SAMPLE QUESTIONS

Mathematics

1. The direction ratios of the line determined by the planes $2x - 3y + z = 7$ and $3x - y + 2z = 7$ are

(1) 5,1,7 (2) -5,-1,7 (3) 5,-1,7 (4)7,5,1 (5) 7,1,5.

2. $\mathbf{a} = 2\mathbf{i} + 3\mathbf{j} - 2\mathbf{k}$ and $\mathbf{b} = 3\mathbf{i} + \mathbf{j} + 5\mathbf{k}$. If $\mathbf{c} = 11\mathbf{a} - 25\mathbf{b}$ then the value of $\mathbf{a} \cdot (\mathbf{b} \times \mathbf{c})$ equals

(1) -213 (2) 435 (3) 312 (4) 132 (5) none of the above.

3. Three vertices are chosen at random from the vertices of a regular hexagon. The probability that they form the vertices of an equilateral triangle is

(1) $\frac{1}{20}$ (2) $\frac{1}{10}$ (3) $\frac{1}{15}$ (4) $\frac{2}{15}$ (5) $\frac{3}{20}$.

4. $f(x) = \sin x$. If $f^{(n)}$ denotes the n^{th} derivative of f then $f^{(2005)}(\frac{2\pi}{3})$ equals

(1) $\frac{\sqrt{3}}{2}$ (2) $-\frac{\sqrt{3}}{2}$ (3) $\frac{1}{2}$ (4) $-\frac{1}{2}$ (5) $\frac{1}{\sqrt{2}}$.

5. $f : [2, 5] \to \mathbf{R}$, $f(x) = x^2 - 6x + 7$. Then the maximum value f attains is

(1) 2 (2) -3 (3) 7 (4) 11 (5) 10.

6. Let k denote the total number of three digit natural numbers which are divisible either by 2 or by 3 but not by 6 then k equals

(1) 150 (2) 300 (3) 600 (4) 710 (5) 450.

7. A is a 3×3 matrix. Then $|-5A|$ equals

(1) $125|A|$ (2) $5|A|$ (3) $-125|A|$ (4) $-5|A|$ (5) $-|A|^5$.

8. If $x + \dfrac{1}{x} = 3$ then the value of $x^5 + \dfrac{1}{x^5}$ equals

(1) 243 (2) 241 (3) 123 (4) 126 (5) 621.

9. If $\sin^5 x + \cos^7 x = 1$. Let $k = \sin^{10} x + \cos^{12} x$, then

(1) $k = 2$ (2) $k < 1$ (3) $k > 1$ (4) $k = 1$ (5) 0.

10. The value of $\sin^{-1}\left(\frac{-\sqrt{2}}{\sqrt{2}+1}\right) + \cos^{-1}(\sqrt{2} - 2)$ equals

(1) $\frac{\pi}{4}$ (2) $-\frac{\pi}{4}$ (3) $\frac{\pi}{12}$ (4) $\frac{\pi}{2}$ (5) none of the above.

11. P is a poi nt on the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$. If PM, PN are the lengths of the perpendiculars from P on the directrices of the ellipse then $PM + PN$ equals

(1) $\frac{50}{3}$ (2) 6 (3) $\frac{40}{3}$ (4) 8 (5) 10.

12. $1^2 - 2^2 + 3^2 - 4^2 + \cdots - (100)^2 + (101)^2$ equals

(1) 5050 (2) -5151 (3) 5151 (4) 5150 (5) 1001.

13. $\cos 10^\circ + \cos 20^\circ + \cos 30^\circ + \cdots + \cos 350^\circ$ equals

(1) 1 (2) 0 (3) -2 (4) -1 (5) 3.

14. $f(x) = 8 + 5\cos x - 12\sin x$. The range of f is

(1) [-9,15] (2) [-9,1] (3) [-4,13] (4) [-9,25] (5) [-5,21].

15. $a_1, a_2, a_3, a_4, a_5 \geq 0$. If $a_1 + a_2 + a_3 + a_4 + a_5 = 10$ then $a_1a_2a_3a_4a_5$ can take any value in the interval

(1) [0,32] (2) [4,36] (3) [8,40] (4) [32,64] (5) [64,128].