

Grade: XII (science)

F.M.: 75

Time: 3 Hrs

Candidates are required to give their answer in their own words as far as practicable. The figures in the margin indicate full marks

Attempt ALL the questions

Group "A"

 $1 \times 11 = 11$

Rewrite the correct option in your answer sheet

1. The number of combination of n objects taken r at a time in which p particular objects never occur is
 - a) $C(n, r)$
 - b) $C(n - p, r)$
 - c) $C(n, r - p)$
 - d) $C(n - p, r - p)$
2. The number of terms in the expansion of $(1 - x)^{-5}$; ($|x| < 1$) is
 - a) -4
 - b) 4
 - c) 6
 - d) infinite
3. If $-1 + \sqrt{-3} = re^{i\theta}$, then the value of θ is

Type equation here.

 - a) $\frac{\pi}{6}$
 - b) $\frac{\pi}{3}$
 - c) $\frac{2\pi}{3}$
 - d) $\frac{5\pi}{3}$
4. If $n = 55$ then the value of $\sum_{1}^n n^3$ is
 - a) 110
 - b) 150
 - c) 2025
 - d) 3025
5. For what value of k the system of equations $4x + 3y = 5$; $3x + ky = 15$ will have no solution?
 - a) 1.5
 - b) 2.5
 - c) 3.5
 - d) 4.5
6. The derivative of $\ln(\sinh x)$ is
 - a) $\frac{1}{\sinh x}$
 - b) $\cosh x$
 - c) $\frac{1}{\cosh x}$
 - d) $\tanh x$
7. If the radius of the sphere changes from 2 to 2.1 cm then the approximate increase in its volume is
 - a) $1.61\pi \text{ cm}^3$
 - b) $4\pi \text{ cm}^3$
 - c) $1.64\pi \text{ cm}^3$
 - d) $1.6\pi \text{ cm}^3$



8. The inclination of the tangent to the curve $x^2 + y^2 = 16$ at $(2\sqrt{3}, -2)$ is
 a) $\frac{\pi}{6}$ b) $\frac{\pi}{4}$ c) $\frac{\pi}{3}$ d) $\frac{\pi}{2}$
9. Which of the following is not the integral value of $\int \frac{1}{\sqrt{1-x^2}} dx$
 a) $\sin^{-1} x + C$ b) $\cos^{-1} \sqrt{1-x^2} + C$
 c) $\frac{\pi}{2} - \cos^{-1} x + C$ d) $\frac{\pi}{2} + \cos^{-1} x + C$
10. The integral value of $\int \frac{1}{e^x + 4e^{-x}} dx$
 a) $\frac{1}{2} \tan^{-1} \left(\frac{e^x}{2} \right) + C$ b) $\frac{1}{2} \tan^{-1}(e^x) + C$
 c) $-\tan^{-1}(e^{-x}) + C$ d) $\frac{1}{2} \tan^{-1} \left(\frac{e^{-x}}{2} \right) + C$
11. The integral value of $\int \frac{\sin 2x}{(\sin x + \cos x)^2} dx$ is
 a) $x - \frac{1}{1+\tan x} + C$ b) $x - \frac{1}{1-\tan x} + C$
 c) $x + \frac{1}{1-\tan x} + C$ d) $x + \frac{1}{1+\tan x} + C$

Group "B"

5 × 8 = 40

12. a) Write the relation between permutation and combination of set of n different objects taken r at a time. 1
 b) From 6 boys and 4 girls a committee of 5 members is to be formed. In how many ways this can be done so as to include at most 3 girls? 2
 Find 2
 c) If the coefficient of x in the expansion of $\left(x^2 + \frac{3}{x}\right)^n$ 2
13. a) Write one property of binomial coefficient in the expansion of $(a+x)^n$. 1
 b) State binomial series. 1
 c) Write the expansion of a^x where $|x| < 1$. 1
 d) If $x = y - \frac{y^2}{2} + \frac{y^3}{3} - \frac{y^4}{4} + \dots$, show that: $y = x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \dots$ 2
14. a) Express the complex number $\sqrt{2} - \sqrt{2}i$ in polar form. 2
 b) Using De-Moivre's theorem, find the cube roots of unity. 3
15. a) Find n^{th} term and sum of the n terms of the series $1.3 + 2.4 + 3.5 + \dots$. 2
 b) Using principle of mathematical induction prove that: $2 + 5 + 8 + \dots + (3n-1) = \frac{n(3n+1)}{2}$ for all $n \in \mathbb{N}$. 3
16. a) Find the derivative of $x^{\cosh x}$. 2
 b) Using L-Hospital's rule evaluate: $\lim_{x \rightarrow 0} \frac{\ln x}{\ln(\tan x)}$. 2
 c) Write the condition that the tangent to the curve $y = f(x)$ makes an acute angle with x -axis. 1



17. a) Find points on the curve $x^2 + y^2 = 9$ at which tangents are parallel to $y - \text{axis}$. 2
 b) If the volume of a cube is increasing at the constant rate. Prove that the increase in the surface area varies inversely as the length of the edge of the cube 3
18. a) Integrate: $\int \frac{dx}{(2x-1)\sqrt{4x-3}}$. 2
 b) Write the integral of $\int \sqrt{x^2 - a^2} dx$. 1
 c) Integrate: $\int \frac{dx}{x+\sqrt{x^2-1}}$. 2
19. a) Integrate: $\int \frac{dx}{1+\sin x+\cos x}$. 3
 b) Integrate: $\int \frac{x}{(x-a)(x-b)} dx$. 2

Group "C"

$8 \times 3 = 24$

20. a) In how many ways can the letters of the word **ARRANGE** be arranged so the no two R's come together? 2
 b) Prove that: $1 - \frac{1}{4} + \frac{1.3}{4.8} - \frac{1.3.5}{4.8.12} + \dots = \sqrt{\frac{2}{3}}$ 2
 c) 40 people are employed in a certain factory. If the daily total wage bill of the factory is Rs. 3625 and the daily wage of man and women are Rs. 100 and Rs. 75 respectively. Find the number of man and women employed in the factory by using matrix method. 4
21. a) Show that: $\frac{2}{1!} + \frac{4}{3!} + \frac{6}{5!} + \dots \text{to } \infty = e$ 2
 b) Let α and β be the imaginary cube roots of unity. Prove that: $\alpha^2 + \beta^2 - \alpha\beta = -2$ 2
 c) Write the derivative of $\cosh^{-1} x$. 1
 d) At what angle does the tangent to the curve $y(1+x) = x$ cut the $x - \text{axis}$. 3
22. a) The distance S travelled by a particle at a time t given by $S = 4t^3 - 3t^2 - 90t + 29$. Determine the time after which the particle comes to rest. 2
 b) Integrate: $\int \frac{dx}{\sin x + \sqrt{3}\cos x}$. 2
 c) Define proper rational fraction with an example. Using the concept of partial fraction integrate: $\int \frac{dx}{(x-1)(x^2+3)}$. 1+3

" Best of Luck' "