

GENERAL INSTRUCTIONS :-

- All questions are compulsory.
- SECTION – A comprises of 6 questions of one marks each.
- SECTION – B comprises of 13 questions of four marks each.
- SECTION – C comprises of 7 questions of six marks each.

SECTION – A

Q. 1. Evaluate : $\cos\left(\frac{3\pi}{2} + x\right) \cos(2\pi + x) \left[\cot\left(\frac{3\pi}{2} - x\right) + \cot(2\pi + x) \right]$

Q. 2. The minute hand of a watch is 1.5 cm long. How far does its tip move in 40 minutes?

Q. 3. If $\cot x = -\frac{5}{12}$, x lies in 2nd quadrant find the value of $2 \sin(2x) + 1$

Q. 4. Find x and y if $(3 + i)x + (1 - 2i)y + 7i = 0$

Q. 5. Evaluate: $\frac{2}{5} + \frac{3}{5^2} + \frac{2}{5^3} + \frac{3}{5^4} + \dots + \infty$

Q. 6. Find 'n' if $P(n, 5) = 20 P(n, 3)$

SECTION – B

Q. 7. Solve for 'x' : $\sqrt{3} \sin x - \cos x = \sqrt{2}$.

Q. 8. Show that, $\cos 2x \cdot \cos\left(\frac{x}{2}\right) - \cos 3x \cdot \cos\left(\frac{9x}{2}\right) = \sin 5x \sin\left(\frac{5x}{2}\right)$

Q. 9. Solve for real x , $\frac{1}{|x| - 3} \leq \frac{1}{2}$

Q. 10. Using Principle of Mathematical Induction prove that:

$$\text{for all } n \geq 1, \frac{1}{2.5} + \frac{1}{5.8} + \frac{1}{8.11} + \dots + \frac{1}{(3n-1)(3n+2)} = \frac{n}{(6n+4)}$$

Q. 11. Find the polar form of the complex number $\frac{1+7i}{(2-i)^2}$

Q. 12. Solve for 'x' : $x^2 - 5x - ix - i + 18 = 0$.

Q. 13. If $z = x + iy$, $z^{1/3} = a - ib$ and $bx + ay = kab (a^2 + b^2)$, then find the value of 'k'.

Q. 14. How many words can be formed by using 4 letters at a time from the letters of the word 'MATHEMATICS' ?

Q. 15. What is the position of the word 'INDIAN' if letters of the given word are arranged as in dictionary?

- Q. 16.** If a, b, c are in A.P. ; b, c, d are in G.P. and $\frac{1}{c}, \frac{1}{d}, \frac{1}{e}$ are in A.P. Then show that a, c, e are in G.P.
- Q. 17.** A committee of 7 has to be formed from 9 boys and 4 girls. In how many ways can this be done when the committee consists of : (i) at least 3 girls ? (ii) at most 3 girls ?
- Q. 18.** If f is a function satisfying $f(x+y) = f(x)f(y)$ for all $x, y \in \mathbf{N}$ such that $f(1) = 3$ and $\sum_{x=1}^n f(x) = 120$ find the value of n .
- Q. 19.** The sum of first two terms of an infinite geometric series is 15 and each term is equal to the sum of all the terms following it. Find the series.

SECTION – C

- Q. 20.** Prove that : $\cos\left(\frac{\pi}{5}\right) \cos\left(\frac{2\pi}{5}\right) \cos\left(\frac{4\pi}{5}\right) \cos\left(\frac{8\pi}{5}\right) = \frac{-1}{16}$
- Q. 21.** Prove that, $\sin^3 x + \sin^3\left\{x + \frac{2\pi}{3}\right\} + \sin^3\left\{x + \frac{4\pi}{3}\right\} = -\frac{3}{4}\sin 3x$
- Q. 22.** Find the value of $\sin\left(\frac{x}{2}\right), \cos\left(\frac{x}{2}\right)$ and $\tan\left(\frac{x}{2}\right)$ if $\sin x = -\frac{1}{4}$; x lies in IIIrd quadrant .
- Q. 23.** Using Principle of Mathematical Induction prove that :
- for all $n \geq 1$, $\cos x + \cos 2x + \cos 3x + \dots + \cos nx = \sin\left(\frac{nx}{2}\right) \cdot \operatorname{cosec}\left(\frac{x}{2}\right) \cdot \cos\left(\frac{(n+1)x}{2}\right)$
- Q. 24.** If a, b, c, d and p are different real numbers such that $(a^2 + b^2 + c^2)p^2 - 2(ab + bc + cd)p + (b^2 + c^2 + d^2) \leq 0$, then show that a, b, c and d are in G.P.
- Q. 25.** Evaluate: $3 \times 8 + 6 \times 11 + 9 \times 14 + \dots$ n terms.
- Q. 26.** Solve the system of inequalities graphically :
- $$x + y \leq 4, x + 5y \geq 4, 6x + 2y \geq 8, x \leq 3, y \leq 3, x \geq 0, y \geq 0$$
