**1.** The resultant of P and Q is R. If P is reversed, Q remaining the same, the resultant becomes $R'$. If R is perpendicular to $R'$, then

(a) $2P = Q$ (b) $P = Q$

(c) $P = 2Q$ (d) None of these

**2.** $ABC$ is an equilateral triangle. E and F are the middle- points of the sides CA and AB respectively. Forces of magnitudes 4N, PN, 2N, P N and Q N act at a point and are along the lines BC, BE, CA, CF and AB respectively. If the system is in equilibrium, then

(a) $P = 2\sqrt{3}N, Q = 6N$ (b) $P = 6N, Q = 2\sqrt{3}N$

(c) $P = \sqrt{3}N, Q = 6N$ (d) $P = 2\sqrt{3}N, Q = 3N$

**3.** A uniform rod of weight W rests with its ends in contact with two smooth planes, inclined at angles $\alpha$ and $\beta$ respectively to the horizon, and intersecting in a horizontal line. The inclination $\theta$ of the rod to the vertical is given by

(a) $2\cot\theta = \cot\beta - \cot\alpha$ (b) $\tan\theta = \dfrac{2\tan\alpha\tan\beta}{(\tan\alpha - \tan\beta)}$

(c) $\cot\theta = \dfrac{\sin(\alpha-\beta)}{2\sin\alpha\sin\beta}$ (d) All of these

**4.** Three forces $\vec{P}, \vec{Q}$ and $\vec{R}$ acting along $IA, IB$ and $IC$, where I is the incentre of a $\Delta ABC$, are in equilibrium. Then $\vec{P} : \vec{Q} : \vec{R}$

(a) $\text{cosec}\dfrac{A}{2} : \text{cosec}\dfrac{B}{2} : \text{cosec}\dfrac{C}{2}$

(b) $\sec\dfrac{A}{2} : \sec\dfrac{B}{2} : \sec\dfrac{C}{2}$

(c) $\sin\dfrac{A}{2} : \sin\dfrac{B}{2} : \sin\dfrac{C}{2}$

(d) $\cos\dfrac{A}{2} : \cos\dfrac{B}{2} : \cos\dfrac{C}{2}$

**5.** What will be that force when applying along any inclined plane will stop 10 kilogram weight, it is given that force, reaction of plane and weight of body are in arithmetic series

(a) 4 kg-wt (b) 6 kg-wt

(c) 8 kg-wt (d) 7 kg-wt

**6.** Forces P, 3P, 2P and 5P act along the sides AB, BC, CD and DA of the square ABCD. If the resultant meets AD produced at the point E, then AD : DE is

(a) 1 : 2 (b) 1 : 3

(c) 1 : 4 (d) 1 : 5

**7.** A rigid wire, without weight, in the form of the arc of a circle subtending an angle $\alpha$ at its centre and having two weights P and Q at its extremities rests with its convexity downwards upon a horizontal plane. If $\theta$ be the inclination to the vertical of the radius to the end at which P is suspended, then $\tan\theta$ =

(a) $\dfrac{Q\sin\alpha}{P+Q\cos\alpha}$ (b) $\dfrac{P\sin\alpha}{Q+P\cos\alpha}$

(c) $\dfrac{Q\cos\alpha}{P+Q\sin\alpha}$ (d) $\dfrac{P\cos\alpha}{Q+P\sin\alpha}$

**8.** $\begin{vmatrix} x+1 & x+2 & x+4 \\ x+3 & x+5 & x+8 \\ x+7 & x+10 & x+14 \end{vmatrix} =$

(a) 2 (b) – 2

(c) $x^2 - 2$ (d) None of these

**9.** $\begin{vmatrix} 1 & a & b \\ -a & 1 & c \\ -b & -c & 1 \end{vmatrix} =$

(a) $1+a^2+b^2+c^2$ (b) $1-a^2+b^2+c^2$

(c) $1+a^2+b^2-c^2$ (d) $1+a^2-b^2+c^2$

**10.** If the system of equations, $x+2y-3z=1$, $(k+3)z=3,\ (2k+1)x+z=0$ is inconsistent, then the value of k is

(a) – 3 (b) 1/2

(c) 0 (d) 2

**11.** If $A = \begin{bmatrix} i & 0 \\ 0 & -i \end{bmatrix}, B = \begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}$, where $i = \sqrt{-1}$, then the correct relation is

(a) $A+B=O$ (b) $A^2 = B^2$

(c) $A-B=O$ (d) $A^2+B^2=O$

**12.** If the matrix $\begin{bmatrix} 1 & 3 & \lambda+2 \\ 2 & 4 & 8 \\ 3 & 5 & 10 \end{bmatrix}$ is singular, then $\lambda =$

(a) – 2 (b) 4

(c) 2 (d) – 4

**13.** If $R \subset A \times B$ and $S \subset B \times C$ be two relations, then $(SoR)^{-1} =$

(a) $S^{-1}oR^{-1}$ (b) $R^{-1}oS^{-1}$

(c) $SoR$ (d) $RoS$

**14.** If R be a relation < from A = {1,2, 3, 4} to B = {1, 3, 5} i.e., $(a,b) \in R \Leftrightarrow a < b$, then $RoR^{-1}$ is

