

1. Solve for x $2^{2x+1} \cdot 3^{2x+2} + 2^x \cdot 3^{x+2} - 2 = 0$ ans:-1
2. If $\log_9(x+3) - \log_9 \frac{1}{3} = \frac{3}{2}$. Find the value of x ans:-6
3. The sum of the first ten terms of an arithmetic series is 60, the sum of the first twenty-two terms is 220.
Find the common difference and the first term of the series. ans: $\frac{2}{3}, 3$
4. Find the sum to infinity of the geometric series $16 + 12 + 9 + \dots$ ans:64
5. A geometric series has first term 27 and common ratio $\frac{4}{3}$. Find the least number of terms the series can have if the sum exceeds 550. ans:8
6. Solve for x $\frac{(x-2)(x-3)}{(x-1)} \leq 0$ ans: $\{x : 2 \leq x \leq 3\}$
7. Find the inverse of the function defined by $h : x \rightarrow \frac{x}{x^2-1}$. ans: $h^{-1}(x) = \frac{1-\sqrt{1+4x^2}}{2x}$
8. A polynomial $p(x)$ is divided by $x^2 - x$ and the remainder is $a + bx$. Determine the constants a and b . ans: $p(0)$ and $(p(1) - p(0))$
9. Simplify $\frac{x^{\frac{1}{3}} + x^{-\frac{2}{3}}}{x^{\frac{1}{2}}}$ ans: $\frac{x+1}{x^2}$
10. Simplify $\left(\frac{x^a}{x^b}\right)^{a+b} \times \left(\frac{x^{a+b}}{x^{a-b}}\right)^{\frac{a^2}{b}}$ ans: $x^{3a^2-b^2}$
11. Find the positive square root of $49 - 12\sqrt{5}$ ans: $2 + 3\sqrt{5}$
12. Give the first three terms of $(1+x)^{15}$ in ascending order ans: $1 + 15x + 105x^2$
13. If $\log_a\left(1 + \frac{1}{8}\right) = l$, $\log_a\left(1 + \frac{1}{15}\right) = m$ and $\log_a\left(1 + \frac{1}{24}\right) = n$. Find $l - m - n$? ans: $\log_a\left(1 + \frac{1}{80}\right)$
14. Find the value of a if the function $a(x^2 + 2x - 8)$ has a minimum value of -27 . ans:3
15. If $\log_2 2a = c$, $2\log_8 a = b$ and $b - c = -4$. Find a ? ans:512
16. Express $\frac{1+2x+3x^2}{(1-x)(1+x^2)}$ in partial fractions ans: $\frac{3}{1-x} - \frac{2}{1+x^2}$
17. The roots of the equation $x^2 + 7x + 11 = 0$ are α and β , where $\alpha > \beta$. Find $\alpha - \beta$. ans: $\sqrt{5}$
18. Find the values of x such that $|2x - 3| > |x + 3|$ ans: $x > 6$
19. Solve the equation $x^{\frac{1}{3}} - 3x^{-\frac{1}{3}} = 2$. ans:-1
20. If the equation $x^2 - 3x + 1 = n(x - 3)$ has equal roots, find the possible value of n . ans:5
21. Find the greatest value of $-2x^2 + 4x + 3 = 0$ ans:1

22. Obtain the set of values of x for which $2x > \frac{1}{x}$ ans: $-\frac{1}{\sqrt{2}} < x < 0$
23. Write down the first five terms of the sequence specified by this recurrence relation: $U_1 = 0, U_n = \frac{1}{5-U_{n-1}} (n \geq 2)$ ans: $0, \frac{1}{5}, \frac{5}{24}, \frac{24}{115}, \frac{115}{551}$
24. The polynomial $f(x)$ is given by $f(x) = x^4 + x^3 - 7x^2 + 3x + 2$. If also, $f(x) = (x-1)(x-2)(x+3)(x+c) + Px + Q$, find the values of P, Q and c . ans: $4, -4, 1$
25. Find the inverse of matrix $Q = \begin{pmatrix} 2 & 4 & 3 \\ 1 & -2 & -2 \\ -3 & 3 & 2 \end{pmatrix}$
ans: $\frac{1}{11} \begin{pmatrix} 2 & 1 & -2 \\ 4 & 13 & 7 \\ -3 & -18 & -8 \end{pmatrix}$
26. If the minimum value of $x^2 + 2x + k$ is 3, find the value of k . ans: 4
27. If α and β are the roots of the equation $3x^2 - 7x - 1$. find the values of $(\alpha - \beta)^2$. ans: $\frac{61}{9}$
