SELECTED TWO MARKS QUESTIONS FOR QUARTERLY EXAMINATION – 2022

1. RELATIONS & FUNCTIONS

(i) CARTESIAN PRODUCT

1. If A = {1, 3, 5} and B = {2, 3} then show that n(A × B) = n(B × A) = n(A) × n(B)
2. Find A × B, B × A and A × A if A = {m, n}; B = Ø
3. If A × B = {(3, 2), (3, 4), (5, 2), (5, 4)} then find A and B
4. If B × A = {(- 2, 3), (- 2, 4), (0, 3), (0, 4), (3, 3), (3, 4) then find A and B
5. Let A = {1, 2} and B = {1, 2, 3, 4}, C = {5, 6} and D = {5, 6, 7, 8}. Verify whether A × C is a subset of B × D.

(ii) RELATION

6. Let A = {1, 2, 3, 7} and B = {3, 0, -1, 7}, which of the following are relation from A to B?

   (i) R_1 = {(2, 1), (7, 1)} (ii) R_2 = {(-1. 1)} (iii) R_3 = {(2, -1), (7, 7), (1, 3)}

7. Let A = {1, 2, 3, 4,……., 45} and R be a relation defined as "is square of" on A. Write R as a subset of A × A. Also find the domain and range of R
8. A relation R is given by the set {(x, y)/ y = x + 3, x ∈ {0, 1, 2, 3, 4, 5}}. Determine its domain and range.
9. Represent the relation R = {(x, y)/ y = x + 3, x, y are natural numbers < 10} by (a) an arrow diagram, (b) a set in roster form and (c) a graph

(iii) FUNCTIONS

10. Let X = {1, 2, 3, 4} and Y = {2, 4, 6, 8, 10} and R = {(1, 2), (2, 4), (3, 6), (4, 8)}. Show that R is function and find its domain, co-domain and range?
11. A relation f is defined by $f(x) = x^2 - 2$ where, x ∈ {-2, -1, 0, 3}

    (i) List the elements of f (ii) Is f a function?

12. Let f = {(x, y)/x, y ∈ N and y = 2x} be a relation on N. Find the domain, co-domain and range. Is this relation a function?
13. Given the function $f(x) = x^2 - 5x + 6$, evaluate (i) f(2) (ii) f(x – 1)
14. Given $f(x) = 2x - x^2$, find (i) f(x + 1) (ii) f(x) + f(1)
15. Let f(x) = 2x + 5. If x ≠ 0, then find $\frac{f(x+2) - f(2)}{x}$

(iv) TYPES OF FUNCTIONS

15. Show that the function f : N → N defined by f(x) = 2x – 1 is one – one but not onto.
16. Show that the function f : N → N defined by $f(m) = m^2 + m + 3$ is one – one function.

17. Let f be a function f : N → N defined by f(x) = 3x + 2 ϵ N (i) Find the images of 1, 2,3
    (ii) Find the pre – images of 29, 53 (III) Identify the type of function.
18. State whether the function f: R → R defined by f(x) = 2x + 1 is bijective or not.
19. Let f be a function from R to R defined by f(x) = 3x – 5. Find the values of a and b given that (a, 4) and (1, b) belong to f.
20. Let A = {- 1, 1} and B = {0, 2}. If the function f : A → B defined by f(x) = ax + b is an onto function? Find a and b.

(v) COMPOSITION OF FUNCTIONS

21. Find f∘g and g∘f when f(x) = 2x + 1 and $g(x) = x^2 - 2$.
22. f(x) = 2x – 1 and $g(x) = \frac{x+1}{2}$, show that f∘g = g∘f = x.
23. If $f(x) = \frac{x-1}{x+1}$, x ≠ - 1 show that $f(f(x)) = -\frac{1}{x}$, provided x ≠ 0

24. If f(x) = 3x – 2, g(x) = 2x + k and if f∘g = g∘f, then find the value of k.
25. If $f(x) = x^2 - 1$, g(x) = x – 2 find a if g∘f(a) = 1
26. Let $f(x) = x^2 - 1$. Find (i) f∘f (ii) f∘f∘f
27. Let f = {(- 1, 3), (0, - 1), (2, - 9)} be a linear function from z into z. Find f(x).