(a) {(1, 3), (1, 5), (2, 3), (2, 5), (3, 5), (4, 5)}
(b) {(3, 1) (5, 1), (3, 2), (5, 2), (5, 3), (5, 4)}
(c) {(3, 3), (3, 5), (5, 3), (5, 5)}
(d) {(3, 3) (3, 4), (4, 5)}

**15.** A relation from P to Q is

(a) A universal set of P × Q
(b) P × Q
(c) An equivalent set of P × Q
(d) A subset of P × Q

**16.** If A and B are disjoint, then $n(A \cup B)$ is equal to

(a) $n(A)$ (b) $n(B)$
(c) $n(A)+n(B)$ (d) $n(A).n(B)$

**17.** If A and B are not disjoint sets, then $n(A \cup B)$ is equal to

(a) $n(A)+n(B)$ (b) $n(A)+n(B)-n(A \cap B)$
(c) $n(A)+n(B)+n(A \cap B)$ (d) $n(A)n(B)$
(e) $n(A)-n(B)$

**18.** In a battle 70% of the combatants lost one eye, 80% an ear, 75% an arm, 85% a leg, x% lost all the four limbs. The minimum value of x is

(a) 10 (b) 12
(c) 15 (d) None of these

**19.** Out of 800 boys in a school, 224 played cricket, 240 played hockey and 336 played basketball. Of the total, 64 played both basketball and hockey; 80 played cricket and basketball and 40 played cricket and hockey; 24 played all the three games. The number of boys who did not play any game is

(a) 128 (b) 216
(c) 240 (d) 160

**20.** A survey shows that 63% of the Americans like cheese whereas 76% like apples. If x% of the Americans like both cheese and apples, then

(a) $x = 39$ (b) $x = 63$
(c) $39 \le x \le 63$ (d) None of these

**21.** If the product of the roots of the equation $2x^2 + 6x + \alpha^2 + 1 = 0$ is $-\alpha$, then the value of $\alpha$ will be

(a) –1 (b) 1
(c) 2 (d) –2

**22.** If $\sqrt{3x^2 - 7x - 30} + \sqrt{2x^2 - 7x - 5} = x + 5$, then x is equal to

(a) 2 (b) 3
(c) 6 (d) 5

**23.** The value of $2 + \cfrac{1}{2 + \cfrac{1}{2 + \ldots\ldots\ldots\infty}}$ is

(a) $1-\sqrt{2}$ (b) $1+\sqrt{2}$
(c) $1 \pm \sqrt{2}$ (d) None of these

**24.** The roots of the equation $2^{x+2}27^{x/(x-1)} = 9$ are given by

(a) $1-\log_2 3, 2$ (b) $\log_2\left(\frac{2}{3}\right), 1$
(c) 2,–2 (d) $-2, 1-\frac{\log 3}{\log 2}$

**25.** Let $\alpha$ and $\beta$ be the roots of the equation $x^2 + x + 1 = 0$ The equation whose roots are $\alpha^{19}, \beta^7$ is

(a) $x^2 - x - 1 = 0$ (b) $x^2 - x + 1 = 0$
(c) $x^2 + x - 1 = 0$ (d) $x^2 + x + 1 = 0$

**26.** If $\alpha$ and $\beta$ are roots of $ax^2 + 2bx + c = 0$, then $\sqrt{\frac{\alpha}{\beta}} + \sqrt{\frac{\beta}{\alpha}}$ is equal to

(a) $\frac{2b}{ac}$ (b) $\frac{2b}{\sqrt{ac}}$
(c) $-\frac{2b}{\sqrt{ac}}$ (d) $\frac{-b}{\sqrt{2}}$

**27.** The quadratic equation with real coefficients whose one root is $7 + 5i$, will be

(a) $x^2 - 14x + 74 = 0$ (b) $x^2 + 14x + 74 = 0$
(c) $x^2 - 14x - 74 = 0$ (d) $x^2 + 14x - 74 = 0$

**28.** If the roots of the equation $\frac{1}{x+p} + \frac{1}{x+q} = \frac{1}{r}$ are equal in magnitude but opposite in sign, then the product of the roots will be

(a) $\frac{p^2+q^2}{2}$ (b) $-\frac{(p^2+q^2)}{2}$
(c) $\frac{p^2-q^2}{2}$ (d) $-\frac{(p^2-q^2)}{2}$

**29.** If the roots of the equation $ax^2 + bx + c = 0$ are reciprocal to each other, then

(a) $a - c = 0$ (b) $b - c = 0$
(c) $a + c = 0$ (d) $b + c = 0$

**30.** If the $(m+1)^{th}, (n+1)^{th}$ and $(r+1)^{th}$ terms of an A.P. are in G.P. and $m, n, r$ are in H.P., then the value of the ratio of the common difference to the first term of the A.P. is