28. Solve the inequality $5 - 4x > 8$ and write the solution set in interval notation ans: $\{-\infty, -\frac{3}{4}\}$
29. The sum of the first ten terms of an arithmetic series is 60, the sum of the first twenty-two terms is 220.
Find the common difference and the first term of the series. ans: $\frac{2}{3}, 3$
30. For all x , except $x = 1$, $\frac{x^2+1}{x-1}$ equals ans: $x + 1 + \frac{2}{x-1}$
31. Functions h_1, h_2 are defined by $h_1 : x \rightarrow \log_2 x, h_2 : x \rightarrow \frac{1}{x}$. Find $h_1(h_2(x)) + h_1(x)$. ans: 0
32. Solve completely, the equation $\sqrt{(x^2 - 3x + 6)} = 1 - \sqrt{(x^2 - 3x + 3)}$ ans: 1
33. Solve $x(x+1) + \frac{12}{x(x+1)} = 8$ ans: $-3, 2, -2, 1$
34. If α and β are the roots of the expression $2x^2 + 8x + 7 = 0$, write down the value of $\sqrt{\alpha^2 + \beta^2} + 1$ ans: 4
35. If $\log_4 u = \log_8 v + 1$. Find u in terms of v . ans: $u = 4v^{\frac{2}{3}}$
36. Using the remainder's theorem, find the remainder when $x^4 - 5x^3 + 6x^2 - 7$ is divided by $x^2 - 4x + 3$ ans: $-x - 4$
37. The fifth term of an A.P is 23 and the twelfth is 37. Find the first term, the common difference and the sum of the first eleven terms. ans: $15, 2, 275$
38. Find the first four terms in the expansion of $(1-x)^{-\frac{1}{2}}$ ans: $1 + \frac{1}{2}x + \frac{3}{8}x^2 + \frac{15}{48}x^3$

39. The function f is given by the equation $f(x) = x^2 + 6x + 7$ for all numbers x . Which of the following statement is true? ans: The graph of $y = f(x)$ in the $x - y$ plane has a minimum point at $(-3, -2)$
40. Find the least value of $3x^2 - 4x + 2$ ans: $\frac{2}{3}$
41. Express $\frac{3x^2+2x-9}{(x^2-1)^2}$ in partial fractions ans: $\frac{3}{x^2-1} - \frac{2x-6}{(x^2-1)^2}$
Find the value of $\sum_{r=1}^{\infty} \frac{k}{10^r}$ ans: $\frac{k}{9}$
42. If the roots of the equation $x^2 - 2(k-2)x + 2k - 10 = 0$ are real. Find the possible values of k when the roots of the equation differ by 6. ans: 5, 1
43. Find the first four terms in the expansion of $(1-x)^4(1+2x)^7$ in ascending powers of x ans: $1 + 13x + 76x^2 + 504x^4$
44. Find the 6th term of the geometric sequence $\sin 2\alpha, -\sin \alpha \cos 2\alpha, \sin 2\alpha \cos^2 \alpha$ ans: $\frac{1}{32} \sin 2\alpha$
45. Find the term x^5 in the expansion of $(1+x)^{10}$ ans: $252x^5$
46. If $\sqrt[3]{x} = 3$ and $x = \sqrt{y}$, what is the value of y ? ans: 729
47. Find the sum to infinity of the geometric series $16 + 12 + 9 + \dots$ ans: 64
48. Solve the equation $\log_a(x^2 + 3) - \log_a x = \frac{2}{\log_2 a}$ ans: 1
49. If \mathcal{U} is the universal set $\{1, 3, 5, 7, 11\}$. $A = \{1, 3, 7, 11\}$ and $B = \{3, 5, 7, 19\}$ are the subsets. List the elements of $(A \cap B') - (A \cup B')$. ans: \emptyset
50. If α and β are the roots of the expression $2x^2 + 8x + 7 = 0$, write down the value of $\sqrt{\alpha^2 + \beta^2} + 1$ ans: 4
51. Using the remainder's theorem, find the remainder when $x^4 - 5x^3 + 6x^2 - 7$ is divided by $x^2 - 4x + 3$ ans: $-x - 4$
52. The fifth term of an A.P is 23 and the twelfth is 37. Find the first term, the common difference and the sum of the first eleven terms. ans: 15, 2, 275
53. It is given that $\frac{1}{b+c}, \frac{1}{c+a}, \frac{1}{a+b}$ are three consecutive terms of an arithmetic series. Which of the following statements is true of the series. ans: a^2, b^2, c^2 are also three consecutive terms of an series
54. Out of the 1000 undergraduate students in the faculty of science 650 are offering Algebra and 500 are offering Trigonometry. How many students are offering both Algebra and trigonometry, if only 210 students are offering neither Algebra or trigonometry. ans: 360