2. NUMBERS & SEQUENCES

(i) EULID'S DIVISION LEMMA

01. Prove that the product of two consecutive positive integers is divisible by 2.
02. When the positive integers a, b and c are divided by 13, the respective remainders are 9, 7 and 10. Show that a + b + c is divisible by 13.
03. A positive integer when divided by 88 gives the remainder 61. What will be the remainder when the same number is divided by 11?
04. Use Euclid's Division Algorithm to find the Highest Common Factor (HCF) of
    (i) 340 and 412 (ii) 10224 and 9648 (EACH)
05. Use Euclid's Division Algorithm to find the Highest Common Factor (HCF) of 84, 90, and 120
06. Find the greatest number that will divide 445 and 572 leaving remainders 4 and 5 respectively.
07. If the Highest Common Factor of 210 and 55 is expressible in the form 55x – 325, find x.
08. Prove that two consecutive positive integers are always Co-prime.

(ii) FUNDAMENTAL THEOREM OF ARITHMETIC

09. Can the number 6^n, n being a natural number end with the digit 5? Give reason for your answer.
10. If m, n are natural numbers, for what values of m, does $2^n \times 5^m$ ends in 5?
11. 'a' and 'b' are two positive integers such that $a^b \times b^a = 800$. Find 'a' and 'b
12. If $p_1^{x_1} \times p_2^{x_2} \times p_3^{x_3} \times p_4^{x_4} = 113400$ where p_1 , p_2 , p_3 , p_4 are primes in ascending order and x_1 , x_2 , x_3 , x_4 are integers, find the value of p_1 , p_2 , p_3 , p_4 and x_1 , x_2 , x_3 , x_4 .
13. Find the HCF of 252525 and 363636.
14. Find the greatest number consisting of 6 digits which is exactly divisible by 24, 15, 36?
15. Find the least number that is divisible by the first ten natural numbers

(iii) MODULAR ARITHMETIC

16. Find the remainders when 70004 and 778 is divided by 7
17. Find the least positive value of x such that (i) $67 + x \equiv 1 \pmod 4$ (ii) $98 \equiv (x + 4) \pmod 5$ (each)
18. Solve $5x \equiv 4 \pmod 6$
19. Solve $3x - 2 \equiv 0 \pmod{11}$
20. What is the time 100 hours after 7 a.m.?
21. What is the time 15 hours before 11 p.m.?
22. Find the remainder when 2^{81} is divided by 17.
23. Compute x, such that $10^4 \equiv x \pmod{19}$.

(iv) SEQUENCES

24. Find the first four terms of the sequence whose n^{th} term are given by
    (i) $a_n = n^3 - 2$ (ii) $a_n = (-1)^{n+1} n(n + 1)$ (iii) $a_n = 2n^2 - 6$ (EACH)
25. Find a_8 and a_{15} whose n^{th} term is a_n =
$$\begin{cases} \frac{n^2 - 1}{n + 3} \text{ ; n is even, n } \epsilon \text{ N} \\ \frac{n^2}{2n + 1} \text{ ; n is odd, n } \epsilon \text{ N} \end{cases}$$
26. Find the five terms of the following sequence. $a_1 = 1$, $a_2 = 1$, $a_n = \frac{a_{n-1}}{a_{n-2} + 3}$; $n \geq 3$, $n \epsilon N$
27. If $a_1 = 1$, $a_2 = 1$ and $a_n = 2\, a_{n-1} + a_{n-2}$ $n \geq 3$, $n \epsilon N$, then find the first six terms of the sequence.

(v) ARITHMETIC PROGRESSUON

28. Write an A.P. whose first term is 20 and common difference is 8
29. Find the first term and common difference of the Arithmetic Progressions whose n^{th} terms are given below (i) $t_n = -3 + 2n$ (ii) $t_n = 4 - 7n$ (EACH)
30. Find nth term (general term) of an A.P. given by 3, 15, 27, 39,...
31. Find the 19th term of an A.P. - - 11, - 15 - 19.....
32. Find the number of terms in the A.P. 3, 6, 9, 12,..., 111.

