

# 01. COMPLEX NUMBERS

## SHORT ANSWER QUESTIONS (4 MARKS)

01. Find the real values of  $x$  and  $y$  if  $\frac{x-1}{3+i} + \frac{y-1}{3-i} = i$ .
02. If  $u + iv = \frac{2+i}{z+3}$  and  $z = x + iy$ , then find  $u, v$ .
03. Show that  $\frac{2-i}{(1-2i)^2}$  and  $\left(\frac{-2-11i}{25}\right)$  are conjugate to each other.
04. Show that,  $z_1 = \frac{2+11i}{25}$ ,  $z_2 = \frac{-2+i}{(1-2i)^2}$  are conjugate to each other.
05. If  $(x-iy)^{1/3} = a-ib$ , then prove that  $\frac{x}{a} + \frac{y}{b} = 4(a^2 - b^2)$ . AP Mar 18
06. If  $x + iy = \frac{1}{1 + \cos \theta + i \sin \theta}$ , then show that  $4x^2 - 1 = 0$ . AP Mar 16, 17, 19; TS Mar 15, May 16, 19, 22
07. If  $x + iy = \frac{3}{2 + \cos \theta + i \sin \theta}$ , then show that  $x^2 + y^2 = 4x - 3$ . TS Mar 17
08. If  $\frac{z_2}{z_1}$ , ( $z_1 \neq 0$ ) is an imaginary number, then find the value of  $\left| \frac{2z_1 + z_2}{2z_1 - z_2} \right|$ .
09. If  $z = 2 - i\sqrt{7}$ , then show that  $3z^3 - 4z^2 + z + 88 = 0$ . TS Mar 20
10. The complex number 'z' has argument  $\theta$ ,  $0 < \theta < \frac{\pi}{2}$  and satisfying the equation  $|z - 3i| = 3$ .  
Then prove that  $\left(\cot \theta - \frac{6}{z}\right) = i$ .
11. If the real part of  $\frac{z+1}{z+i}$  is 1, then find the locus of 'z'. AP Mar 19
12. If the amplitude of  $(z-1)$  is  $\frac{\pi}{2}$ , then find the locus of 'z'. TS Mar 15
13. If the point 'P' denotes the complex number  $z = x + iy$  in the Argand plane and if  $\frac{z-i}{z-1}$  is a purely imaginary number, find the locus of 'P'. AP Mar 17
14. If the amplitude of  $\left(\frac{z-2}{z-6i}\right) = \frac{\pi}{2}$ , find its locus. May 06

# 02. DEMOIVRE'S THEOREM

## LONG ANSWER QUESTIONS (7 MARKS)

01. If 'n' is an integer, then show that  $(1+i)^{2n} + (1-i)^{2n} = 2^{n+1} \cos\left(\frac{n\pi}{2}\right)$ .

June 02; Mar 09, AP Mar 15; TS May 22

02. If 'n' is a positive integer show that  $(1+i)^n + (1-i)^n = 2^{(n+2)/2} \cdot \cos\left(\frac{n\pi}{4}\right)$ .

AP Mar 15, 17; TS Mar 17

03. If  $\alpha, \beta$  are the roots of the equation  $x^2 - 2x + 4 = 0$ , then for any positive integer 'n' show that  $\alpha^n + \beta^n = 2^{n+1} \cos\left(\frac{n\pi}{3}\right)$ .

Mar 11, 14, AP Mar 17, 19; TS Mar 16

04. If 'n' is an integer, then show that

$$(1 + \cos \theta + i \sin \theta)^n + (1 + \cos \theta - i \sin \theta)^n = 2^{n+1} \cos^n\left(\frac{\theta}{2}\right) \cos\left(\frac{n\theta}{2}\right).$$

May 97; AP Mar 17, Aug 22; TS Mar 17

05. Show that one value of  $\left(\frac{1 + \sin(\pi/8) + i \cos(\pi/8)}{1 + \sin(\pi/8) - i \cos(\pi/8)}\right)^{8/3} = -1$ .

June 10, AP Mar 18, Aug 22; TS Mar 16, 20

06. If  $\cos \alpha + \cos \beta + \cos \gamma = 0 = \sin \alpha + \sin \beta + \sin \gamma$ , then prove that

$$\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma = \frac{3}{2} = \sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma.$$

Mar 03, AP Mar 15, 16, 18, May 22; TS Mar 15, 18

07. If  $\cos \alpha + \cos \beta + \cos \gamma = 0 = \sin \alpha + \sin \beta + \sin \gamma$ , then show that

i)  $\cos 3\alpha + \cos 3\beta + \cos 3\gamma = 3 \cos(\alpha + \beta + \gamma)$ .    ii)  $\sin 3\alpha + \sin 3\beta + \sin 3\gamma = 3 \sin(\alpha + \beta + \gamma)$ .

iii)  $\cos(\alpha + \beta) + \cos(\beta + \gamma) + \cos(\gamma + \alpha) = 0$ .

Mar 08; TS Mar 18

08. If 'n' is a positive integer, show that  $(p+iq)^{1/n} + (p-iq)^{1/n} = 2(p^2 + q^2)^{1/2n} \cos\left(\frac{1}{n} \tan^{-1} \frac{q}{p}\right)$ .

AP May 15, Mar 18

09. If 'n' is an integer and  $z = \text{cis}(\theta)$ ,  $\left(\theta \neq (2n+1)\frac{\pi}{2}\right)$ , then show that  $\frac{z^{2n} - 1}{z^{2n} + 1} = i \tan n\theta$ .

10. If  $m, n \in \mathbb{Z}$  and  $x = \cos \alpha + i \sin \alpha$ ,  $y = \cos \beta + i \sin \beta$ , then show that

(i)  $x^m y^n + \frac{1}{x^m y^n} = 2 \cos(m\alpha + n\beta)$ , (ii)  $x^m y^n - \frac{1}{x^m y^n} = 2i \sin(m\alpha + n\beta)$ .

11. Solve  $(x-1)^n = x^n$ , where 'n' is a positive integer.

Mar 02

12. Find all the roots of the equation  $x^{11} - x^7 + x^4 - 1 = 0$ .

Model Paper

13. Solve  $x^9 - x^5 + x^4 - 1 = 0$ .

### VERY SHORT ANSWER QUESTIONS (2 MARKS)

14. Simplify  $\frac{(\cos \alpha + i \sin \alpha)^4}{(\sin \beta + i \cos \beta)^8}$ .

15. If  $x = \text{cis}(\theta)$ , then find the value of  $\left(x^6 + \frac{1}{x^6}\right)$ . May 07, AP Mar 17, 19, Aug 22; TS Mar 16, 18

16. Find the value of  $(-i)^{1/6}$ .

17. Find the value of  $(1+i)^{16}$ .

Model Paper

18. Find the value of  $(1-i)^8$ .19. Find the value of  $(1+i\sqrt{3})^3$ .

Mar 07

20. Find the value of  $(\sqrt{3}+i)^{1/4}$ .21. Find the value of  $\left(\frac{\sqrt{3}}{2} + \frac{i}{2}\right)^5 - \left(\frac{\sqrt{3}}{2} - \frac{i}{2}\right)^5$ .

June 04

22. If A, B, C are angles of a triangle ABC such that  $x = \text{cis}(A)$ ,  $y = \text{cis}(B)$ ,  $z = \text{cis}(C)$ , then find the value of  $xyz$ .

AP Mar 15, 16, 18; TS May 15, 16, 22

23. Find the value of  $(-32)^{1/5}$ .

24. Find the cube roots of 8.

25. If 1,  $\omega$ ,  $\omega^2$  are the cube roots of unity, then find the value  $(1-\omega+\omega^2)^3$ .

TS Mar 19

26. If 1,  $\omega$ ,  $\omega^2$  are the cube roots of unity, then prove that  $(2-\omega)(2-\omega^2)(2-\omega^{10})(2-\omega^{11}) = 49$ .

July 01; TS Mar 15, 17, May 22

27. If 1,  $\omega$ ,  $\omega^2$  are the cube roots of unity, show that  $(1-\omega+\omega^2)^6 + (1+\omega-\omega^2)^6 = 128$ .

