IIT Foundation Material

SECTION - I

Straight Objective Type

This section contains multiple choice questions. Each question has 4 choices (A), (B), (C), (D), out of which ONLY ONE is correct. Choose the correct option.

1. If x + y = 7 and xy = 12 then the value of $x^2 + y^2$ is
   (a) 84 (b) 25 (c) 5 (d) 49

2. If $x + \frac{1}{x} = 3$ and then $x^2 + \frac{1}{x^2}$ is
   (a) 5 (b) 7 (c) 6 (d) 8

3. If a + b + c and ab + bc + ca = 26 then the value of $a^2 + b^2 + c^2$ is
   (a) 24 (b) 25 (c) 29 (d) 96

4. If a – b = 2 and ab = 15 then $a^3 + b^3$ is
   (a) 9 (b) 89 (c) 98 (d) 86

5. If $(x+1)(x+2)(x+3) = x^3 + kx^2 + 11x + 6$ then the value of K is
   (a) 3 (b) 4 (c) 5 (d) 6

6. If $x^3 - 3x^2 + 2x - 5$ is divided by x – 2 then the remainder is
   (a) 5 (b) – 5 (c) 4 (d) – 4

7. If a + b + c = 0 then $a^3 + b^3 + c^3$ is
   (a) 0 (b) 3 abc (c) $a^2 - b^2$ (d) – 4

8. The value of $\frac{1.3 \times 1.3 + 2.6 \times 2.7 + 2.7 \times 2.7}{(2.7 \times 2.7) - 1.3 \times 1.3}$
   (a) 1 (b) $\frac{10}{3.5}$ (c) 2 (d) $\frac{5}{2.7}$

9. If $(a^2 + b^2)^3 = (a^3 + b^3)^2$ and $ab \neq 0$ then the numerical value of $\frac{a}{b} + \frac{b}{a}$ is

(a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $\frac{4}{3}$ (d) $\frac{5}{3}$

10. If $x=\frac{\sqrt{3}-1}{\sqrt{3}+1}, y=\frac{\sqrt{3}+1}{\sqrt{3}-1}$ the value of $\frac{x^2-xy+y^2}{x^2+xy+y^2}$ is

(a) $\frac{13}{15}$ (b) $\frac{17}{15}$ (c) $\frac{15}{17}$ (d) $\frac{15}{13}$

11. If $3^{x-y}=27$ and $3^{y+1}=27^x$ then 2^{2x-y} is

(a) 0 (b) 1 (c) 2 (d) 4

12. If $zx+y=7z, yz+x=8z, x+y+z=12$ then (x, y, z) =

(a) $(4,6,2)$ (b) $(4,6,-2)$ (c) $(2,6,4)$ (d) None of these

13. The value of $\frac{119^2+119\times111+(111)^2}{119^3-111^3}$ is

(a) 8 (b) 1/8 (c) 230 (d) 1/300

14. If ax = by = cz and $\frac{b}{c}=\frac{c}{a}$ then $\frac{2z}{x+z}$ is

(a) $\frac{y}{x}$ (b) $\frac{x}{y}$ (c) $\frac{x}{z}$ (d) $\frac{z}{x}$

15. Factor of $4x^2-y^2+2x-2y-3xt$ are

(a) $(x+y)(4x+y-2)$ (b) $(x-y)(4x-y+2)$

(c) $(x+y)(4x-y-2)$ (d) $(x-y)(4x+y+2)$

16. If $x^4+ax^2+bx^2+cx+d+(x^2+px+q)^2$ then 2q =?

(a) $\frac{a}{2c}$ (b) $\frac{2c}{a}$ (c) $\frac{b^2-a^2}{4}$ (d) None of these

17. If $1+3^{x-1}=4^{x-2}$ then x is equal to

(a) (- 4, 1) (b) (4, - 1) (c) $\left(-\frac{1}{4},1\right)$ (d) $\left(\frac{1}{4},1\right)$