33. Which term of an A.P. 16, 11, 6, 1,... is -54 ?

34. If 3 + k, 18 -k, 5 1 k + are in A.P. then find k.

(vi) ARITHMETIC SERIES

34. Find the sum of first 15 terms of the A. P. 8, $7\frac{1}{4}$, $6\frac{1}{2}$, $5\frac{3}{4}$,.....

35. Find the sum of all natural numbers between 300 and 600 which are divisible by 7.

36. Find the sum of 6 + 13 + 20 + ... + 97

37. Find the sum of 0.40 + 0.43 + 0.46 + ... + 1.

38. How many terms of the series 1 + 5 + 9 + ... must be taken so that their sum is 190?

39. Find the sum of all odd positive integers less than 450.

(vi) GEOMETRIC PROGRESSUON

40. Find the 8th term of the G.P. 9, 3, 1, ...

41. In a G.P. 729, 243, 81,... find t_7 .

42. Find x so that x + 6, x + 12 and x + 15 are consecutive terms of a Geometric Progression.

43. Find the number of terms in The G.P. 4, 8, 16, ... , 8192 ?

44. Find the number of terms in the G.P. $\frac{1}{3}, \frac{1}{9}, \frac{1}{27}, \ldots\ldots \frac{1}{2187}$.

45. If a, b, c are in A.P. then show that 3a, 3b, 3c are in G.P.

(vii) GEOMETRIC SERIES

46. Find the sum of 8 terms of the G.P. 1, –3, 9, –27, ...

47. Find the sum of first six terms of the G.P. 5, 15, 45, ...

48. Find the sum to infinity of 9 + 3 + 1 + ...

49. Find the sum 3 + 1 + ...

50. How many terms of the series 1 + 4 + 16 + ... make the sum 1365 ?

51. Find the first term of G.P. in which S6 = 4095 and r = 4.

52. If the first term of an infinite G.P. is 8 and its sum to infinity is $\frac{32}{3}$ then find the common ratio.

(viii) SPECIAL SERIES

53. Find the value of (i) 1 + 2 + 3 + ... + 50 (ii) 2 + 4 + 6 + ... + 80 (iii) 16 + 17 + 18 + ... + 75 (Each)

54. Find the sum of (i) $1^2 + 2^2 + ... + 19^2$ (ii) 1 + 4 + 9 + 16 + ... + 225 (Each)

55. Find the sum of (i) 1 + 3 + 5 + ... + 71 (ii) 1 + 3 + 5 + ... + 55

56. Find the sum of (i) $1^3 + 2^3 + 3^3 + ... + 16^3$

57. If 1 + 2 + 3 + ... + n = 666 then find n.

58. If 1 + 2 + 3 + ... + k = 325, then find $1^3 + 2^3 + 3^3 + ... + k^3$

59. If $1^3 + 2^3 + 3^3 + ... + k^3 = 44100$, then find 1 + 2 + 3 + ... + k.

3. ALGEBRA

(i) GCD AND LCM OF POLYNOMIALS

60. Find the LCM of the following: (each)
(i) $4x^2y, 8x^3y^2$ (ii) $x^4 - 1, x^2 - 2x + 1$ (iii) $x^3 - 27, (x - 3)^2, x^2 - 9$ (iv) $2x^2 - 5x - 3, 4x^2 - 36$

61. Find the LCM and GCD for $(x^3 - 1)(x + 1), (x^3 + 1)$ and verify that $f(x) \times g(x) = LCM \times GCD$

62. Find the LCM of the polynomials $a^2 + 4a - 12, a^2 - 5a + 6$ whose GCD is $a - 2$.

(ii) REDUCTION OF RATIONAL EXPRESSION

63. Reduce each of the following rational expressions to its lowest form.

(i) $\frac{x^2 - 1}{x^2 + x}$ (ii) $\frac{x^2 - 11x + 18}{x^2 - 4x + 4}$ (Each)

(iii) EXCLUDED of RATIONAL EXPRESSION

64. Find the excluded values of the following expressions (if any)

(i) $\frac{y}{y^2 - 25}$ (ii) $\frac{x^2 + 6x + 8}{x^2 + x - 2}$ [Each]