TS Mar 16

28. If 1,  $\omega$ ,  $\omega^2$  are the cube roots of unity, then find the value  $(a+2b)^2 + (a\omega+2b\omega)^2 + (a\omega^2+2b\omega^2)^2$ .29. If 1,  $\omega$ ,  $\omega^2$  are the cube roots of unity, then find the value  $(1-\omega)(1-\omega^2)(1-\omega^4)(1-\omega^8)$ .30. If 1,  $\omega$ ,  $\omega^2$  are the cube roots of unity, show that  $(a+b)(a\omega+b\omega^2)(a\omega^2+b\omega) = a^3 + b^3$ .

AP Mar 17

31. If 1,  $\omega$ ,  $\omega^2$  are the cube roots of unity, then prove that  $\frac{1}{2+\omega} + \frac{1}{1+2\omega} = \frac{1}{1+\omega}$ .

TS Mar 15, 17, 18

32. If the cube roots of unity are 1,  $\omega$ ,  $\omega^2$ , then find the roots of the equation  $(x-1)^3 + 8 = 0$ .33. If  $\alpha$ ,  $\beta$  are the roots of the equation  $x^2 + x + 1 = 0$ , then prove that  $\alpha^4 + \beta^4 + \alpha^{-1}\beta^{-1} = 0$ .

AP Mar 15, 20

## 03. QUADRATIC EQUATIONS & EXPRESSIONS

### SHORT ANSWER QUESTIONS (4 MARKS)

01. Solve  $2x^4 + x^3 - 11x^2 + x + 2 = 0$ .

TS Mar 15

02. Solve  $\left(x^2 + \frac{1}{x^2}\right) - 5\left(x + \frac{1}{x}\right) + 6 = 0$ , when  $x \neq 0$ .03. Solve  $7^{1+x} + 7^{1-x} = 50$  for real 'x'.04. If the expression  $\frac{x-p}{x^2-3x+2}$  takes all real values for  $x \in \mathbb{R}$ , then find the limits for 'p'.

AP &amp; TS May 15

05. If 'x' is real, then prove that  $\frac{x}{x^2-5x+9}$  lies between  $\frac{-1}{11}$  and 1.

AP Mar 17, 19; TS Mar 16

06. If 'x' is real show that the value of the expression  $\frac{x^2+34x-71}{x^2+2x-7}$  does not lie between 5 and 9.

May 07, Mar 12

07. Prove that  $\frac{1}{3x+1} + \frac{1}{x+1} - \frac{1}{(3x+1)(x+1)}$  does not lie between 1 and 4, if x is real.

AP Mar 15, 16, 17, 19; TS Mar 16, 18, May 22

08. If 'x' is real, find the maximum and minimum values of the expression  $\frac{x^2 + 14x + 9}{x^2 + 2x + 3}$ .

June 05, May 14; AP Mar 18

09. Determine the range of  $\frac{x+2}{2x^2+3x+6}$  for  $x \in \mathbb{R}$ .

AP Mar 16; TS Mar 19

10. Determine the range of the expression  $\frac{x^2+x+1}{x^2-x+1}$  for  $x \in \mathbb{R}$ .

AP Mar 20, May 22, Aug 22; TS Mar 17, 20

11. If 'x' is real, then find the range of  $\frac{2x^2-6x+5}{x^2-3x+2}$ .

Mar 09

12. Determine the range of the expression  $\frac{(x-1)(x+2)}{x+3}$ ,  $x \in \mathbb{R}$ .

Mar 09

### VERY SHORT ANSWER QUESTIONS (2 MARKS)

13. Find the quadratic equation whose roots are  $7+2\sqrt{5}$  and  $7-2\sqrt{5}$ .

Mar 05, 11; TS Mar 16, 18; AP Aug 22

14. Find the quadratic equation whose roots are  $\frac{p-q}{p+q}$ ,  $\frac{-(p+q)}{p-q}$  ( $p \neq \pm q$ ). Mar 06, 07; AP Mar 19

15. Find the quadratic equation whose roots are  $-3 \pm 5i$ .

Mar 07

16. If  $\alpha, \beta$  are the roots of  $ax^2 + bx + c = 0$ , then find the value of  $\alpha^2 + \beta^2$  in terms of a, b, c.

17. If  $\alpha, \beta$  are the roots of the equation  $ax^2 + bx + c = 0$ , then find the value of  $\frac{1}{\alpha} + \frac{1}{\beta}$ .

Mar 10, TS May 22

18. If  $\alpha, \beta$  are the roots of the equation  $ax^2 + bx + c = 0$ , then find the value of  $\frac{1}{\alpha^2} + \frac{1}{\beta^2}$ .

Mar 08, 09, May 12; AP & TS Mar 16

19. If  $\alpha, \beta$  are the roots of the equation  $ax^2 + bx + c = 0$ , then find the value of  $\frac{\alpha}{\beta^2} + \frac{\beta}{\alpha^2}$ .

20. If  $\alpha, \beta$  are the roots of the equation  $ax^2 + bx + c = 0$ , find the value of  $\alpha^4\beta^7 + \alpha^7\beta^4$ .

21. Find all numbers which exceed their square root by 12.

22. Find the quadratic equation the sum of whose roots is '1' and sum of the squares of the roots is 13.

Mar & May 07

23. Find the quadratic equation, the sum of whose roots is 7 and sum of the squares of the roots is 25.

AP Mar 20, May 22

24. Find the condition that one root of the quadratic equation  $ax^2 + bx + c = 0$  shall be 'n' times the other, where 'n' is a positive integer.

25. If the equations  $x^2 - 6x + 5 = 0$  and  $x^2 - 3ax + 35 = 0$  have a common root, then find 'a'.

TS Mar 18

26. If the quadratic equations  $x^2 + bx + c = 0$ ,  $x^2 + cx + b = 0$  have a common root, then show that  $b + c + 1 = 0$ .

27. If the quadratic equations  $ax^2 + 2bx + c = 0$  and  $ax^2 + 2cx + b = 0$  have a common root, then show that  $a + 4b + 4c = 0$ .

28. If  $x^2 + 4ax + 3 = 0$  and  $2x^2 + 3ax - 9 = 0$  have a common root, then find the values of  $a$  and the common roots.
29. Suppose that the quadratic equations  $ax^2 + bx + c = 0$  and  $bx^2 + cx + a = 0$  have a common root. Then show that  $a^3 + b^3 + c^3 = 3abc$ .
30. If the equations  $x^2 + cx + d = 0$  and  $x^2 + ax + b = 0$  have a common root and the second equation has equal roots, then prove that  $2(b + d) = ac$ .
31. Find the nature of the roots of  $3x^2 + 7x + 2 = 0$ . AP Mar 16
32. For what values of 'm' the equation  $(m + 1)x^2 + 2(m + 3)x + m + 8 = 0$  has equal roots. Mar 03
33. If the equation  $x^2 - 15 - m(2x - 8) = 0$  has equal roots find the value of 'm'.  
AP Mar 17, 19; TS May 15, 17
34. Prove that the roots of  $(x - a)(x - b) = h^2$  are always real. May 09, AP May 15
35. If  $c^2 \neq ab$  and the roots of the equation  $(c^2 - ab)x^2 - 2(a^2 - bc)x + (b^2 - ac) = 0$  are equal, then show that  $a^3 + b^3 + c^3 = 3abc$  (or)  $a = 0$ . TS Mar 19
36. For what values of  $m$ ,  $x^2 + (m + 3)x + (m + 6) = 0$  will have equal roots ?
37. State the sign of the expression  $x^2 - 5x + 6$  for  $x \in \mathbb{R}$ . Mar 11, AP May 18
38. For what value of 'x', the expression  $x^2 - 5x - 14$  is positive. AP Mar 18
39. For what values of  $x$ , the expression  $15 + 4x - 3x^2$  is negative. AP Mar 15
40. Find the maximum (or) minimum of the expression  $12x - x^2 - 32$ . May 06
41. Find the maximum (or) minimum of the expression  $2x - 7 - 5x^2$  where  $x \in \mathbb{R}$ . Mar 12, 14
42. Find the maximum (or) minimum value of the expression  $x^2 - x + 7$  as  $x$  varies over  $\mathbb{R}$ . May 14