(a) $-\frac{2}{n}$ (b) $\frac{2}{n}$

(c) $-\frac{n}{2}$ (d) $\frac{n}{2}$

**31.** If G.M. = 18 and A.M. = 27, then H.M. is

(a) $\frac{1}{18}$ (b) $\frac{1}{12}$

(c) 12 (d) $9\sqrt{6}$

**32.** If the A.M. is twice the G.M. of the numbers $a$ and $b$, then $a:b$ will be

(a) $\frac{2-\sqrt{3}}{2+\sqrt{3}}$ (b) $\frac{2+\sqrt{3}}{2-\sqrt{3}}$

(c) $\frac{\sqrt{3}-2}{\sqrt{3}+2}$ (d) $\frac{\sqrt{3}+2}{\sqrt{3}-2}$

**33.** $\left[\sin\left(\tan^{-1}\frac{3}{4}\right)\right]^2 =$

(a) $\frac{3}{5}$ (b) $\frac{5}{3}$

(c) $\frac{9}{25}$ (d) $\frac{25}{9}$

**34.** The principal value of $\sin^{-1}\left(\sin\frac{5\pi}{3}\right)$ is

(a) $\frac{5\pi}{3}$ (b) $-\frac{5\pi}{3}$

(c) $-\frac{\pi}{3}$ (d) $\frac{4\pi}{3}$

**35.** The value of x which satisfies the equation $\tan^{-1}x = \sin^{-1}\left(\frac{3}{\sqrt{10}}\right)$ is

(a) 3 (b) –3

(c) $\frac{1}{3}$ (d) $-\frac{1}{3}$

**36.** From an aeroplane vertically over a straight horizontally road, the angles of depression of two consecutive mile stones on opposite sides of the aeroplane are observed to be α and β, then the height in miles of aeroplane above the road is

(a) $\frac{\tan\alpha.\tan\beta}{\cot\alpha+\cot\beta}$ (b) $\frac{\tan\alpha+\tan\beta}{\tan\alpha.\tan\beta}$

(c) $\frac{\cot\alpha+\cot\beta}{\tan\alpha.\tan\beta}$ (d) $\frac{\tan\alpha.\tan\beta}{\tan\alpha+\tan\beta}$

**37.** A balloon is observed simultaneously from three points A, B and C on a straight road directly under it. The angular elevation at B is twice and at C is thrice that of A. If the distance between A and B is 200 metres and the distance between B and C is 100 metres, then the height of balloon is given by

(a) 50 metres (b) $50\sqrt{3}$ metres

(c) $50\sqrt{2}$ metres (d) None of these

**38.** In $\Delta ABC$, $a^2(\cos^2 B-\cos^2 C)+ b^2(\cos^2 C-\cos^2 A)+ c^2(\cos^2 A-\cos^2 B) =$

(a) 0 (b) 1

(c) $a^2+b^2+c^2$ (d) $2(a^2+b^2+c^2)$

**39.** In triangle $ABC$, $\frac{1+\cos(A-B)\cos C}{1+\cos(A-C)\cos B} =$

(a) $\frac{a-b}{a-c}$ (b) $\frac{a+b}{a+c}$

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

**40.** In $\Delta ABC$, $\frac{\cos\frac{1}{2}(B-C)}{\sin\frac{1}{2}A} =$

(a) $\frac{b-c}{a}$ (b) $\frac{b+c}{a}$

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

**41.** $\frac{\cos 10^o+\sin 10^o}{\cos 10^o-\sin 10^o} =$

(a) $\tan 55^o$ (b) $\cot 55^o$

(c) $-\tan 35^o$ (d) $-\cot 35^o$

**42.** If $\cos P = \frac{1}{7}$ and $\cos Q = \frac{13}{14}$, where P and Q both are acute angles. Then the value of $P-Q$ is

(a) $30^o$ (b) $60^o$

(c) $45^o$ (d) $75^o$

**43.** $\sec 50^o + \tan 50^o$ is equal to

(a) $\tan 20^o + \tan 50^o$ (b) $2\tan 20^o + \tan 50^o$

(c) $\tan 20^o + 2\tan 50^o$ (d) $2\tan 20^o + 2\tan 50^o$

**44.** If $\tan\alpha = (1+2^{-x})^{-1}$, $\tan\beta = (1+2^{x+1})^{-1}$, then $\alpha+\beta$ equals

(a) $\pi/6$ (b) $\pi/4$

(c) $\pi/3$ (d) $\pi/2$

**45.** The sum $S = \sin\theta + \sin 2\theta + .... + \sin n\theta$, equals

(a) $\sin\frac{1}{2}(n+1)\theta \sin\frac{1}{2}n\theta / \sin\frac{\theta}{2}$

(b) $\cos\frac{1}{2}(n+1)\theta \sin\frac{1}{2}n\theta / \sin\frac{\theta}{2}$

(c) $\sin\frac{1}{2}(n+1)\theta \cos\frac{1}{2}n\theta / \sin\frac{\theta}{2}$

(d) $\cos\frac{1}{2}(n+1)\theta \cos\frac{1}{2}n\theta / \sin\frac{\theta}{2}$

**46.** The value of $\cot 70^o + 4\cos 70^o$ is

(a) $\frac{1}{\sqrt{3}}$ (b) $\sqrt{3}$

(c) $2\sqrt{3}$ (d) $\frac{1}{2}$

**47.** The expression $2\cos\frac{\pi}{13}.\cos\frac{9\pi}{13} + \cos\frac{3\pi}{13} + \cos\frac{5\pi}{13}$ is equal to

(a) – 1 (b) 0

(c) 1 (d) None of these

**48.** If $\sin\theta = \frac{12}{13}, (0 < \theta < \frac{\pi}{2})$ and $\cos\phi = -\frac{3}{5}, \left(\pi < \phi < \frac{3\pi}{2}\right)$.

