ is $(-\infty, a) \cup [b, c) \cup [4, \infty)$, $a < b < c$, then the value of $a + b + c$ is :
- 8
 - 1
 - 2
 - 3
- 10) Let $y = y(x)$ be the solution of differential equation $x \tan\left(\frac{y}{x}\right) = \left(y \tan\left(\frac{y}{x}\right) - x\right) dx$, $-1 \leq x \leq 1$, $y\left(\frac{1}{2}\right) = \frac{\pi}{6}$. Then the area of the region bounded by the curves $x = 0$, $x = \frac{1}{\sqrt{2}}$ and $y = y(x)$ in the upper half plane is :
- $\frac{1}{8}(\pi - 1)$
 - $\frac{1}{12}(\pi - 3)$
 - $\frac{1}{4}(\pi - 2)$
 - $\frac{1}{6}(\pi - 1)$
- 11) Find the coefficient of x^{256} in $(1 - x)^{101} (x^2 + x + 1)^{100}$ is:
- $\binom{100}{16}$
 - $\binom{100}{15}$
 - $-\binom{100}{16}$
 - $-\binom{100}{15}$
- 12) Let $A = [a_{ij}]$ be a 3×3 matrix, where $a_{ij} = \begin{cases} 1 & , \text{ if } i = j \\ -x & , \text{ if } |i - j| = 1 \\ 2x + 1 & , \text{ otherwise} \end{cases}$
- Let a function $f: R \rightarrow R$ be defined as $f(x) = \det(A)$. Then the sum of maximum and minimum values of f on R is equal to :
- $-\frac{20}{27}$
 - $\frac{88}{27}$
 - $\frac{20}{27}$

d) $-\frac{88}{27}$

- 13) Let $\vec{a} = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{b} = \hat{i} + \hat{j}$. If \vec{c} is a vector such that $\vec{a} \cdot \vec{c} = |\vec{c}|$, $|\vec{c} - \vec{a}| = 2\sqrt{2}$ and the angle between $(\vec{a} \times \vec{b})$ and \vec{c} is $\frac{\pi}{6}$, then the value of $\left| (\vec{a} \times \vec{b}) \times \vec{c} \right|$ is :

- a) $\frac{2}{3}$
 b) 4
 c) 3
 d) $\frac{3}{2}$

- 14) The number of solutions of $\tan^{-1} \sqrt{x(x+1)} + \sin^{-1} \sqrt{x^2 + x + 1} = \frac{\pi}{4}$ is

- a) 1
 b) 2
 c) 4
 d) 0

- 15) Let $y = y(x)$ be the solution of the differential equation $e^x \sqrt{1 - y^2} dx + \left(\frac{y}{x}\right) dy = 0$, $y(1) = -1$. Then the value of $(y(3))^2$ is equal to :

- a) $1 - 4e^3$
 b) $1 - 4e^6$
 c) $1 + 4e^3$
 d) $1 + 4e^6$