## 04. THEORY OF EQUATIONS

### LONG ANSWER QUESTIONS (7 MARKS)

01. Solve  $x^4 + 4x^3 - 2x^2 - 12x + 9 = 0$ , given that it has two pairs of equal roots.
02. Solve  $x^4 + x^3 - 16x^2 - 4x + 48 = 0$  given that the product of two roots is 6. May 09, 12
03. Solve  $8x^4 - 2x^3 - 27x^2 + 6x + 9 = 0$ , given that two of the roots have the same absolute value, but are opposite in sign.
04. Solve  $8x^3 - 36x^2 - 18x + 81 = 0$  given that the roots are in A.P. TS May 22
05. If the roots of the equation  $x^3 + 3px^2 + 3qx + r = 0$  are in A.P., then show that  $2p^3 - 3pq + r = 0$ .  
May 08, Mar 09, AP Aug 22
06. Find the condition that the roots of  $x^3 + 3px^2 + 3qx + r = 0$  may be in G.P. Mar 03, AP Aug 22
07. Find the condition that the roots of  $x^3 + 3px^2 + 3qx + r = 0$  may be in H.P. Mar 05, May 11
08. Solve  $4x^3 - 24x^2 + 23x + 18 = 0$  given the roots of this equation are in A.P.  
July 01, May 06, Mar 14; AP Mar 20, May 22
09. Solve the equation  $x^3 - 7x^2 + 14x - 8 = 0$ , given that the roots are in Geometric progression.
10. Solve  $3x^3 - 26x^2 + 52x - 24 = 0$ , given that the roots are in G.P. TS Mar 15

**Sr. INTER MATHS-A**

11. Solve  $18x^3 + 81x^2 + 121x + 60 = 0$  given that one root is equal to half the sum of the remaining roots. Mar 05; AP Mar 19; TS May 18, 20
12. Solve the equation  $x^4 - 6x^3 + 13x^2 - 24x + 36 = 0$ , given that they have multiple roots. May 09, 12
13. Solve  $x^4 - 4x^2 + 8x + 35 = 0$  given that  $2 + i\sqrt{3}$  is a root. AP Mar 15, Aug 22
14. Solve the equation  $x^4 - 10x^3 + 26x^2 - 10x + 1 = 0$ . Mar 10, 12; AP Mar 18; TS Mar 18, May 22
15. Solve  $6x^4 - 35x^3 + 62x^2 - 35x + 6 = 0$ . June 10
16. Solve  $6x^6 - 25x^5 + 31x^4 - 31x^2 + 25x - 6 = 0$ . Model of 05, AP May 15, Mar 18
17. Solve the equation  $x^5 - 5x^4 + 9x^3 - 9x^2 + 5x - 1 = 0$ . AP Mar 13; Mar 16
18. Solve the equations  $2x^5 + x^4 - 12x^3 - 12x^2 + x + 2 = 0$ . AP Mar 16, 17, 18; TS May 15, 17

**VERY SHORT ANSWER QUESTIONS (2 MARKS)**

19. Find the quotient and remainder when  $x^4 - 11x^3 + 44x^2 - 76x + 48$  is divided by  $x^2 - 7x + 12$ .
20. Form the monic polynomial equation of degree 3 whose roots are 2, 3, 6. IPE 14
21. Form the equation whose roots are  $2 \pm \sqrt{3}$ ,  $1 \pm 2i$ . July 01, June 02, Mar 07
22. If 1, 2, 3 and 4 are the roots of  $x^4 + ax^3 + bx^2 + cx + d = 0$ , then find the values of a, b, c and d. AP May 15
23. If 1, -2, 3 are the roots of  $x^3 - 2x^2 + ax + 6 = 0$ , then find 'a'. Mar 04, TS May 15
24. If -1, 2 and  $\alpha$  are the roots of  $2x^3 + x^2 - 7x - 6 = 0$ , then find  $\alpha$ . Mar 10, 12, 13, 14, May 17; TS Mar 18, May 22
25. If 1, 1,  $\alpha$  are the roots of  $x^3 - 6x^2 + 9x - 4 = 0$ , then find  $\alpha$ . May 11, AP Mar 18, TS May 16, 18, 20
26. If  $\alpha$ ,  $\beta$ , 1 are the roots of  $x^3 - 2x^2 - 5x + 6 = 0$ , then find  $\alpha$ ,  $\beta$ . Mar 08, 16, AP May 16; TS May 17
27. If the product of the roots of  $4x^3 + 16x^2 - 9x - a = 0$  is 9, then find 'a'. May 12, 13; AP Mar 17, 19, May 22; TS Mar 16, May 22
28. If  $\alpha$ ,  $\beta$ ,  $\gamma$  are the roots of  $4x^3 - 6x^2 + 7x + 3 = 0$ , then find  $\alpha\beta + \beta\gamma + \gamma\alpha$ . TS Mar 19
29. If  $\alpha$ ,  $\beta$ ,  $\gamma$  are the roots of  $x^3 - 2x^2 + 3x - 4 = 0$ , then find i)  $\sum \alpha^2\beta^2$ , ii)  $\sum \alpha^2\beta + \sum \alpha\beta^2$ .
30. Find the transformed equation whose roots are the negatives of the roots of  $x^4 + 5x^3 + 11x + 3 = 0$ . AP Mar 15
31. Find the equation whose roots are reciprocals of the roots of  $x^4 - 3x^3 + 7x^2 + 5x - 2 = 0$ . May 11, TS Mar 15
32. If  $\alpha$ ,  $\beta$ ,  $\gamma$  are the roots of the equation  $x^3 + 2x^2 - 4x - 3 = 0$ , find the equation whose roots are 3 times the roots of given equation. May 05, Mar 09
33. Find the algebraic equation whose roots are two times the roots of  $x^5 - 2x^4 + 3x^3 - 2x^2 + 4x + 3 = 0$ .
34. Find the algebraic equation of degree 4 whose roots are 3 times the roots of the equation  $6x^4 - 7x^3 + 8x^2 - 7x + 2 = 0$ .
35. Find the polynomial equation whose roots are the square of the roots of  $x^3 + 3x^2 - 7x + 6 = 0$ .

36. Form the equation whose roots are 'm' times the roots of the equation  $x^3 + \frac{1}{4}x^2 - \frac{1}{16}x + \frac{1}{7^2} = 0$  and reduce the case when  $m = 12$ .

## 05. PERMUTATIONS & COMBINATIONS

### SHORT ANSWER QUESTIONS (4 MARKS)

01. Find the number of numbers that are greater than 4000 which can be formed using the digits 0, 2, 4, 6, 8 without repetition. May 09
02. Find the sum of all four digit numbers that can be formed using the digits 1, 2, 4, 5, 6 without repetition. Mar 10
03. Find the sum of all 4 digit numbers that can be formed using the digits 1, 3, 5, 7, 9. AP Mar 18 ; TS Mar 18, May 22
04. Find the number of 4 digit numbers that can be formed by using the digits 1, 2, 3, 4, 5, 6 that are divisible by (i) 2 (ii) 3 when repetitions are allowed.
05. Find the number of ways of arranging 6 boys and 6 girls in a row. In how many of these arrangements.  
(i) all the girls are together (ii) no two girls are together  
(iii) boys and girls come alternatively
06. Find the number of ways of arranging 6 red roses and 3 yellow roses of different sizes into a garland. In how many of them (i) all the yellow roses are together (ii) no two yellow roses are together.
07. Find the number of ways of arranging 6 boys and 6 girls around a circular table so that  
(i) all the girls sit together, (ii) no two girls sit together,  
(iii) boys and girls sit alternatively.
08. Find the number of ways of seating 5 Indians, 4 Americans and 3 Russians at a round table so that TS Mar 15  
(i) all Indians are sit together (ii) persons of same nationality sit together  
(iii) No two Russians sit together.
09. Find the number of ways of permuting the letters of the word 'PICTURE' so that  
(i) all vowels come together (ii) no two vowels come together
10. If the letters of the word MASTER are permuted in all possible ways and the words thus formed are arranged in the dictionary order. Then find the rank of the word MASTER.
11. If the letters of word PRISON are permuted in all possible ways and the words thus formed are arranged in dictionary order. Then find the rank of the word PRISON. Mar 2014, 17, May 13, 17
12. If the letters of the word EAMCET are permuted in all possible ways and if the words thus formed are arranged in dictionary order find the rank of the word EAMCET. Mar 12; AP Mar 16, 17; TS May 15, 16, 18
13. If the letters of the word AJANTA are permuted in all possible ways and the words thus formed are arranged in the dictionary order, find the ranks of the words  
(i) AJANTA; (ii) JANATA
14. If the letters of the word BRING are permuted in all possible ways and the words thus formed are arranged in the dictionary order, then find the 59<sup>th</sup> word.
15. Simplify  ${}^{34}C_5 + \sum_{r=0}^4 (38-r)C_4$ . May 11, Mar 12 ; AP Mar 16, 17