18. If $x=\frac{\sqrt{3}}{2}$ then the value of $\frac{1+x}{1+\sqrt{1+x}}+\frac{1-x}{1-\sqrt{1-x}}$ is

(a) 2 (b) 1 (c) 0 (d) None of these

19. If $2x - 3y - z = 0$ and $x + 3y - 14z = 0$ $z \neq 0$ the numerical value of $\frac{x^2+3xy}{y^2+z^2}$ is

(a) 7 (b) 2 (c) 0 (d) – 2

20. If a, b, c are positive integer then $(a+b)(b+c)(c+a)$ is greater than

(a) 2 abc (b) 4 abc (c) 6 abc (d) 8 abc

21. If $xy = -42$, $yz = 30$, $zx = -35$ the values of x, y, z are respectively given by

(a) 7, 6, – 5 (b) – 7 , – 6, 5 (c) 7, 6, 5 (d) 7, - 6, – 5

22. $a^x=(x+y+z)^y, a^y=(x+y+z)^z, a^z=(x+y+z)^x,$

(a) $x=y=z=\frac{a}{3}$ (b) $x+y+z=\frac{a}{3}$

(c) $x+y+z=0$ (d) None

23. If $p=\sqrt{7}-\sqrt{5}$ and $q=\sqrt{13}-\sqrt{11}$ then

(a) p > q (b) p < q (c) p = q (d) None

24. The equation $x-\frac{2}{x-1}=1-\frac{2}{x-1}$ has

(a) no root (b) one root

(c) 2 equal roots (d) infinite number of roots

25. L.C.M. of $2x+2, 3x^2-12x^2, 4x^2+12x=8$ is

(a) no root (b) one root

(c) 2 equal roots (d) infinite number of roots

26. If the roots of $x^2 - 2mx + m^2 - 1 = 0$ lies between – 2 and 4 then

(a) $-3 \le m \le 3$ (b) $-3 \le m \le 3$ (c) $-1 \le m \le 5$ (d) $-1 \le m \le 3$

27. If $x = 7 + 4\sqrt{3}$ the xy = 1 then $\frac{1}{x^2} + \frac{1}{y^2}$ is equal to

(a) 64 (b) 134 (c) 194 (d) 234

28. If $2^{x-2} = 5^{2-x}$ then x is equal to

(a) 1 (b) 2 (c) 4 (d) 6

29. If $4^x.5^{y-18}$ and $3 \times 0^x - 10$, then (x, y) is equal to

(a) (1, 0) (b) (4, 0) (2, 0) (d) (0, 2)

30. If $y = \frac{1-t^2}{1+t^2}$ then 't' is equal to

(a) $\left(\frac{1-y}{y+1}\right)^2$ (b) $\sqrt{\frac{1-y}{y+1}}$ (c) $\sqrt{\frac{1-y}{2}}$ (d) $\sqrt{\frac{(1-y)^2}{4}}$

SECTION - II

Assertion - Reason Questions

This section contains certain number of questions. Each question contains STATEMENT-1 (Assertion) and STATEMENT - 2 (Reason). Each question has 4 choices (a), (b), (c) and (d) out of which ONLY ONE is correct. Choose the correct option.

31. STATEMENT-1: Square root of $a^2 + 4ab + 4b^2$ is a + 2b

because

STATEMENT - 2: $(a + 2b)^2 = a^2 + 4b^2 + 4ab$

(a) Statement - 1 is True, Statement - 2 is True; Statement - 2 is a correct explanation for statement - 1

(b) Statement - 1 is True, Statement - 2 is True; Statement - 2 is NOT a correct explanation for Statement - 1

(c) Statement - 1 is True, Statement - 2 is False

(d) Statement - 1 is False, Statement - 2 is True

32. STATEMENT-1: $\sum a^2b = a^2b + b^2a$

because

STATEMENT - 2: $\prod_{a,b,c}\left(a^2+b^2\right) = \left(a^2+b^2\right)\left(b^2+c^2\right)\left(c^2+a^2\right)$

(a) Statement - 1 is True, Statement - 2 is True; Statement - 2 is a correct explanation for statement - 1

(b) Statement - 1 is True, Statement - 2 is True; Statement - 2 is NOT a correct explanation for Statement - 1

(c) Statement - 1 is True, Statement - 2 is False

(d) Statement - 1 is False, Statement - 2 is True

33. STATEMENT-1: The roots of $5x^2 - 7x - 36 = 0$ are $\frac{9}{5}$ and $-\frac{4}{3}$

because

STATEMENT - 2: $\left(a+b\right)^2 = \left(a-b\right)^2 = 4ab$

(a) Statement - 1 is True, Statement - 2 is True; Statement - 2 is a correct explanation for statement - 1

(b) Statement - 1 is True, Statement - 2 is True; Statement - 2 is NOT a correct explanation for Statement - 1

(c) Statement - 1 is True, Statement - 2 is False

(d) Statement - 1 is False, Statement - 2 is True

34. STATEMENT-1: If x + y = 7, xy = 12, then $x^2 + y^2 = 25$

because

STATEMENT - 2: $(a+b)^2 = a^2 + b^2 + 2ab$

(a) Statement - 1 is True, Statement - 2 is True; Statement - 2 is a correct explanation for statement - 1

(b) Statement - 1 is True, Statement - 2 is True; Statement - 2 is NOT a correct explanation for Statement - 1

(c) Statement - 1 is True, Statement - 2 is False

(d) Statement - 1 is False, Statement - 2 is True

35. STATEMENT-1:

$(a+b+c) = (a^2 + b^2 + c^2 - ab - bc - ca) = a^3 + b^3 + c^3 - 3abc$

because

STATEMENT - 2: $(x-3)(x-4) = x^2 - 7x + 12$

(a) Statement - 1 is True, Statement - 2 is True; Statement - 2 is a correct explanation for statement - 1