55. Find the set of values of k for which $f(x) = x^2 + 3kx + k$ is greater than zero for real values of x . ans: $0 < k < \frac{4}{9}$

56. If $\log_4 a = \log_8 b + 1$. Find a in terms of b . ans: $a = 4b^{\frac{2}{3}}$
57. When $x^3 + 2x^2 + px - 3$ is divided by $x + 1$ the remainder is the same as when it is divided by $x - 2$. Find p . ans:-5
58. If the quadratic expression $kx^2 - px + q$ has a repeated root, obtain the value for k . ans: $\frac{p^2}{4q}$
59. Find the square root of $14 + 6\sqrt{5}$ ans: $\pm(3 + \sqrt{5})$
60. Solve the simultaneous equations $\log_2 xy = 7$, $\log_2 \frac{x^2}{y} = 5$ ans: 8, 16
61. Determine the set of range for the function $f(x) = x^2 - 2x + 3$ ans: $2 \leq x \leq 6$
62. The first term of an arithmetic series is $3n + 5$ where n is a positive integer. The last term is $(17n + 17)$ and the common difference is 2. Find in terms of n the sum of the series. ans: $(7n + 7)(10n + 11)$
63. Suppose $M = \begin{pmatrix} -x & 2 \\ -x + 1 & x - 1 \end{pmatrix}$, find the possible value(s) of x if $|M| = 0$. ans: 1 or 2
64. The co-efficient of x^5 in the expansion of $(1 + 5x)^8$ is equal to the co-efficient of x^4 in the expansion of $(k + 5x)^7$. Find the value of k ? ans: 2
65. Given that the universal set $\mathcal{U} = \{x \in \mathbb{Z} \mid -10 \leq x \leq 10\}$, $A = \{x \in \mathbb{Z} \mid x \text{ is divisible by } 3\}$, $B = \{x \in \mathbb{Z} \mid x \text{ is a prime number}\}$, $C = \{x \in \mathbb{Z} \mid \text{roots of } x^4 + 2x^3 - 5x^2 - 6x = 0\}$, where A , B and C are subsets of the universal \mathcal{U} . Find $A - (B \cup C)$? ans: $\{-9, -6, 6, 9\}$
66. Solve for x if $\log_3(x + 2) = \log_9(6x + 4)$ ans: 0
67. Find the co-efficient of x^3 in the expansion of $(1 - x)^{-2}(1 + x)^{-2}$ ans: 0
68. The logarithm of a number to the base $\sqrt{2}$ is a , what is its logarithm to the base $2\sqrt{2}$? ans: $\frac{a}{3}$
69. Express $\frac{x^2 - 7x - 6}{x^2(x - 3)}$ in partial fraction. $\frac{2}{x^2} + \frac{3}{x} - \frac{2}{x - 3}$
70. If $(\log_4 x)^2 = \log_2 x \log_n x$, find the value of n . ans: 16
71. If p and q are the roots of the equation $2x^2 - x - 4 = 0$. Find $p^3 + q^3$. ans: $\frac{25}{8}$
72. Solve the equation $\frac{3^{5x+2}}{9^{1-x}} = \frac{27^{4+3x}}{729}$. ans: -3
73. If $p = \log_a(ab^2)$, $q = \log_b(a^2b)$. Which of the following statements is/are true?
I. $pq = p + q + 3$ II. $\sqrt{(p + q)^2 - pq} = 3$ III. $3pq = p^2 - q^2$ ans: I only

74. Simplify $\left(\frac{x^a}{x^b}\right)^{a+b} \times \left(\frac{x^b}{x^c}\right)^{b+c} \times \left(\frac{x^c}{x^a}\right)^{c+a}$ ans:1
75. Given the simultaneous equations, $2^x = 3^y$ and $x + y = 1$. Obtain an expression for x in terms of logarithm ans: $\frac{\log 2}{\log 3}$
76. A survey of 18 families in a housing estate, all of whom kept a cat or dog or both, revealed that 8 families kept a cat and 14 families kept a dog. How many kept both? ans:4
77. Given that $x^2 - 3x + 2$ is a factor of $x^4 + ax^2 + bx + 8$, find the values of a and b . ans:-3, -6
78. Express $\frac{5x+4}{(x-1)(x+2)^2}$ in partial fractions ans: $\frac{1}{x-1} - \frac{1}{x+2} + \frac{2}{(x+2)^2}$
79. If $n(n^2+5)$ is a multiple of 6, by inductive hypothesis which of the following is also a multiple of 6? ans: $n(n^2+5) + 3n(n+1) + 6$
80. Given that $f(x) = ax + b$ and that $f(2) = 7$ and $f(3) = 12$, find a and b . ans: $a = 5, b = -3$