16. Show that  ${}^{25}C_4 + \sum_{r=0}^4 ({}^{29-r}C_3) = {}^{30}C_4$ . AP Mar 18, Aug 22; TS Mar 18
17. Prove that  $\frac{{}^{4n}C_{2n}}{{}^{2n}C_n} = \frac{1 \cdot 3 \cdot 5 \dots (4n-1)}{\{1 \cdot 3 \cdot 5 \dots (2n-1)\}^2}$ . May 08; AP Mar 15, 17; TS May 15
18. i) If  $1 \leq r \leq n$ , then  ${}^nC_{r-1} + {}^nC_r = {}^{n+1}C_r$ . Mar 11  
 ii) For  $3 \leq r \leq n$ , prove that  ${}^{n-3}C_r + 3 \cdot {}^{n-3}C_{r-1} + 3 \cdot {}^{n-3}C_{r-2} + {}^{n-3}C_{r-3} = {}^nC_r$ . May 09
19. Find the number of ways of selecting a cricket team of 11 players from 7 batsmen and 6 bowlers such that there will be atleast 5 bowlers in the team. Mar 05, May 14, 16, Mar 18
20. Find the number of ways of selecting 11 members cricket team from 7 batsmen, 6 bowlers and 2 wicket-keepers, so that the team contains 2 wicket-keepers and atleast 4 bowlers. Mar 14, May 13, 18
21. Find the number of ways of forming a committee of 5 members out of 6 Indians and 5 Americans so that always the Indians will be in majority in the committee. Mar 08, 09
22. Find the no. of ways of forming a committee of 4 members out of 6 boys and 4 girls such that there is atleast one girl in the committee.

### VERY SHORT ANSWER QUESTIONS (2 MARKS)

23. If  ${}^nP_4 = 1680$ , then find 'n'. Mar 06, May 06, Mar 14
24. If  ${}^nP_3 = 1320$ , then find 'n'. Mar 05, 09, May 08, TS May 22
25. If  ${}^{(n+1)}P_5 : {}^nP_6 = 2 : 7$ , then find 'n'. Mar 2007, 10
26. If  ${}^{(n+1)}P_5 : {}^nP_5 = 3 : 2$ , then find 'n'. Mar 2012; AP Aug 22
27. If  ${}^nP_7 = 42 \cdot {}^nP_5$ , then find 'n'. May 09, 11, 12; AP May 22; TS May 15, 17
28. If  ${}^{12}P_5 + 5 \cdot {}^{12}P_4 = {}^{13}P_r$ , then find 'r'. TS May 15
29. If  ${}^{12}P_r = 1320$ , then find 'r'. Mar 09, May 15
30. Find the number of functions from set 'A' containing 5 elements into a set 'B' containing 4 elements. AP Mar 19
31. Find the number of injections of a set 'A' with 5 elements to a set 'B' with 7 elements. TS Mar 17
32. Find the number of bijections from set A containing 7 elements onto itself.
33. A man has 4 sons and there are 5 schools within his reach. In how many ways can he admit his sons in the schools so that no two of them will be in the same school ?
34. Find the number of 4 letter words that can be formed using the letters of the word PISTON in which at least one letter is repeated. AP Mar 15
35. Define palindrome and give examples.
36. Find the number of seven digit palindromes that can be formed using 0, 1, 2, 3, 4.
37. Find the number of different chains that can be prepared using 7 different coloured beads. May 08, AP Mar 17
38. Find the number of different chains that can be prepared using 6 different coloured beads. TS Mar 16
39. Find the number of ways of arranging the letters of the word INTERMEDIATE May 11, AP Aug 22
40. Find the number of ways of arranging the letters of the word INDEPENDENCE Mar 09
41. Find the number of ways of arranging the letters of the word MATHEMATICS Mar 09, 11
42. Find the number of ways of arranging the letters of the word  $a^4b^3c^5$  in its expanded form.



**Sr. INTER MATHS-A**

43. Find the number of 7-digit number that can be formed using 2, 2, 2, 3, 3, 4, 4.
44. There are 4 copies alike each of 3 different books. Find the number of ways of arranging these 12 books in a shelf in a single row.
45. Find the number of ways in which 4 letters can be put in 4 addressed envelopes so that no letter goes into the envelope meant for it.
46. If  ${}^nC_4 = 210$  find 'n'. TS Mar 19
47. If  $10 \cdot {}^nC_2 = 3 \cdot {}^{n+1}C_3$  find 'n'. May 12; AP Mar 15
48. If  ${}^nC_{21} = {}^nC_{27}$ , then find  ${}^{49}C_n$ . Mar 06, May 06
49. If  ${}^nC_5 = {}^nC_6$ , then find the value of  ${}^{13}C_n$ . Mar 13, 18, June 10, May 14
50. If  ${}^{12}C_{r+1} = {}^{12}C_{3r-5}$ , then find 'r'. Mar 08, TS Mar 16
51. If  ${}^{12}C_{s+1} = {}^{12}C_{(2s-5)}$ , then find 's'. Mar 11
52. If  ${}^{15}C_{2r-1} = {}^{15}C_{(2r+4)}$ , then find 'r'. Mar 14
53. Prove that  ${}^{10}C_3 + {}^{10}C_6 = {}^{11}C_4$ .
54. If  ${}^9C_3 + {}^9C_5 = {}^{10}C_r$ , then find 'r'.
55. Find the value of  ${}^{10}C_5 + 2 \cdot {}^{10}C_4 + {}^{10}C_3$ . Mar 10, 17, 18
56. If  ${}^nP_r = 5040$  and  ${}^nC_r = 210$ , then find 'n' and 'r'. AP Mar 16, 17; B.P
57. Find the number of ways of selecting 3 vowels and 2 consonants from the letters of the word 'EQUATION'. Mar 07, May 11
58. Find the number of ways of selecting 4 boys and 3 girls from a group of 8 boys and 5 girls. Mar 15; AP Aug 22
59. In a class there are 30 students. If each student plays a chess game with each of the other student, then find the total number of chess games played by them.
60. Find the number of ways of forming a committee of 5 members from 6 men and 3 ladies.
61. Find the number of ways of selecting 7 members from a contingent of 10 soldiers.
62. If a set A has 12 elements. Find the number of subsets of A having (i) 4 elements, (ii) Atleast 3 elements, (iii) Atmost 3 elements.
63. Find the number of diagonals of a polygon with 12 sides? May 15, 18; TS May 22
64. If a set of 'm' parallel lines intersect another set of 'n' parallel lines (not parallel to the lines in the first set), then find the no. of parallelograms formed in this lattice structure.
65. Find the number of positive divisors of 1080. Mar 16, May 13, 16; AP May 22
66. Find the no. of zero's in  $100!$ .