Then $\sin(\theta + \phi)$ will be

(a) $\frac{-56}{61}$ (b) $\frac{-56}{65}$

(c) $\frac{1}{65}$ (d) – 56

**49.** If $f(r) = \pi r^2$, then $\lim_{h\to 0}\frac{f(r+h) - f(r)}{h} =$

(a) $\pi r^2$ (b) $2\pi r$

(c) $2\pi$ (d) $2\pi r^2$

**50.** $\lim_{x\to 0} x\log(\sin x) =$

(a) –1 (b) $\log_e 1$

(c) 1 (d) None of these

**51.** The period of $f(x) = x - [x]$, if it is periodic, is

(a) $f(x)$ is not periodic (b) $\frac{1}{2}$

(c) 1 (d) 2

**52.** If $f(x)$ is periodic function with period T then the function $f(ax+b)$ where $a > 0$, is periodic with period

(a) $T/b$ (b) aT

(c) bT (d) $T/a$

**53.** The function $f(x) = \begin{cases} x+2 & , 1 \le x \le 2 \\ 4 & , x = 2 \\ 3x-2 & , x > 2 \end{cases}$ is continuous at

(a) $x = 2$ only (b) $x \le 2$

(c) $x \ge 2$ (d) None of these

**54.** If the function $f(x) = \begin{cases} 5x-4 & , \text{ if } 0 < x \le 1 \\ 4x^2 + 3bx & , \text{ if } 1 < x < 2 \end{cases}$ is continuous at every point of its domain, then the value of b is

(a) – 1 (b) 0

(c) 1 (d) None of these

**55.** Let $f(x) = \begin{cases} 1 & \forall x < 0 \\ 1 + \sin x & \forall 0 \le x \le \pi/2 \end{cases}$, then what is the value of $f'(x)$ at $x = 0$

(a) 1 (b) –1

(c) $\infty$ (d) does not exist

**56.** If the lines $x + y = 6$ and $x + 2y = 4$ be diameters of the circle whose diameter is 20, then the equation of the circle is

(a) $x^2 + y^2 - 16x + 4y - 32 = 0$

(b) $x^2 + y^2 + 16x + 4y - 32 = 0$

(c) $x^2 + y^2 + 16x + 4y + 32 = 0$

(d) $x^2 + y^2 + 16x - 4y + 32 = 0$

**57.** The number of circles touching the lines $x = 0$, $y = a$ and $y = b$ is

(a) One (b) Two

(c) Four (d) Infinite

**58.** The length of the latus rectum of the parabola $x^2 - 4x - 8y + 12 = 0$ is

(a) 4 (b) 6

(c) 8 (d) 10

**59.** The focus of the parabola $y = 2x^2 + x$ is

(a) (0, 0) (b) $\left(\frac{1}{2}, \frac{1}{4}\right)$

(c) $\left(-\frac{1}{4}, 0\right)$ (d) $\left(-\frac{1}{4}, \frac{1}{8}\right)$

**60.** The centre of the ellipse $\frac{(x+y-2)^2}{9} + \frac{(x-y)^2}{16} = 1$ is

(a) (0, 0) (b) (1, 1)

(c) (1, 0) (d) (0, 1)

**61.** The equation of an ellipse whose focus (–1, 1), whose directrix is $x - y + 3 = 0$ and whose eccentricity is $\frac{1}{2}$, is given by

(a) $7x^2 + 2xy + 7y^2 + 10x - 10y + 7 = 0$

(b) $7x^2 - 2xy + 7y^2 - 10x + 10y + 7 = 0$

(c) $7x^2 - 2xy + 7y^2 - 10x - 10y - 7 = 0$

(d) $7x^2 - 2xy + 7y^2 + 10x + 10y - 7 = 0$

**62.** The point of contact of the line $y = x - 1$ with $3x^2 - 4y^2 = 12$ is

(a) (4, 3) (b) (3, 4)
(c) (4, –3) (d) None of these

**63.** If the straight line $x\cos\alpha + y\sin\alpha = p$ be a tangent to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, then

(a) $a^2\cos^2\alpha + b^2\sin^2\alpha = p^2$
(b) $a^2\cos^2\alpha - b^2\sin^2\alpha = p^2$
(c) $a^2\sin^2\alpha + b^2\cos^2\alpha = p^2$
(d) $a^2\sin^2\alpha - b^2\cos^2\alpha = p^2$