(iv) OPERATION ON RATIONAL EXPRESSION

65. Simplify: $\frac{p^2 - 10p + 21}{p - 7} \times \frac{p^2 + p - 12}{(p - 3)^2}$

66. Simplify: (i) $\frac{x + 4}{3x + 4y} \times \frac{9x^2 - 16y^2}{2x^2 + 3x - 20}$ (ii) $\frac{x^3 - y^3}{3x^2 + 9xy + 6y^2} \times \frac{x^2 + 2xy + y^2}{x^2 - y^2}$

67. Find $\frac{x^2 - 16}{x + 4} \div \frac{x - 4}{x + 4}$

68. Simplify: $\frac{b^2 + 3b - 28}{b^2 + 4b + 4} \div \frac{b^2 - 49}{b^2 - 5b - 14}$

69. If a polynomial $p(x) = x^2 - 5x - 14$ is divided by another polynomial $q(x)$ we get $\frac{x - 7}{x + 2}$, find $q(x)$.

70. Simplify: (i) $\frac{x^2}{x - y} + \frac{y^2}{y - x}$ (ii) $\frac{x + 2}{x + 3} + \frac{x - 1}{x - 2}$ [Each]

71. Subtract $\frac{1}{x^2 + 2}$ from $\frac{2x^3 + x^2 + 3}{(x^2 + 2)^2}$

72. Which rational expression should be subtracted from $\frac{x^2 + 6x + 8}{x^3 + 8}$ to get $\frac{3}{x^2 - 2x + 4}$

(v) To find the square root of a given expression

73. Find the square root of (i) $\frac{144a^8b^{12}c^{16}}{81f^{12}g^4h^{14}}$ (ii) $\frac{121(a+b)^8(x+y)^8(b-c)^8}{81(b-c)^4(a-b)^{12}(b-c)^4}$ [Each]

74. Find the square root of $16x^2 + 9y^2 - 24xy + 24x - 18y + 9$

75. Find the square root of $1+\frac{1}{x^6}+\frac{2}{x^3}$

(vi) QUADRATIC EQUAGTION

76. Write down the quadratic equation in general form for which sum and product of the roots are given below: (i) 9, 14 (ii) $-\frac{7}{2},\frac{5}{2}$ (iii) $-\frac{3}{5},-\frac{1}{2}$ [Each]

77. Find the sum and product of the roots for each of the roots for each of the following quadratic equations: (i) $x^2 + 8x - 65 = 0$ (ii) $2x^2 + 5x + 7 = 0$ (iii) $kx^2 - k^2x - 2k^3 = 0$ [Each]

78. Solve the following by using factorization method:
(i) $2m^2 + 19m + 30 = 0$ (ii) $3(p^2 - 6) = p(p + 5)$ (iii) $\sqrt{2}\,x^2 + 7x + 5\sqrt{2}$ [Each]

79. Solve the following by using completing square method:
(i) $x^2 - 3x - 2 = 0$ (ii) $9x^2 - 12x + 4 = 0$ [Each]

80. Solve the following by using formula method:
(i) $2x^2 - 3x - 3 = 0$ (ii) $3p^2 + 2\sqrt{5}\,p - 5 = 0$ (iii) $36y^2 - 12ay + (a^2 - b^2) = 0$ [Each}

(vi) NATURE OF ROOTS OF A QUADRATIC EQUAGTION

81. Determine the nature of the roots for the following quadratic equations.
(i) $15x^2 + 11x + 2 = 0$ (ii) $x^2 - x - 1 = 0$ (iii) $\sqrt{2}\,t^2 - 3t + 3\sqrt{2} = 0$ [Each]

82. Find the value of 'k', for which the quadratic equation $kx^2 - (8k + 4)x + 81 = 0$ has real and equal roots.

(vii) RELATION BETWEEN ROOTS AND COEFFICIENT OF A QUADRATIC EQUATION

83. Write each of the following expression in terms of $\alpha + \beta$ and $\alpha\beta$. (i) $\frac{\alpha}{3\beta}+\frac{\beta}{3\alpha}$ (ii) $\frac{\alpha+3}{\beta}+\frac{\beta+3}{\alpha}$