## 06. BINOMIAL THEOREM

### LONG ANSWER QUESTIONS (7 MARKS)

01. If P and Q are the sum of odd terms and the sum of even terms respectively in the expansion of  $(x+a)^n$ , then prove that
- a)  $P^2 - Q^2 = (x^2 - a^2)^n$       b)  $4PQ = (x+a)^{2n} - (x-a)^{2n}$ . Mar 10; AP Mar 16
02. If the coefficients of 4 consecutive terms in the expansion of  $(1+x)^n$  are  $a_1, a_2, a_3, a_4$  respectively, then show that  $\frac{a_1}{a_1 + a_2} + \frac{a_3}{a_3 + a_4} = \frac{2a_2}{a_2 + a_3}$ . Mar 07, 11, May 11, 17, May 17

**Sr. INTER MATHS-A**

03. If 36, 84, 126 are three successive binomial coefficients in the expansion of  $(1+x)^n$ , then find 'n'. TS Mar 16
04. If the coefficients of  $(2r+4)^{\text{th}}$ ,  $(r-2)^{\text{th}}$  terms in the expansion of  $(1+x)^{18}$  are equal, find 'r'.
05. If the coefficients of  $r^{\text{th}}$ ,  $(r+1)^{\text{th}}$  and  $(r+2)^{\text{nd}}$  terms in the expansion of  $(1+x)^n$  are in A.P, then show that  $n^2 - (4r+1)n + 4r^2 - 2 = 0$ . Mar 08; AP Mar 15, 18, May 16
06. If the coefficients of  $x^9$ ,  $x^{10}$  and  $x^{11}$  terms in the expansion of  $(1+x)^n$  are in A.P, then prove that  $n^2 - 41n + 398 = 0$ .
07. If the  $2^{\text{nd}}$ ,  $3^{\text{rd}}$ , and  $4^{\text{th}}$  terms in the expansion of  $(a+x)^n$  are respectively 240, 720, 1080 find a, x, n. Mar 06, TS Mar 16, May 09
08. If the coefficient of  $x^{10}$  in the expansion of  $\left(ax^2 + \frac{1}{bx}\right)^{11}$  is equal to the coefficient of  $x^{-10}$  in the expansion of  $\left(ax - \frac{1}{bx^2}\right)^{11}$  find the relation between 'a' and 'b', when 'a' and 'b' are real numbers. Model Paper 07; AP May 15
09. Find the numerically greatest term(s) in the expansion of  $(3x-5y)^n$ , when  $x = \frac{3}{4}$ ,  $y = \frac{2}{7}$  and  $n = 17$ .
10. For  $n = 0, 1, 2, \dots, n$ , prove that  $C_0 \cdot C_r + C_1 \cdot C_{r+1} + C_2 \cdot C_{r+2} + \dots + C_{n-r} \cdot C_n = {}^{2n}C_{n+r}$ , and hence deduce that  
 i)  $C_0^2 + C_1^2 + C_2^2 + \dots + C_n^2 = {}^{2n}C_n$ ,  
 ii)  $C_0 \cdot C_1 + C_1 \cdot C_2 + C_2 \cdot C_3 + \dots + C_{n-1} \cdot C_n = {}^{2n}C_{n+1}$ . Mar 12, 18; TS Mar 15
11. Prove that  $(C_0 + C_1) \cdot (C_1 + C_2) \cdot (C_2 + C_3) \dots (C_{n-1} + C_n) = \frac{(n+1)^n}{n!} C_0 \cdot C_1 \cdot C_2 \dots C_n$  TS May 15
12. If  $C_r$  denotes  ${}^nC_r$ , then prove that  $C_0 + C_1 \cdot \frac{x}{2} + C_2 \cdot \frac{x^2}{3} + \dots + C_n \cdot \frac{x^n}{n+1} = \frac{(1+x)^{n+1} - 1}{(n+1)x}$ . Also deduce that (i)  $C_0 + \frac{C_1}{2} + \frac{C_2}{3} + \dots + \frac{C_n}{n+1} = \frac{2^{n+1} - 1}{n+1}$ ;  
 (ii)  $C_0 + \frac{3}{2}C_1 + \frac{9}{3}C_2 + \frac{27}{4}C_3 + \dots + \frac{3^n}{n+1} \cdot C_n = \frac{4^{n+1} - 1}{3(n+1)}$ . AP Mar 16, 17, 18; TS Mar 17, 18
13. Find the sum of series  $1 - \frac{4}{5} + \frac{4.7}{5.10} - \frac{4.7.10}{5.10.15} + \dots$  TS Mar 17
14. Using binomial theorem prove that  $50^n - 49n - 1$  is divisible by  $49^2$  in all positive integers 'n'.
15. Find the sum of the series  $\frac{3 \cdot 5}{5 \cdot 10} + \frac{3 \cdot 5 \cdot 7}{5 \cdot 10 \cdot 15} + \frac{3 \cdot 5 \cdot 7 \cdot 9}{5 \cdot 10 \cdot 15 \cdot 20} + \dots \infty$ . Mar 06, 09, May 09, Mar 11, 17,
16. Find the sum of the infinite series  $\frac{3}{4} + \frac{3 \cdot 5}{4 \cdot 8} + \frac{3 \cdot 5 \cdot 7}{4 \cdot 8 \cdot 12} + \dots \infty$ . June 10, Mar 11
17. Find the sum of the series  $1 + \frac{1}{3} + \frac{1 \cdot 3}{3 \cdot 6} + \frac{1 \cdot 3 \cdot 5}{3 \cdot 6 \cdot 9} + \dots \infty$ . AP May 22; TS Mar 15

18. If  $x = \frac{1 \cdot 3}{3 \cdot 6} + \frac{1 \cdot 3 \cdot 5}{3 \cdot 6 \cdot 9} + \frac{1 \cdot 3 \cdot 5 \cdot 7}{3 \cdot 6 \cdot 9 \cdot 12} + \dots$ , then prove that  $9x^2 + 24x = 11$ .

Mar 09; AP Mar & May 15; TS Mar 16, May 16, 18; Mar 17, 18

19. If  $x = \frac{1}{5} + \frac{1 \cdot 3}{5 \cdot 10} + \frac{1 \cdot 3 \cdot 5}{5 \cdot 10 \cdot 15} + \dots \infty$ , then find  $3x^2 + 6x$ .

May 08, 11, Mar 12, 14, May 14, 16, 17, 18

20. If  $x = \frac{5}{(2!)3} + \frac{5 \cdot 7}{(3!)3^2} + \frac{5 \cdot 7 \cdot 9}{(4!)3^3} + \dots$ , then find the value of  $x^2 + 4x$ .

May 12, Mar 13, 15

21. If  $t = \frac{4}{5} + \frac{4 \cdot 6}{5 \cdot 10} + \frac{4 \cdot 6 \cdot 8}{5 \cdot 10 \cdot 15} + \dots \infty$ , then prove that  $9t = 16$ .

22. Find the sum of the infinite series  $\frac{7}{5} \left( 1 + \frac{1}{10^2} + \frac{1 \cdot 3}{1 \cdot 2} \left( \frac{1}{10^4} \right) + \frac{1 \cdot 3 \cdot 5}{1 \cdot 2 \cdot 3} \left( \frac{1}{10^6} \right) + \dots \right)$ .

Mar 05, May 13; AP Mar 16, 18

23. Find the sum of infinite series  $1 + \frac{2}{3} \cdot \frac{1}{2} + \frac{2 \cdot 5}{3 \cdot 6} \cdot \left( \frac{1}{2} \right)^2 + \frac{2 \cdot 5 \cdot 8}{3 \cdot 6 \cdot 9} \cdot \left( \frac{1}{2} \right)^3 + \dots \infty$ .

24. Find the sum of the infinite series  $\frac{3}{4 \cdot 8} - \frac{3 \cdot 5}{4 \cdot 8 \cdot 12} + \frac{3 \cdot 5 \cdot 7}{4 \cdot 8 \cdot 12 \cdot 16} - \dots$ .