**64.** Let P(n) be a statement and let P(n) ⇒ p(n + 1) for all natural numbers n, then P(n) is true

(a) For all n
(b) For all n > 1
(c) For all n > m, m being a fixed positive integer
(d) Nothing can be said

**65.** $(1+x)^n - nx - 1$ is divisible by (where $n \in N$ )

(a) $2x$ (b) $x^2$
(c) $2x^3$ (d) All of these

**66.** $\frac{d}{dx}\sqrt{\sec^2 x + \operatorname{cosec}^2 x} =$

(a) $4\operatorname{cosec} 2x.\cot 2x$ (b) $-4\operatorname{cosec} 2x.\cot 2x$
(c) $-4\operatorname{cosec} x.\cot 2x$ (d) None of these

**67.** $\frac{d}{dx}\left(\frac{\sec x + \tan x}{\sec x - \tan x}\right) =$

(a) $\frac{2\cos x}{(1-\sin x)^2}$ (b) $\frac{\cos x}{(1-\sin x)^2}$
(c) $\frac{2\cos x}{1-\sin x}$ (d) None of these

**68.** $\frac{d}{dx}\left(x^3\tan^2\frac{x}{2}\right) =$

(a) $x^3\tan\frac{x}{2}.\sec^2\frac{x}{2} + 3x\tan^2\frac{x}{2}$
(b) $x^3\tan\frac{x}{2}.\sec^2\frac{x}{2} + 3x^2\tan^2\frac{x}{2}$
(c) $x^3\tan^2\frac{x}{2}.\sec^2\frac{x}{2} + 3x^2\tan^2\frac{x}{2}$
(d) None of these

**69.** If $y = x^{\sin x}$, then $\frac{dy}{dx} =$

(a) $\frac{x\cos x.\log x + \sin x}{x}.x^{\sin x}$
(b) $\frac{y[x\cos x.\log x + \cos x]}{x}$
(c) $y[x\sin x.\log x + \cos x]$
(d) None of these

**70.** $\frac{d}{dx}\{(\sin x)^x\} =$

(a) $\left[\frac{x\cos x + \sin x\log\sin x}{\sin x}\right]$
(b) $(\sin x)^x\left[\frac{x\cos x + \sin x\log\sin x}{\sin x}\right]$
(c) $(\sin x)^x\left[\frac{x\sin x + \sin x\log\sin x}{\sin x}\right]$
(d) None of these

**71.** If $u = x^2 + y^2$ and $x = s + 3t,\ y = 2s - t,$ then $\frac{d^2u}{ds^2} =$

(a) 12 (b) 32
(c) 36 (d) 10

**72.** $\frac{d^n}{dx^n}(\log x) =$

(a) $\frac{(n-1)!}{x^n}$ (b) $\frac{n!}{x^n}$
(c) $\frac{(n-2)!}{x^n}$ (d) $(-1)^{n-1}\frac{(n-1)!}{x^n}$

**73.** In [0, 1] Lagrange's mean value theorem is NOT applicable to

(a) $f(x) = \begin{cases} \frac{1}{2} - x, & x < \frac{1}{2} \\ \left(\frac{1}{2} - x\right)^2, & x \ge \frac{1}{2} \end{cases}$ (b) $f(x) = \begin{cases} \frac{\sin x}{x}, & x \ne 0 \\ 1, & x = 0 \end{cases}$
(c) $f(x) = x|x|$ (d) $f(x) = |x|$

**74.** If the function $f(x) = x^3 - 6ax^2 + 5x$ satisfies the conditions of Lagrange's mean value theorem for the interval [1, 2] and the tangent to the curve $y = f(x)$ at $x = \frac{7}{4}$ is parallel to the chord that joins the points of intersection of the curve with the ordinates $x = 1$ and $x = 2$. Then the value of $a$ is

(a) $\frac{35}{16}$ (b) $\frac{35}{48}$
(c) $\frac{7}{16}$ (d) $\frac{5}{16}$

**75.** Let $f(x) = \begin{Bmatrix} x^\alpha \ln x, x > 0 \\ 0, \quad x = 0 \end{Bmatrix}$, Rolle's theorem is applicable to f for $x \in [0,1]$, if $\alpha =$

(a) – 2 (b) – 1
(c) 0 (d) $\frac{1}{2}$

**76.** If $a=\cos\alpha+i\sin\alpha$, $b=\cos\beta+i\sin\beta$, $c=\cos\gamma+i\sin\gamma$ and $\frac{b}{c}+\frac{c}{a}+\frac{a}{b}=1$, then $\cos(\beta-\gamma)+\cos(\gamma-\alpha)+\cos(\alpha-\beta)$ is equal to
(a) 3/2 (b) – 3/2
(c) 0 (d) 1

**77.** If $(1+i)(1+2i)(1+3i).....(1+ni)=a+ib$, then 2.5.10....$(1+n^2)$ is equal to
(a) $a^2-b^2$ (b) $a^2+b^2$
(c) $\sqrt{a^2+b^2}$ (d) $\sqrt{a^2-b^2}$