84. The roots of the equation $2x^2 - 7x + 5 = 0$ are α and β. Without solving for the roots find $\frac{1}{\alpha}+\frac{1}{\beta}$

85. If α and β are the roots of $x^2 + 7x + 10 = 0$. Find the values of (i) $\alpha - \beta$ (ii) $\alpha^2 + \beta^2$ (iii) $\alpha^3 + \beta^3$

5. COORDINATE GEOMETRY

(i) AREA OF A TRIANGLE

86. Find the area of the triangle whose vertices are
(i) (-3, 5) , (5,6) and (5,-2) (ii) (–10, – 4), (–8, –1) and (–3, –5) [Each]
87. Show that the points P(–1.5, 3), Q(6, –2) , R(–3, 4) are collinear.
88. Determine whether the sets of points (a, b + c), (b, c + a) and (c, a + b) are collinear or not.
89. Vertices of given triangles are taken in order and their areas are provided below. In each case, find the value of 'p'.

Sl. No.	Vertices	Area (sq.units)
01	(0, 0), (p, 8), (6, 2)	20
02	(p, p), (5, 6), (5, - 2)	32

(ii) INCLINATION AND SLOPE OF A STRAIGHT LINE

90. (i) What is the slope of a line whose inclination is 30^0 ?
(ii) What is the inclination of a line whose slope is $\sqrt{3}$?
91. Find the slope of a line joining the given points (i) (– 6, 1) and (– 3, 2) (ii) $\left(\frac{-1}{3}, \frac{1}{2}\right)$ and $\left(\frac{2}{3}, \frac{3}{7}\right)$
92. Show that the points (– 3, – 4), (7, 2) and (12, 5) are collinear.
93. If the three points (3, –1), (a, 3) and (1, –3) are collinear, find the value of a.
94. The line through the points (–2, a) and (9, 3) has slope $\frac{1}{2}$. Find the value of a
95. The line r passes through the points (–2, 2) and (5, 8) and the line s passes through the points (–8, 7) and (–2, 0). Is the line r perpendicular to s?
96. The line p passes through the points (3, –2), (12, 4) and the line q passes through the points (6, –2) and (12, 2). Is p parallel to q?

(iii) EQUATIONS OF A STRAIGHT LINE

Given information	Equation of straight line
Line is parallel to X - axis	y = k
Line is parallel to Y - axis	x = k
Slope = m, y – intercept = c	y = mx + c

97. Find the equation of a straight line passing through the mid-point of a line segment joining the points (1,-5), (4,2) and parallel to (i) X axis (ii) Y axis
98. Find the equation of a straight line whose (i) Slope is 5 and y intercept is – 9
(ii) Inclination is 45° and y intercept is 11 [Each]

99. Calculate the slope and y intercept of the straight line $8x - 7y + 6 = 0$.

100. Find the value of 'a', if the line through (–2, 3) and (8, 5) is perpendicular to $y = ax + 2$.

101. The equation of a straight line is $2(x - y) + 5 = 0$. Find its slope, inclination and intercept on the Y axis.

Given information	Equation of straight line
Straight line has slop m and passes through the point (x_1, y_1)	$y - y_1 = m(x - x_1)$
Straight line passes through two points (x_1, y_1) and (x_2, y_2)	$\frac{x - x_1}{x_2 - x_1} = \frac{y - y_1}{y_2 - y_1}$
Straight line has x – intercept = a and y – intercept = b	$\frac{x}{a} + \frac{y}{b} = 1$

102. Find the equation of a line passing through the point (3, – 4) and having slope $-\frac{5}{7}$.

103. Find the equation of a straight line passing through (5, –3) and (7, – 4).

104. Find the intercepts made by the line $4x - 9y + 36 = 0$ on the coordinate axes.

105. The hill in the form of a right triangle has its foot at (19, 3). The inclination of the hill to the ground is 45˚. Find the equation of the hill joining the foot and top.