25. Show that for any non-zero rational number 'x',

$$1 + \frac{x}{2} + \frac{x(x-1)}{2 \cdot 4} + \frac{x(x-1)(x-2)}{2 \cdot 4 \cdot 6} + \dots = 1 + \frac{x}{3} + \frac{x(x+1)}{3 \cdot 6} + \frac{x(x+1)(x+2)}{3 \cdot 6 \cdot 9} + \dots$$

Mar 94

26. Suppose that 'n' is a natural number and  $(7 + 4\sqrt{3})^n = I + F$  where I, F are respectively the integral part and fractional part, then show that

(i) 'I' is an odd integer (ii)  $(I + F)(I - F) = 1$

AP May 22

27. If R, n are positive integers, 'n' is odd,  $0 < f < 1$  and if  $(5\sqrt{5} + 11)^n = R + F$ , then prove that

(i) 'R' is an even integer and (ii)  $(R + F) \cdot F = 4^n$

## VERY SHORT ANSWER QUESTIONS (2 MARKS)

28. Find the number of terms in the expansion of  $\left( \frac{3a}{4} + \frac{b}{2} \right)^9$ . Mar 12, 14, May 13, 14, Mar 17

29. Find the number of terms with non-zero coefficients in  $(4x - 7y)^{49} + (4x + 7y)^{49}$ .

30. Find the 7<sup>th</sup> term in  $\left( \frac{4}{x^3} + \frac{x^2}{2} \right)^{14}$ .

31. Find the 6<sup>th</sup> term in  $\left( \frac{2x}{3} + \frac{3y}{2} \right)^9$ .

32. Find the 7<sup>th</sup> term in  $\left( \frac{4}{x^3} + \frac{x^2}{2} \right)^{14}$ .

33. Find the 4<sup>th</sup> term from the end in the expansion  $(2a + 5b)^8$ .

34. Find the middle term/terms in the expansion of  $\left( \frac{3x}{7} - 2y \right)^{10}$  June 10, Mar 12, May 18

June 05; TS May 15

35. Find the middle term/terms in the expansion of  $\left(4a + \frac{3}{2}b\right)^{11}$ .

36. Find the middle term(s) in the expansion of  $(4x^2 + 5x^3)^{17}$ .

37. Find the term independent of 'x' in the expansion of  $\left(4x^3 + \frac{7}{x^2}\right)^{14}$ .

38. Find the term independent of 'x' in the expansion of  $\left(\frac{2x^2}{5} + \frac{15}{4x}\right)^9$ .

39. Find the term independent of 'x' in the expansion of  $\left(\sqrt{\frac{x}{3}} + \frac{3}{2x^2}\right)^{10}$ .

40. Find the coefficient of  $x^{-7}$  in  $\left(\frac{2x^2}{3} - \frac{5}{4x^5}\right)^7$ .

Mar 10

41. Find the coefficient of  $x^{11}$  in  $\left(2x^2 + \frac{3}{x^3}\right)^{13}$ .

42. Find the largest binomial coefficients in the expansions of  $(1+x)^{24}$ .

43. If  ${}^{22}C_r$  is the largest binomial coefficient in the expansion of  $(1+x)^{22}$ , find the value of  ${}^{13}C_r$ .

May 11, AP &amp; TS May 15; AP Mar 16, May 22

44. Find the largest binomial coefficient(s) in the expansion of  $(1+x)^{19}$ .

45. Prove that  $C_0 + 2 \cdot C_1 + 4 \cdot C_2 + 8 \cdot C_3 + \dots + 2^n \cdot C_n = 3^n$ .

Mar 07; AP Mar 15

46. If  $(1+3x-2x^2)^{10} = a_0 + a_1x + a_2x^2 + \dots + a_{20}x^{20}$ , prove that  $a_0 + a_1 + a_2 + \dots + a_{20} = 2^{10}$ .

47. If  $(1+3x-2x^2)^{10} = a_0 + a_1x + a_2x^2 + \dots + a_{20}x^{20}$ , prove that  $a_0 - a_1 + a_2 - \dots + a_{20} = 4^{10}$ .

48. If  $(1+x+x^2)^n = a_0 + a_1x + a_2x^2 + \dots + a_{2n}x^{2n}$ , then find the value of  $a_0 + a_2 + a_4 + \dots + a_{2n}$ . B.P

49. Find the sum of  $\frac{{}^{15}C_1}{{}^{15}C_0} + 2 \cdot \frac{{}^{15}C_2}{{}^{15}C_1} + 3 \cdot \frac{{}^{15}C_3}{{}^{15}C_2} + \dots + 15 \cdot \frac{{}^{15}C_{15}}{{}^{15}C_{14}}$ .

50. Find the sum  $2^2 \cdot C_0 + 3^2 \cdot C_1 + 4^2 \cdot C_2 + \dots + (n+2)^2 \cdot C_n$ .

51. Find the set of values of 'x' for which  $(2+3x)^{-2/3}$  is valid.

52. Find the set of values of 'x' for which  $(7+3x)^{-5}$  is valid.

53. Find the set of values of 'x' for which  $(3-4x)^{3/4}$  is valid.

Mar 11; TS Mar 16

54. Find the 8<sup>th</sup> term of  $\left(1 - \frac{5x}{2}\right)^{-3/5}$ .

55. Find the remainder when  $2^{2013}$  is divided by 17.

56. Find the approximate value of  $\sqrt[6]{63}$ .

57. Find the number of terms in the expansion of  $(2x+3y+z)^7$ .

Mar 12, 14, May 13, 14, Mar 17; TS May 22

# 07. PARTIAL FRACTIONS

## SHORT ANSWER QUESTIONS (4 MARKS)

01. Resolve  $\frac{x+4}{(x^2-4)(x+1)}$  into Partial Fractions. Mar 14
02. Resolve  $\frac{3x+7}{x^2-3x+2}$  into partial fractions.
03. Resolve  $\frac{2x^2+1}{x^3-1}$  into partial fractions.
04. Resolve  $\frac{x^2+5x+7}{(x-3)^3}$  into Partial Fractions. AP Mar 17, 18
05. Resolve  $\frac{3x^3-8x^2+10}{(x-1)^4}$  into Partial Fractions. Mar 06
06. Resolve  $\frac{x-1}{(x+1)(x-2)^2}$  into Partial Fractions. [AP Polycet 2018]
07. Resolve  $\frac{x^2-x+1}{(x+1)(x-1)^2}$  into Partial Fractions. TS Mar 15, May 15, 22
08. Resolve  $\frac{2x^2+2x+1}{x^3+x^2}$  into partial fractions. AP Mar 17; TS Mar 17
09. Resolve  $\frac{3x-18}{x^3(x+3)}$  into Partial Fractions. May 18
10. Resolve  $\frac{x^2-3}{(x+2)(x^2+1)}$  into Partial Fractions.  
Mar 05, 07, 09, May 09, Mar 12, May 16; AP Mar 16, 17, May 22
11. Resolve  $\frac{2x^2+3x+4}{(x-1)(x^2+2)}$  into Partial Fractions. Mar 11, May 11, 12; AP Mar 15, 18,
12. Resolve  $\frac{3x-1}{(1-x+x^2)(x+2)}$  into partial fractions. TS Mar 20
13. Resolve  $\frac{x^3+x^2+1}{(x^2+2)(x^2+3)}$  into partial fractions.
14. Resolve  $\frac{x^3}{(2x-1)(x-1)^2}$  into partial fractions.
15. Resolve  $\frac{x^3}{(x-a)(x-b)(x-c)}$  into Partial Fractions. May 15; TS May 16
16. Resolve  $\frac{x^3}{(2x-1)(x+2)(x-3)}$  into Partial Fractions. AP Aug 22
17. Resolve  $\frac{x^2}{(x-1)(x-2)}$  into partial fractions.

18. Resolve  $\frac{x^3}{(x-1)(x+2)}$  into Partial Fractions.

19. Resolve  $\frac{x^4}{(x-1)(x-2)}$  into Partial Fractions.

Mar 10, 13; TS Mar 16

20. Find the coefficient of  $x^n$  in the power series expansions of  $\frac{x-4}{x^2-5x+6}$  specifying the region in which the expansion is valid.