**78.** If $z$ is a complex number, then the minimum value of $|z|+|z-1|$ is
(a) 1 (b) 0
(c) 1/2 (d) None of these

**79.** For any two complex numbers $z_1$ and $z_2$ and any real numbers a and b; $|(az_1-bz_2)|^2+|(bz_1+az_2)|^2=$
(a) $(a^2+b^2)(|z_1|+|z_2|)$ (b) $(a^2+b^2)(|z_1|^2+|z_2|^2)$
(c) $(a^2+b^2)(|z_1|^2-|z_2|^2)$ (d) None of these

**80.** If $S_n=\sum_{r=0}^{n}\frac{1}{{}^nC_r}$ and $t_n=\sum_{r=0}^{n}\frac{r}{{}^nC_r}$, then $\frac{t_n}{S_n}$ is equal to
(a) $\frac{2n-1}{2}$ (b) $\frac{1}{2}n-1$
(c) $n-1$ (d) $\frac{1}{2}n$

**81.** When $2^{301}$ is divided by 5, the least positive remainder is
(a) 4 (b) 8
(c) 2 (d) 6

**82.** Out of 5 apples, 10 mangoes and 15 oranges, any 15 fruits distributed among two persons. The total number of ways of distribution
(a) 66 (b) 36
(c) 60 (d) None of these

**83.** The value of ${}^{50}C_4+\sum_{r=1}^{6}{}^{56-r}C_3$ is
(a) ${}^{56}C_3$ (b) ${}^{56}C_4$
(c) ${}^{55}C_4$ (d) ${}^{55}C_3$

**84.** The figure formed by the lines $x^2+4xy+y^2=0$ and $x-y=4$, is
(a) A right angled triangle (b) An isosceles triangle
(c) An equilateral triangle (d) None of these

**85.** The equation $x^2-3xy+\lambda y^2+3x-5y+2=0$ when $\lambda$ is a real number, represents a pair of straight lines. If $\theta$ is the angle between the lines, then $\operatorname{cosec}^2\theta=$
(a) 3 (b) 9
(c) 10 (d) 100

**86.** The centroid of a triangle is (2, 7) and two of its vertices are (4, 8) and (–2, 6). The third vertex is
(a) (0,0) (b) (4,7)
(c) (7,4) (d) (7,7)

**87.** The points $(1,1)$, $(0,\sec^2\theta)$, $(\operatorname{cosec}^2\theta,0)$ are collinear for
(a) $\theta=\frac{n\pi}{2}$ (b) $\theta\neq\frac{n\pi}{2}$
(c) $\theta=n\pi$ (d) None of these

**88.** The ends of a rod of length l move on two mutually perpendicular lines. The locus of the point on the rod which divides it in the ratio 1 : 2 is
(a) $36x^2+9y^2=4l^2$ (b) $36x^2+9y^2=l^2$
(c) $9x^2+36y^2=4l^2$ (d) None of these

**89.** Two fixed points are $A(a,0)$ and $B(-a,0)$. If $\angle A-\angle B=\theta$, then the locus of point C of triangle ABC will be
(a) $x^2+y^2+2xy\tan\theta=a^2$ (b) $x^2-y^2+2xy\tan\theta=a^2$
(c) $x^2+y^2+2xy\cot\theta=a^2$ (d) $x^2-y^2+2xy\cot\theta=a^2$

**90.** Let $A(2,-3)$ and $B(-2,1)$ be vertices of a triangle ABC. If the centroid of this triangle moves on the line $2x+3y=1$, then the locus of the vertex C is the line
(a) $3x-2y=3$ (b) $2x-3y=7$
(c) $3x+2y=5$ (d) $2x+3y=9$

**91.** The number of integral values of m, for which the x-co-ordinate of the point of intersection of the lines $3x+4y=9$ and $y=mx+1$ is also an integer is
(a) 2 (b) 0
(c) 4 (d) 1

**92.** $\int\frac{1+\cos^2 x}{\sin^2 x}dx=$
(a) $-\cot x-2x+c$ (b) $-2\cot x-2x+c$
(c) $-2\cot x-x+c$ (d) $-2\cot x+x+c$

**93.** $\int\sin^{-1}(\cos x)dx=$
(a) $\frac{\pi x}{2}$ (b) $\frac{\pi x^2}{2}$
(c) $\frac{\pi x-x^2}{2}$ (d) $\frac{\pi x+x^2}{2}$

**94.** The value of $\int_0^{\pi} \left|\sin^3\theta\right| d\theta$ is

(a) 0 (b) 3/8
(c) 4/3 (d) $\pi$

**95.** $\int_0^1 \sin\left(2\tan^{-1}\sqrt{\frac{1+x}{1-x}}\right)dx =$

(a) $\pi/6$ (b) $\pi/4$
(c) $\pi/2$ (d) $\pi$

**96.** Area bounded by the curve $y = \log x$, $x-$axis and the ordinates $x = 1, x = 2$ is

(a) $\log 4$ sq. unit (b) $(\log 4 + 1)$ sq. unit
(c) $(\log 4 - 1)$ sq. unit (d) None of these