106. Find the equation of a line whose intercepts on the x and y axes are given below.

(i) 4, – 6 (ii) $-5, \frac{3}{4}$

107. Find the slope of the line which is (i) parallel to $3x - 7y = 11$ (ii) perpendicular to $2x - 3y + 8 = 0$.

108. Show that the straight lines $2x + 3y - 8 = 0$ and $4x + 6y + 18 = 0$ are parallel.

109. Show that the straight lines $x - 2y + 3 = 0$ and $6x + 3y + 8 = 0$ are perpendicular.

110. Check whether the given lines are parallel or perpendicular

(i) $\frac{x}{3} + \frac{y}{4} + \frac{1}{7} = 0$ and $\frac{2x}{3} + \frac{y}{2} + \frac{1}{10} = 0$ (ii) $5x + 23y + 14 = 0$ and $23x - 5y + 9 = 0$

111. If the straight lines $12y = -(p + 3)x + 12$, $12x - 7y = 16$ are perpendicular then find 'p'.

6. TRIGNOMETRY

(i) TRIGNOMETRIC IDENTITIES

112. Prove that $\tan \sin \tan^2\theta - \sin^2\theta = \tan^2\theta \sin^2\theta$

113. Prove that $\frac{\sin A}{1 + \cos A} = \frac{1 - \cos A}{\sin A}$

114. Prove that $1 + \frac{\cot^2\theta}{1 + \operatorname{cosec}\theta} = \operatorname{cosec}\theta$

115. Prove that $\sec\theta - \cos\theta = \tan\theta \sin\theta$

116. Prove that $\frac{\sec\theta}{\sin\theta} - \frac{\sin\theta}{\cos\theta} = \cot\theta$

117. Prove that $\sin^2A\cos^2B + \cos^2A\sin^2B + \cos^2A\cos^2B + \sin^2A\sin^2B = 1$

118. Prove that $(\operatorname{cosec}\theta - \sin\theta)(\sec\theta - \cos\theta)(\tan\theta + \cot\theta) = 1$

119. Prove that $\frac{\sin A}{1+\cos A} + \frac{\sin A}{1-\cos A} = 2 \operatorname{cosec} A$

120. Prove that $\tan^2 A - \tan^2 B = \frac{\sin^2 A - \sin^2 B}{\cos^2 A \cos^2 B}$

121. Prove that $\cot \theta + \tan \theta = \sec \theta \operatorname{cosec} \theta$

121. Prove that $\tan^4 \theta + \tan^2 \theta = \sec^4 \theta - \sec^2 \theta$

122. Prove that $\frac{1-\tan^2 \theta}{\cot^2 \theta - 1} = \tan^2 \theta$

123. Prove that $\frac{\cos \theta}{1+\sin \theta} = \sec \theta - \tan \theta$

124. Prove that $\sqrt{\frac{1+\sin\theta}{1-\sin\theta}} = \sec \theta + \tan \theta$

125. Prove that $\sqrt{\frac{1+\sin\theta}{1-\sin\theta}} + \sqrt{\frac{1-\sin\theta}{1+\sin\theta}} = 2 \sec \theta$

126. Prove that $\sqrt{\frac{1+\cos\theta}{1-\cos\theta}} = \operatorname{cosec} \theta + \cot \theta$

127. Prove that $\sec^6 \theta = \tan^6 \theta + 3 \tan^2 \theta \sec^2 \theta + 1$

128. Prove that $\sec^4 \theta (1 - \sin^4 \theta) - 2 \tan^2 \theta = 1$

129. Prove that $\frac{\cot \theta - \operatorname{cosec} \theta}{\cot \theta + \operatorname{cosec} \theta} = \frac{\operatorname{cosec} \theta - 1}{\operatorname{cosec} \theta + 1}$

130. Prove that $\frac{\sin A - \sin B}{\cos A + \cos B} + \frac{\cos A - \cos B}{\sin A + \sin B} = 0$

131. Prove that $\frac{\sin^3 A + \cos^3 A}{\sin A + \cos A} + \frac{\sin^3 A - \cos^3 A}{\sin A - \cos A} = 2$

4. GEOMETRY

1. Examples: 4.1, 4.4, 4.5, 4.8, 4.13, 4.15
2. Exercise 4.1: 1, 8,
3. Exercise 4.2: 3(i), (ii), 7, 8, 9