June 10

## 08. MEASURES OF DISPERSION

### LONG ANSWER QUESTIONS (7 MARKS)

01. Find the mean deviation about the mean for the following data.

$x_i$	2	5	7	8	10	35
$f_i$	6	8	10	6	8	2

02. Find the mean deviation about the mean for the following continuous distribution

Height (in cms)	95–105	105–115	115–125	125–135	135–145	145–155
No. of Boys	9	13	26	30	12	10

03. Find the mean deviation from the mean for the following continuous frequency distribution.

Sales (in Rs. thousand)	40–50	50–60	60–70	70–80	80–90	90–100
Number of companies	5	15	25	30	20	5

AP Mar 15, 16

04. Find the mean deviation from the mean of the following data, using the step deviation method.

TS Mar 16, 18; May 17, 18, AP Aug 22

Marks	0–10	10–20	20–30	30–40	40–50	50–60	60–70
No. of Students	6	5	8	15	7	6	3

05. Find mean deviation about the mean of the data.

AP May 15, 16; Mar 17, 18

Marks obtained	0–10	10–20	20–30	30–40	40–50
No. of Students	5	8	15	16	6

06. Find the mean deviation about the median for the following frequency distribution.

$x_i$	5	7	9	10	12	15
$f_i$	8	6	2	2	2	6

07. Find the mean deviation from the median for the following data.

May 14

$x_i$	6	9	3	12	15	13	21	22
$f_i$	4	5	3	2	5	4	4	3

08. Find the mean deviation about the median from the following continuous distribution.

Class Interval	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	5	8	7	12	28	20	10	10

09. Find the mean deviation about median for the following data.

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of boys	6	8	14	16	4	2

10. The coefficient of variation of two distributions are 60 and 70 and their standard deviations are 21 and 16 respectively. Find their arithmetic means.
11. The mean of 5 observations is 4.4. Their variance is 8.24. If three of the observations are 1, 2 and 6. Find the other two observations.
12. Find the variance and standard deviation of the following frequency distribution

$(x_i)$	4	8	11	17	20	24	32
$(f_i)$	3	5	9	5	4	3	1

TS Mar 15; May 15; AP May 22

13. Calculate the variance and standard deviation of the following continuous frequency distribution.

Class Interval	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	3	7	12	15	8	3	2

14. Find the mean and variance using the step deviation method, of the following tabular data, giving the age distribution of 542 members.

Age in years $(x_i)$	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Number of Members $(f_i)$	3	61	132	153	140	51	2

15. The scores of two cricketers A and B in 10 innings are given below. Find who is a better run getter and who is a more consistent player.

Scores of A : $x_i$	40	25	19	80	38	8	67	121	66	76
Scores of B : $y_i$	28	70	31	0	14	111	66	31	25	4

16. Lives of two models of refrigerators A and B, obtained in a survey, are given below.

Life (in years)	Model A	Model B
0-2	5	2
2-4	16	7
4-6	13	12
6-8	7	19
8-10	5	9

Which refrigerator model would you suggest to purchase?



**Sr. INTER MATHS-A**

17. From the prices of shares X and Y given below, for 10 days of trading, find out which share is more stable ?

<b>X</b>	35	54	52	53	56	58	52	50	51	49
<b>Y</b>	108	107	105	105	106	107	104	103	104	101

18. The following table gives the daily wages of workers in a factory. Compute the standard deviation and the coefficient of variation of the wages of the workers.

<b>Wages (Rs.)</b>	125–175	175–225	225–275	275–325	325–375	375–425	425–475	475–525	525–575
<b>No. of workers</b>	2	22	19	14	3	4	6	1	1

19. An analysis of monthly wages paid to the workers of two firms A and B belonging to the same industry gives the following data.

	<b>Firm A</b>	<b>Firm B</b>
<b>Number of workers</b>	500	600
<b>Average daily wage(Rs.)</b>	186	175
<b>Variance of distribution of wages</b>	81	100

- i) Which firm A or B, has greater variability in individual wages ?  
 ii) Which firm has larger wage bill ?

### VERY SHORT ANSWER QUESTIONS (2 MARKS)

20. Define range for an ungrouped data and also find the range of the given data 38, 70, 48, 40, 42, 55, 63, 46, 54, 55. TS Mar 16
21. Find the mean deviation from the mean of the following discrete data 6, 7, 10, 12, 13, 4, 12, 16. Mar 14, May 16, 17
22. Find the mean deviation about the mean for the following data 38, 70, 48, 40, 42, 55, 63, 46, 54, 44. May 15
23. Find the mean deviation about the median for the following data 13, 17, 16, 11, 13, 10, 16, 11, 18, 12, 17. Mar 16
24. Find the mean deviation about the median for the following data : 4, 6, 9, 3, 10, 13, 2. TS Mar 15; Mar 15, May 15, Mar 17, 18,
25. Find the mean deviation about median for the data 6, 7, 10, 12, 13, 4, 12, 16. AP Mar 18
26. The variance of 20 observation is 5. If each of the observations is multiplied by 2, find the variance of the resulting observations.
27. Find the variance for the discrete data: 6, 7, 10, 12, 13, 4, 8, 12.
28. Find the variance and standard deviation of the following data 5, 12, 3, 18, 6, 8, 2, 10.

AP Mar 15, Aug 22

## 09. PROBABILITY

### LONG ANSWER QUESTIONS (7 MARKS)

01. The probabilities of three mutually exclusive events are respectively given as  $\frac{1+3p}{3}$ ,  $\frac{1-p}{4}$ ,

$\frac{1-2p}{2}$ , prove that  $\frac{1}{3} \leq p \leq \frac{1}{2}$ .

AP 19

02. State and prove addition theorem on Probability. (OR)

If A, B are any two events of a random experiment and 'P' is probability function, then prove that  $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ .

Mar 06, 07, 11, 13, 14, May 2007, 09, 12, 14, May 16, 17, Mar 17, 18; TS May 22

03. Define conditional probability. Bag  $B_1$  contains 4 white and 2 black balls. Bag  $B_2$  contains 3 white and 4 black balls. A bag is drawn at random and a ball is chosen at random from it. What is the probability that the ball drawn is white? Mar & May 11

04. There are 3 black and 4 white balls in one bag, 4 black and 3 white balls in the second bag. A die is rolled and the first bag is selected if the die shows up 1 or 3, and the second bag for the rest. Find the probability of drawing a black ball, from the bag thus selected. Mar 09

05. Define conditional probability. State and prove the multiplication theorem on probability.

Mar 04, June 10; TS May 15, 17

06. State and prove Baye's theorem. Jun 05, Mar 09, 12; AP Mar 15, May 15, 16, 22; TS Mar 16, 17

07. Three boxes  $B_1$ ,  $B_2$  and  $B_3$  contain balls with different colours as shown below.

Box	White	Black	Red
$B_1$	2	1	2
$B_2$	3	2	4
$B_3$	4	3	2

A die is thrown,  $B_1$  is chosen if either 1 or 2 turns up.  $B_2$  is chosen if 3 (or) 4 turns up and  $B_3$  is chosen if 5 (or) 6 turns up. Having chosen a box in this way, a ball is chosen at random from this box. If the ball drawn is found to be red, find the probability that it is from box  $B_2$ . May 17, 18

08. Three boxes numbered I, II, III contain the balls as follows.

Box	White	Black	Red
I	1	2	3
II	2	1	1
III	4	5	3

One box is randomly selected and a ball is drawn from it. If the ball is red, then find the probability that it is from box II. AP Mar 16

09. Three Urns have the following composition of balls

Urn I : 1 white, 2 black

Urn II : 2 white, 1 black

Urn III : 2 white, 2 black

One of the Urns is selected at random and a ball is drawn, it turns out to be white. Find the probability that it came from urn III. Mar 2017

10. Suppose that an urn  $B_1$  contains 2 white and 3 black balls and another urn  $B_2$  contains 3 white and 4 black balls. One urn is selected at random and a ball is drawn from it. If the ball drawn is found black, find the probability that the urn chosen was  $B_1$ . AP Mar 17; TS Mar 19

### SHORT ANSWER QUESTIONS (4 MARKS)

11. Find the probability that a non-leap year contains

i) 53 Sundays

Mar 09,12

ii) 52 Sundays Only

Mar 03, 09

12. The probability that Australia wins a match against India in a cricket game is given to be  $1/3$ . If India and Australia play 3 matches what is the probability that

i) Australia will loose all the 3 matches ii) Australia will win atleast one match. May 12

13. A, B, C are three horses in a race. The probability of A to win the race is twice that of B, and probability of B is twice that of C. What are the probabilities of A, B and C to win the race.