**97.** The solution of the differential equation $(1+x^2)\frac{dy}{dx} = x$ is

(a) $y = \tan^{-1}x + c$ (b) $y = -\tan^{-1}x + c$
(c) $y = \frac{1}{2}\log_e(1+x^2) + c$ (d) $y = -\frac{1}{2}\log_e(1+x^2) + c$

**98.** The solution of the differential equation $\frac{dy}{dx} = e^x + \cos x + x + \tan x$ is

(a) $y = e^x + \sin x + \frac{x^2}{2} + \log\cos x + c$
(b) $y = e^x + \sin x + \frac{x^2}{2} + \log\sec x + c$
(c) $y = e^x - \sin x + \frac{x^2}{2} + \log\cos x + c$
(d) $y = e^x - \sin x + \frac{x^2}{2} + \log\sec x + c$

**99.** The solution of differential equation $\frac{dy}{dx} + \sin^2 y = 0$ is

(a) $y + 2\cos y = c$ (b) $y - 2\sin y = c$
(c) $x = \cot y + c$ (d) $y = \cot x + c$

**100.** The solution of the differential equation $(\sin x + \cos x)dy + (\cos x - \sin x)dx = 0$ is

(a) $e^x(\sin x + \cos x) + c = 0$ (b) $e^y(\sin x + \cos x) = c$
(c) $e^y(\cos x - \sin x) = c$ (d) $e^x(\sin x - \cos x) = c$

**101.** The order and degree of the differential equation $y = x\frac{dy}{dx} + \sqrt{a^2\left(\frac{dy}{dx}\right)^2 + b^2}$ are

(a) 1, 2 (b) 2, 1
(c) 1, 1 (d) 2, 2

**102.** The order of the differential equation of a family of curves represented by an equation containing four arbitrary constants, will be

(a) 2 (b) 4
(c) 6 (d) None of these

**103.** If $P(A) = 0.65$, $P(B) = 0.15$, then $P(\bar{A}) + P(\bar{B}) =$

(a) 1.5 (b) 1.2
(c) 0.8 (d) None of these

**104.** For any two independent events $E_1$ and $E_2$, $P\{(E_1 \cup E_2) \cap (\bar{E}_1 \cap \bar{E}_2)\}$ is

(a) $< \frac{1}{4}$ (b) $> \frac{1}{4}$
(c) $\geq \frac{1}{2}$ (d) None of these

**105.** For independent events $A_1, A_2, .........., A_n$, $P(A_i) = \frac{1}{i+1}$, $i = 1, 2, ......, n$. Then the probability that none of the event will occur, is

(a) $\frac{n}{n+1}$ (b) $\frac{n-1}{n+1}$
(c) $\frac{1}{n+1}$ (d) None of these

**106.** 8 coins are tossed simultaneously. The probability of getting at least 6 heads is

(a) $\frac{57}{64}$ (b) $\frac{229}{256}$
(c) $\frac{7}{64}$ (d) $\frac{37}{256}$

**107.** In a box containing 100 eggs, 10 eggs are rotten. The probability that out of a sample of 5 eggs none is rotten if the sampling is with replacement is

(a) $\left(\frac{1}{10}\right)^5$ (b) $\left(\frac{1}{5}\right)^5$
(c) $\left(\frac{9}{5}\right)^5$ (d) $\left(\frac{9}{10}\right)^5$

**108.** If the probability that a student is not a swimmer is 1/5, then the probability that out of 5 students one is swimmer is

(a) ${}^5C_1\left(\frac{4}{5}\right)^4\left(\frac{1}{5}\right)$ (b) ${}^5C_1\frac{4}{5}\left(\frac{1}{5}\right)^4$
(c) $\frac{4}{5}\left(\frac{1}{5}\right)^4$ (d) None of these

**109.** The angle between two diagonals of a cube will be

(a) $\sin^{-1}1/3$ (b) $\cos^{-1}1/3$
(c) Variable (d) None of these

**110.** The equations of the line passing through the point (1,2,–4) and perpendicular to the two lines $\frac{x-8}{3}=\frac{y+19}{-16}=\frac{z-10}{7}$ and $\frac{x-15}{3}=\frac{y-29}{8}=\frac{z-5}{-5}$, will be

(a) $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z+4}{6}$ (b) $\frac{x-1}{-2}=\frac{y-2}{3}=\frac{z+4}{8}$

(c) $\frac{x-1}{3}=\frac{y-2}{2}=\frac{z+4}{8}$ (d) None of these

**111.** If three mutually perpendicular lines have direction cosines $(l_1,m_1,n_1),(l_2,m_2,n_2)$ and $(l_3,m_3,n_3)$, then the line having direction cosines $l_1+l_2+l_3$, $m_1+m_2+m_3$ and $n_1+n_2+n_3$ make an angle of ..... with each other

(a) 0° (b) 30°
(c) 60° (d) 90°

**112.** The straight lines whose direction cosines are given by $al+bm+cn=0, fmn+gnl+hlm=0$ are perpendicular, if

(a) $\frac{f}{a}+\frac{g}{b}+\frac{h}{c}=0$ (b) $\sqrt{\frac{a}{f}}+\sqrt{\frac{b}{g}}+\sqrt{\frac{c}{h}}=0$

