

1)  $\lim_{n \rightarrow \infty} \left( \frac{1}{1+n} + \frac{1}{2+n} + \frac{1}{3+n} + \dots + \frac{1}{2n} \right)$  is equal to :-

- a) 0  
b)  $\log_e(2)$   
c)  $\log_e\left(\frac{3}{2}\right)$   
d)  $\log_e\left(\frac{2}{3}\right)$

2) The negation of the expression  $q \vee ((\neg q) \wedge p)$  is equivalent to

- a)  $(\neg p) \wedge (\neg q)$   
b)  $p \wedge (\neg q)$   
c)  $(\neg p) \vee (\neg q)$   
d)  $(\neg p) \vee q$

3) In a binomial distribution  $\mathbf{B}(n, p)$ , the sum and product of the mean and variance are 5 and 6 respectively, then find  $6(n + p - q)$  is equal to :-

- a) 51  
b) 52  
c) 53  
d) 50

4) The sum to 10 terms of the series  $\frac{1}{1+1^2+1^4} + \frac{2}{1+2^2+2^4} + \frac{3}{1+3^2+3^4} + \dots$  is :-

- a)  $\frac{59}{111}$   
b)  $\frac{55}{111}$   
c)  $\frac{56}{111}$   
d)  $\frac{58}{111}$

5) The value is  $\frac{1}{1!50!} + \frac{1}{3!48!} + \frac{1}{5!46!} + \dots + \frac{1}{49!2!} + \frac{1}{51!1!}$  is

- a)  $\frac{2^{50}}{50!}$   
b)  $\frac{2^{50}}{51!}$   
c)  $\frac{2^{51}}{51!}$   
d)  $\frac{2^{51}}{50!}$

6) If the orthocentre of the triangle, whose vertices are (1, 2), (2, 3) and (3, 1) is  $(\alpha, \beta)$ , then the quadratic equation whose roots are  $\alpha + 4\beta$  and  $4\alpha + \beta$ , is

- a)  $x^2 - 19x + 90 = 0$   
b)  $x^2 - 18x + 80 = 0$   
c)  $x^2 - 22x + 120 = 0$   
d)  $x^2 - 20x + 99 = 0$

7) For a triangle  $ABC$ , the value of  $\cos 2A + \cos 2B + \cos 2C$  is least. If its inradius is 3 and incentre is  $M$ , then which of the following is NOT correct?

- a) Perimeter of  $\triangle ABC$  is  $18\sqrt{3}$   
b)  $\sin 2A + \sin 2B + \sin 2C = \sin A + \sin B + \sin C$   
c)  $\vec{MA} \cdot \vec{MB} = -18$

d) area of  $\Delta ABC$  is  $\frac{27\sqrt{3}}{2}$

8) The combined equation of the two lines  $ax + by + c = 0$  and  $a'x + b'y + c' = 0$  can be written as  $(ax + by + c)(a'x + b'y + c') = 0$ . The equation of the angle bisectors of the lines represented by the equation  $2x^2 + xy - 3y^2 = 0$  is

- a)  $3x^2 + 5xy + 2y^2 = 0$
- b)  $x^2 - y^2 + 10xy = 0$
- c)  $3x^2 + xy - 2y^2 = 0$
- d)  $x^2 - y^2 - 10xy = 0$

9) The shortest distance between the lines  $\frac{x-5}{1} = \frac{y-2}{2} = \frac{z-4}{-3}$  and  $\frac{x+3}{1} = \frac{y+5}{4} = \frac{z-1}{-5}$

- a)  $7\sqrt{3}$
- b)  $5\sqrt{3}$
- c)  $6\sqrt{3}$
- d)  $4\sqrt{3}$

10) Let  $S$  denote the set of all real values of  $\lambda$  such that the system of equations

$$\lambda x + y + z = 1$$

$$x + \lambda y + z = 1$$

$$x + y + \lambda z = 1$$

is inconsistent, then  $\sum_{\lambda \in S} (|\lambda^2| + |\lambda|)$  is equal to

- a) 2
- b) 12
- c) 4
- d) 6

11) Let  $S = \left\{ x : x \in \mathbb{R} \text{ and } (\sqrt{3} + \sqrt{2})^{x^2-4} + (\sqrt{3} - \sqrt{2})^{x^2-4} = 10 \right\}$ . Then  $n(S)$  is equal to

- a) 2
- b) 4
- c) 6
- d) 10

12) Let  $S$  be the set of all solutions of the equation  $\cos^{-1} 2x - 2 \cos^{-1} \sqrt{1-x^2} = \pi$ ,  $x \in \left[ -\frac{1}{2}, \frac{1}{2} \right]$ . Then  $\sum_{x \in S} 2 \sin^{-1} (x^2 - 1)$  is equal to

- a) 0
- b)  $-\frac{2\pi}{3}$
- c)  $\pi - \sin^{-1} \frac{\sqrt{3}}{4}$
- d)  $\pi - 2 \sin^{-1} \frac{\sqrt{3}}{4}$

13) If the center and radius of the circle  $\left| \frac{z-2}{z-3} \right| = 2$  are respectively  $(\alpha, \beta)$  and  $\gamma$ , then  $3(\alpha + \beta + \gamma)$  is equal to

- a) 11
- b) 9
- c) 10
- d) 12

14) If  $y = y(x)$  is the solution curve of the differential equation  $\frac{dy}{dx} + y \tan x = x \sec x$ ,  $0 \leq x \leq \frac{\pi}{3}$ ,  $y(0) = 1$ , then  $y\left(\frac{\pi}{6}\right)$  is equal to

- a)  $\frac{\pi}{12} - \frac{\sqrt{3}}{2} \log_e \left( \frac{2}{e\sqrt{3}} \right)$
- b)  $\frac{\pi}{12} + \frac{\sqrt{3}}{2} \log_e \left( \frac{2\sqrt{3}}{e} \right)$
- c)  $\frac{\pi}{12} - \frac{\sqrt{3}}{2} \log_e \left( \frac{2\sqrt{3}}{e} \right)$
- d)  $\frac{\pi}{12} + \frac{\sqrt{3}}{2} \log_e \left( \frac{2}{e\sqrt{3}} \right)$

15) Let  $R$  be a relation on  $\mathbb{R}$ , given by  $R = \{(a, b) : 3a - 3b + \sqrt{7} \text{ is a irrational number}\}$ .  
Then  $R$  is

- a) Reflexive but neither symmetric nor transitive
- b) Reflexive and transitive but not symmetric
- c) Reflexive and symmetric but not transitive
- d) An equivalence relation