Mar 07, May 09, Mar 13, 14, May 14, Mar 18

**Sr. INTER MATHS-A**

14. A and B are events with  $P(A) = 0.5$ ,  $P(B) = 0.4$  and  $P(A \cap B) = 0.3$ . Find the probability that  
a) A does not occur, b) neither A nor B occurs. Mar 10; AP Mar 16, 17, 18, May 18
15. If A and B are two events with  $P(A \cup B) = 0.65$ ,  $P(A \cap B) = 0.15$ . Find the value of  $P(\bar{A}) + P(\bar{B})$ . Mar 2005, May 2011, 15; TS Mar 15; May 18
16. The probability for a contractor to get a road contract is  $\frac{2}{3}$  and to get a building contract is  $\frac{5}{9}$ . The probability to get atleast one contract is  $\frac{4}{5}$ . Find the probability that he gets both the contracts. AP Mar 16, May 22
17. In a committee of 25 members, each member is proficient either in mathematics or in statistics or in both. If 19 of these are proficient in mathematics, 16 in statistics, find the probability that a person selected from the committee is proficient in both. TS Mar 16
18. A, B, C are 3 newspapers from a city. 20% of the population read A, 16% read B, 14% read C, 8% read both A and B, 5% read both A and C, 4% read both B and C and 2% read all the three. Find the percentage of the population who read atleast one newspaper. Mar 10, May 17, 18
19. If one ticket is randomly selected from the tickets numbered 1 to 30, then find the probability that the number on the tickets is (i) a multiple of 5 or 7. (ii) a multiple of 3 or 5. Mar 08
20. Find the probability of drawing an ace or a spade from a well shuffled pack of 52 playing cards. TS Mar 15
21. A problem in calculus is given to two students A and B whose chances of solving it are  $\frac{1}{3}$  and  $\frac{1}{4}$ . Find the probability of the problem being solved if both of them try independently. Mar 05, May 09, 15; AP Mar 15, 18; TS May 22
22. A speaks truth in 75% of the cases and B in 80% cases. What is the probability that their statements about an incident do not match. June 10; AP & TS Mar 16; AP Aug 22
23. If A and B are independent events with  $P(A) = 0.2$ ,  $P(B) = 0.5$ . Then find  
a)  $P(A/B)$  b)  $P(B/A)$  c)  $P(A \cap B)$  d)  $P(A \cup B)$   
Mar 2006, 09, May 11, Mar 12, May 18; AP May 22
24. If A and B be independent events with  $P(A) = 0.6$ ,  $P(B) = 0.7$ , then compute  
a)  $P(A \cap B)$ , b)  $P(A \cup B)$  c)  $P(B/A)$  d)  $P(A^c \cap B^c)$  May 14, 16, 17, Mar 17, 18,
25. If A and B are independent events of a random experiment, then show that  $\bar{A}$  and  $\bar{B}$  are also independent. May 16

## 10. RANDOM VARIABLES & PROBABILITY DISTRIBUTIONS

### LONG ANSWER QUESTIONS (7 MARKS)

01. If 'X' is a random variable with the probability distribution  $P(X = k) = \frac{(k+1)c}{2^k}$ , ( $k = 0, 1, 2, \dots$ ), then find 'c' and  $P(1 < x < 3)$ . AP Mar 18
02. A random variable X has the following probability distribution.
- |              |   |    |    |    |    |
|--------------|---|----|----|----|----|
| $X = x_i$    | 1 | 2  | 3  | 4  | 5  |
| $P(X = x_i)$ | k | 2k | 3k | 4k | 5k |
- Find i) k ii) mean iii) variance of X Mar 10, 12, May 13, Mar 14, May 14, Mar 17
03. A cubical die is thrown. Find the mean and variance of x, giving the number on the face that shows up. AP May 15, 16

04. Let 'x' be a random variable such that  $P(X = -2) = P(X = -1) = P(X = 2) = P(X = 1) = \frac{1}{6}$  and

$P(X = 0) = \frac{1}{3}$ , find the mean and variance of 'x'.

	$X = x_i$	-3	-2	-1	0	1	2	3
05.	$P(X = x_i)$	1/9	1/9	1/9	1/3	1/9	1/9	1/9

is the probability distribution of a random variable 'x'. Find the variance of 'x'.

06. A random variable X has the following probability distribution.

$X = x_i$	-2	-1	0	1	2	3
$P(X = x_i)$	0.1	k	0.2	2k	0.3	k

Find 'k', mean and variance of X.

Mar 06, 17

07. A random variable X has the following probability distribution.

$X = x_i$	0	1	2	3	4	5	6	7
$P(X = x_i)$	0	k	2k	2k	3k	$k^2$	$2k^2$	$7k^2 + k$

Find (i) k, (ii) the mean of X, (iii)  $P(0 < X < 5)$

Mar 09, Jun 10, May 09, 12, ; AP Mar 16; TS Mar 16, 18, May 16, 17, 18, 22

08. The range of a random variable X is {0,1,2}.

Given that,  $P(X = 0) = 3c^3$ ,  $P(X = 1) = 4c - 10c^2$ ,  $P(X = 2) = 5c - 1$ .

Find i) the value of c ii)  $P(X < 1)$ ,  $P(1 < X \leq 2)$  and  $(0 < X \leq 3)$

Mar 05, 11, 13, May 09, 11; AP Mar 15, May & Aug 22; TS Mar 15

09. Two dice are rolled at random. Find the probability distribution of the sum of the numbers on them. Find the mean of the random variable.

May 18, TS May 22

10. One in 9 ships is likely to be wrecked, when they are set on sail. When 6 ships are on sail, find the probability for (i) atleast one will arrive safely (ii) exactly three will arrive safely.

Mar 07

11. Find the probability of guessing atleast 6 out of 10 answers in

i) true or false type examination ii) multiple choice with four possible answers.

12. Five coins are tossed 320 times. Find the frequencies of the distribution of number of heads and tabulate the result.

### VERY SHORT ANSWER QUESTIONS (2 MARKS)

13. Define mean and variance of a random variable.

14. A random variable 'X' has the range {1,2,3,...}. If  $P(X = k) = \frac{c^k}{k!}$  for  $k = 1, 2, 3, \dots$ , then find 'c' and  $P(0 < X < 3)$ .

TS Mar 15

15. Find the constant 'c', so that  $F(x) = c \left( \frac{2}{3} \right)^x$ ,  $x = 1, 2, 3, \dots$  is the p.d.f of a discrete random variable 'X'.

16. Define Binomial distribution.

17. The mean and variance of a binomial distribution are 4 and 3 respectively. Find  $P(X \geq 1)$ .  
Mar 08, 11, May 11; AP May 15, Mar 16, 17 May 17; TS Mar 15, May 22
18. For a binomial distribution with mean 6 and variance 2, find the first two terms of the distribution.  
AP May 22
19. If the mean and variance of a binomial variable  $X$  are 2.4 and 1.44 respectively, find  $P(1 < X \leq 4)$ .  
Mar 09, 18, May 06, 09; TS May 15, 17
20. If the difference between the mean and the variance of a binomial variate is  $(5/9)$ , then find the probability for the event of 2 successes, when the experiment is conducted 5 times.
21. The probability that a person chosen at random is left handed (in hand writing) is 0.1. What is the probability that in a group of 10 people, there is one who is left handed ?  
AP Mar 15, 17; TS Mar 16
22. It is given that 10% of the electric bulbs manufactured by a company are defective. In a sample of 20 bulbs, find the probability that more than 2 are defective.
23. On an average, rain falls on 12 days in every 30 days. Find the probability that rain will fall on just 3 days of a given week.
24. Define poisson distribution.
25. A poisson variable satisfies  $P(X = 1) = P(X = 2)$ , find  $P(X = 5)$ .  
Mar 10, 14, 18, May 13, 14, 16, 18; TS May 22; AP Aug 22
26. In a city 10 accidents take place in a span of 50 days, assuming that the number of accidents follows the poisson distribution, find the probability that there will be three or more accidents in a day.

\*\*\* THE END \*\*\*