(c) $\sqrt{af}=\sqrt{bg}=\sqrt{ch}$ (d) $\sqrt{\frac{a}{f}}=\sqrt{\frac{b}{g}}=\sqrt{\frac{c}{h}}$

**113.** If the straight lines $x=1+s$, $y=-3-\lambda s$, $z=1+\lambda s$ and $x=t/2, y=1+t, z=2-t$, with parameters s and $t$ respectively, are co-planar, then $\lambda$ equals

(a) 0 (b) –1
(c) –1/2 (d) – 2

**114.** The co-ordinates of the foot of perpendicular drawn from point $P(1,0,3)$ to the join of points $A(4,7,1)$ and $B(3,5,3)$ is

(a) (5, 7, 1) (b) $\left(\frac{5}{3},\frac{7}{3},\frac{17}{3}\right)$

(c) $\left(\frac{2}{3},\frac{5}{3},\frac{7}{3}\right)$ (d) $\left(\frac{5}{3},\frac{2}{3},\frac{7}{3}\right)$

**115.** Let $\mathbf{a}=2\mathbf{i}-\mathbf{j}+\mathbf{k}$, $\mathbf{b}=\mathbf{i}+2\mathbf{j}-\mathbf{k}$ and $\mathbf{c}=\mathbf{i}+\mathbf{j}-2\mathbf{k}$ be three vectors. A vector in the plane of **b** and **c** whose projection on **a** is of magnitude $\sqrt{2/3}$ is

(a) $2\mathbf{i}+3\mathbf{j}-3\mathbf{k}$ (b) $2\mathbf{i}+3\mathbf{j}+3\mathbf{k}$
(c) $-2\mathbf{i}-\mathbf{j}+5\mathbf{k}$ (d) $2\mathbf{i}+\mathbf{j}+5\mathbf{k}$

**116.** A vector **a** has components 2p and 1 with respect to a rectangular cartesian system. The system is rotated through a certain angle about the origin in the anti-clockwise sense. If **a** has components p + 1 and 1 with respect to the new system, then

(a) $p=0$ (b) $p=1$ or $-\frac{1}{3}$

(c) $p=-1$ or $\frac{1}{3}$ (d) $p=1$ or $-1$

**117.** If $\mathbf{u}=2\mathbf{i}+2\mathbf{j}-\mathbf{k}$ and $\mathbf{v}=6\mathbf{i}-3\mathbf{j}+2\mathbf{k}$, then a unit vector perpendicular to both **u** and **v** is

(a) $\mathbf{i}-10\mathbf{j}-18\mathbf{k}$ (b) $\frac{1}{\sqrt{17}}\left(\frac{1}{5}\mathbf{i}-2\mathbf{j}-\frac{18}{5}\mathbf{k}\right)$

(c) $\frac{1}{\sqrt{473}}(7\mathbf{i}-10\mathbf{j}-18\mathbf{k})$ (d) None of these

**118.** If $\mathbf{a}=2\mathbf{i}+\mathbf{k}$, $\mathbf{b}=\mathbf{i}+\mathbf{j}+\mathbf{k}$ and $\mathbf{c}=4\mathbf{i}-3\mathbf{j}+7\mathbf{k}$. If $\mathbf{d}\times\mathbf{b}=\mathbf{c}\times\mathbf{b}$ and $\mathbf{d}.\mathbf{a}=0$, then **d** will be

(a) $\mathbf{i}+8\mathbf{j}+2\mathbf{k}$ (b) $\mathbf{i}-8\mathbf{j}+2\mathbf{k}$
(c) $-\mathbf{i}+8\mathbf{j}-\mathbf{k}$ (d) $-\mathbf{i}-8\mathbf{j}+2\mathbf{k}$

**119.** If $\mathbf{a}\times\mathbf{r}=\mathbf{b}+\lambda\mathbf{a}$ and $\mathbf{a}\,.\,\mathbf{r}=3$, where $\mathbf{a}=2\mathbf{i}+\mathbf{j}-\mathbf{k}$ and $\mathbf{b}=-\mathbf{i}-2\mathbf{j}+\mathbf{k}$, then **r** and $\lambda$ are equal to

(a) $\mathbf{r}=\frac{7}{6}\mathbf{i}+\frac{2}{3}\mathbf{j}, \lambda=\frac{6}{5}$ (b) $\mathbf{r}=\frac{7}{6}\mathbf{i}+\frac{2}{3}\mathbf{j}, \lambda=\frac{5}{6}$

(c) $\mathbf{r}=\frac{6}{7}\mathbf{i}+\frac{2}{3}\mathbf{j}, \lambda=\frac{6}{5}$ (d) None of these

**120.** Let the vectors **a**, **b**, **c** and **d** be such that $(\mathbf{a}\times\mathbf{b})\times(\mathbf{c}\times\mathbf{d})=0$. Let $P_1$ and $P_2$ be planes determined by pair of vectors **a**, **b** and **c**, **d** respectively. Then the angle between $P_1$ and $P_2$ is

(a) $0^o$ (b) $\frac{\pi}{4}$

(c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$