(b) Statement - 1 is True, Statement - 2 is True; Statement - 2 is NOT a correct explanation for Statement - 1

(c) Statement - 1 is True, Statement - 2 is False

(d) Statement - 1 is False, Statement - 2 is True

36. STATEMENT-1: $(x+9)(x+3)x^2 = 12x + 27$

because

STATEMENT - 2: $(x+a)(x+b) = x^2 + (a+b)x + ab$

(a) Statement - 1 is True, Statement - 2 is True; Statement - 2 is a correct explanation for statement - 1

(b) Statement - 1 is True, Statement - 2 is True; Statement - 2 is NOT a

correct explanation for Statement - 1

(c) Statement - 1 is True, Statement - 2 is False

(d) Statement - 1 is False, Statement - 2 is True

37. STATEMENT-1: If $a+b+c=0$ and $a^3+b^3+c^3=3abc$

because

STATEMENT - 2: $(a-b)^3+(b-c)^3+(c-b)^3=3(a-b)(b-c)(c-a)$

(a) Statement - 1 is True, Statement - 2 is True; Statement - 2 is a correct explanation for statement - 1

(b) Statement - 1 is True, Statement - 2 is True; Statement - 2 is NOT a correct explanation for Statement - 1

(c) Statement - 1 is True, Statement - 2 is False

(d) Statement - 1 is False, Statement - 2 is True

38. STATEMENT-1: $a^3+b^3=(a+b)(a^2+ab+b^2)$

because

STATEMENT - 2: $a^3-8+(a-2)$si a^2+2a+4

(a) Statement - 1 is True, Statement - 2 is True; Statement - 2 is a correct explanation for statement - 1

(b) Statement - 1 is True, Statement - 2 is True; Statement - 2 is NOT a correct explanation for Statement - 1

(c) Statement - 1 is True, Statement - 2 is False

(d) Statement - 1 is False, Statement - 2 is True

39. STATEMENT-1:

$$a^2+b^2+c^2-ab-bc-ca=\frac{1}{2}\left[(a-b)^2+(b-c)^2+(c-a)^2\right]$$

because

STATEMENT - 2: $x+\frac{1}{x}=3$ then the value of $x^3+\frac{1}{x^3}=18$

(a) Statement - 1 is True, Statement - 2 is True; Statement - 2 is a correct explanation for statement - 1

(b) Statement - 1 is True, Statement - 2 is True; Statement - 2 is NOT a correct explanation for Statement - 1

(c) Statement - 1 is True, Statement - 2 is False

(d) Statement - 1 is False, Statement - 2 is True

40. STATEMENT-1: $(a+b)^2+(a-b)^2=2(a^2+b^2)$

because

STATEMENT - 2: $(x+y+z)^2=x^2+y^2+z^2+2(xy+yz+zx)$

(a) Statement - 1 is True, Statement - 2 is True; Statement - 2 is a correct explanation for statement - 1

(b) Statement - 1 is True, Statement - 2 is True; Statement - 2 is NOT a correct explanation for Statement - 1

(c) Statement - 1 is True, Statement - 2 is False

(d) Statement - 1 is False, Statement - 2 is True

SECTION - III

Linked Comprehension Type

This section contains paragraphs. Based upon each paragraph multiple choice questions have to be answered. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE is correct. Choose the correct option.

Method of factorization:

(1) Multiply the coefficient of x^2 by the constant term.
(2) Break this product into two factors such that their sum is equal to the coefficient of x.
(3) Rewrite the x term as the sum of two terms with these coefficients.
(4) Then go through the factors.

41. Factor of $2x^2+7x+6$

(a) x + 2 (b) x + 3 (c) 2x + 4 (d) x + 6

42. If one factor of $3x^2-11x+6$ is x – 3 then the other factor is

(a) x + 4 (b) 3x + 1 (c) 3x – 2 (d) (3x – 6)

43. Factor of $12x^2-17x+6$ is

(a) 3x – 2 (b) x + 12 (c) 4x + 4 (d) x + 6

$$(a+b+c)(a^2+b^2+c^2-ab-bc-ca)=a^3+b^3+c^3-3abc$$

$$(x+a)(x+b)(x+c)x^3+x^3(a+b+c)+(ab+bc+ca)+abc$$

$$(ax+b)(cx+d)=acx^2+x(ad+bc)+bd$$

44. The value of $a^3-b^3+c^3-3abc+a-b-c$ is

(a) $a^2+b^2+c^2$ (b) $a^2+b^2+c^2-ab+bc-ac$

(c) $a^2+b^2+c^2+ab-bc+ac$ (d) $a^2+b^2+c^2-ab-bc+ac$

45. The product of (2x + 3) (3x + 5) is

(a) $6x^2+19x+15$ (b) $3x^2+2x+6$

(c) $6x^2+12x+15$ (d) $6x^2+5x+15$

46. $(x+2)(x+3)(x+4)=x^3+x^2.k+mx+l$ then the value of k + l is

(a) 24 (b) 33 (c) 32 (d) 28

In the multiplications of polynomials the degree of the product equals the sum of the degrees polynomials closed under both addition and multiplications.

If A = 2x + 3, B = 3x – 5, C = x^2+3x-1 then

47. $B\times C$ is

(a) $3x^2-x^2+1$ (b) $3x^3+4x^2-18x+5$

(c) x^3-2x^2+7+1 (d) None

48. $A\times B$ is

(a) $6x^2-x-15$ (b) $x^2-4x+12$

(c) $2x^2-x+1$ (d) None

49. $(A\times B)+C$ is

(a) $5x^2-2x-4$ (b) x^2-2x-8

(c) $7x^2+2x-16$ (d) None

In case of division of polynomials, the degree of the Quotient is equal to the degree of the dividend minus the degree of the divisor. The remainder may be zero or its degree is at least one less than that of the divisor.

50. When x^3+3x^2-2x-5 is divided by x + 2 then the remainder is

(a) x + 2 (b) 3 (c) x - 5 (d) 4

51. When $x^3 - 5x^2 + 11x - 10$ is divided by x – 2 then the remainder is

(a) 0 (b) 1 (c) 2 (d) 4

52. When $x^4 - 4x^2 - 13x - 4$ is divided by $x^2 - 2x + 3$ then Quotient is

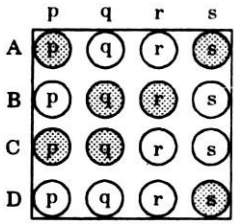
(a) $x^2 - x - 3$ (b) x – 2 (c) x + 4 (d) $x^2 + 2x - 3$

SECTION - IV

Matrix - Match Type

This section contains Matrix-Match type questions. Each question contains statements given in two columns which have to be matched. Statements (a, b, c, d) in Column I have to be matched with statements (p, q, r, s) in Column II. The answers to these questions have to be appropriately bubbled as illustrated in the following example.

If the correct matches are a-p, a-s, b-q, b-r, c-p, c-q and d-s, then the correctly bubbled 4 x 4 matrix should be as follows:



53.

Column I	**Column II**
(a) $\left(a^3 - b^3\right) \div \left(a^2 + ab + b^2\right)$	(p) a – b
(b) $\left(a^2 - b^2\right) \div \left(a - b\right)$	(q) a + b
(c) $\left(a+b\right)^2 + \left(a-b\right)^2$	(r) $2\left(a^2 + b^2\right)$
(d) $\left(a+b\right)^2 - \left(a-b\right)^2$	(s) 4ab

54.

Column I	**Column II**
(a) $a^2+2b+ab+2a$	(p) $(a+b)(a+2)$
(b) $a^2+b^2+c^2+2ab+2bc+2ca$	(q) $(a+b+c)^2$
(c) $(z+1)(x+y)$	(r) $(x+yz+xz+y)$
(d) $1+x+y+z+xy+yz+zx+xyz$	(s) $(1+x)(1+y)(1+z)$

55.

Column I	**Column II**
(a) x^2+5x+6	(p) $(x+2)(x+3)$
(b) $x^2+21x+90$	(q) $(x+6)(x+15)$
(c) $x^2-24x-180$	(r) $(x-30)(x+6)$
(d) $x^2-4\sqrt{2}x+6$	(s) $(x-\sqrt{2})(x-3\sqrt{2})$

56.

Column I	**Column II**
(a) $a^4+a^2b^2+b^4$	(p) $(a^2+ab+b^2)(a^2-ab+b^2)$
(b) x^4+6x^2+1	(q) $(x^2+2x-1)(x^2-2x-1)$
(c) $a^2+b^2+2bc-c^2$	(r) $(a+bc-c)(a-b+c)$
(d) x^2-a^2+4a-4	(s) $(x+a-2)(x-a+2)$

57.

Column I	**Column II**
(a) $\frac{x^2-1}{x}=4$ then $\frac{x^6-1}{x^3}$	(p) 76
(b) $c-\frac{1}{c}=5$ then $c^3-\frac{1}{c^3}$	(q) 140
(c) $\left(\frac{x}{y}+\frac{y}{x}\right)\left(\frac{x}{y}-\frac{y}{x}\right)$	(r) $\frac{x^2}{y^2}-\frac{y^2}{x^2}$
(d) $(53497)^2-(53487)^2$	(s) 1069840