81. Suggest a suitable domain and co-domain for the function $f(x) = \frac{32x+3}{4x+1}$ ans: $x : x \neq -\frac{1}{4}, y : y \neq 8$
82. If $\frac{1}{3\sqrt{5}+\sqrt{2}} \equiv a\sqrt{2} + b\sqrt{5}$, then a and b are respectively. ans: $-\frac{1}{43}, \frac{3}{43}$
83. Solve $\frac{(x-2)(x-3)}{(x-1)} \leq 0$ ans: $x < 1$ or $2 \leq x \leq 3$
84. The three real, distinct and non-zero numbers a, b, c are such that a, b, c are in arithmetic progression and a, c, b are in geometric progression. Find the numerical value of the common ratio of the geometric progression. ans: $-\frac{1}{2}$
85. Use mathematical induction to find the sum to n term of the series $\frac{1}{1 \cdot 2} + \frac{1}{2 \cdot 3} + \dots + \frac{1}{n(n+1)}$. ans: $\frac{n}{n+1}$
86. Solve the equation $3^{2x+1} - 28(3^{x-1}) + 1 = 0$ ans:1
87. The 3rd and the 6th terms of a G.P. are 108 and -32 respectively. Find the sum of the 1st 7 terms. ans:154.3
88. Let A and B be any arbitrary sets, then $A' - B'$ is equivalent to. ans: $(A - B)'$
89. Find the first four terms of the expansion of $\left(1 - \frac{x}{2}\right)^6$ in ascending powers of x . ans: $1 - 3x + \frac{15}{4}x^2 - \frac{5}{2}x^3 + \dots$
90. Find the least value of $2x^2 - x + 1$ ans: $\frac{7}{8}$

91. $f(x) \equiv 2x^3 + p + qx + 6$ where p and q are constants. When $f(x)$ is divided by $(x + 1)$, the remainder is 12. When $f(x)$ is divided by $(x - 1)$, the remainder is -6 . Find the value of p and q ? ans: $-3, -11$
92. Find the values of m and n if the expression $mx^3 + nx^2 - 28x + 15$ is exactly divisible by $x + 3$ and leaves a remainder -60 when it is divided by $x - 3$. When m and n have these values, find all the values for x for which the expression is zero. ans: $-3, \frac{1}{2}, 5$
93. The values of A , B and R respectively, given that $x^2 + 9x - 3 \equiv (x + 1)(Ax + B) + R$. ans: $1, 8$ and -11
94. Find the range of values of p for which the expression $x^2 - (x - 1)p + 3 = 0$ has real roots. ans: $p \leq -2$ or $p \geq 6$
95. Solve for x $2^{2x+1}.3^{2x+2} + 2^x.3^{x+2} - 2 = 0$ ans: -1
96. Solve for x $\frac{x-2}{x^2-x+1} > 0$ ans: $x > 2$
97. Given a function $h : x \rightarrow \frac{x}{x^2-1}$, $x < 0$, $x \neq -1$. Find its inverse. ans: $\frac{1-\sqrt{1+4x^2}}{2x}$, $x \neq 0$
98. In a G.P, $U_3 = 32$ and $U_6 = 4$, Find the sum of the first eight terms of the G.P ans: 255
99. Solve the $(2x^2 - x)^2 - 9(2x^2 - x) + 18 = 0$ ans: $\frac{3}{2}$
100. Find an expression in descending powers of x and with whole number co-efficient for $(2x - 3)^4 - (2x + 3)^4$. ans: $-192x^3$
101. Simplify $\frac{(x^{\frac{3}{2}} + x^{\frac{1}{2}})(x^{\frac{1}{2}} - x^{-\frac{1}{2}})}{(x^{\frac{3}{2}} - x^{\frac{1}{2}})^2}$ ans: $\frac{x+1}{x(x-1)}$
102. Give the first three terms of $(2 + x)^5$ in ascending powers of x ans: $32 + 80x + 8x^2 + 40x^3$
103. State the range of validity of the expansion of $(1 - 2x)^{-\frac{3}{2}}$. ans: $\frac{1}{2} > x > -\frac{1}{2}$
104. Find the domain of the function $f : x \rightarrow \frac{x}{x^2+3x+2} + \frac{2}{x+1}$ where x is real. ans: $x : x \neq -2, x \neq -1$
105. Find the set of values of y for which $y^2 - 9x + 20$ is negative. ans: $4 < x < 5$
106. Express $\frac{1}{x^4+5x^2+6}$ in partial fractions ans: $\frac{1}{x^2+2} - \frac{1}{x^2+3}$
107. If α and β are the roots of the equation $2x^2 - x - 4 = 0$. Find the equation whose roots are $\alpha - \frac{\beta}{\alpha}$ and $\beta - \frac{\alpha}{\beta}$. ans: $2x^2 - 7x + 5 = 0$
108. Simplify $\log 6 + \log 4 + \log 20 - \log 3 - \log 16$ ans: 1
109. Find the value of p for which the matrix $\begin{pmatrix} p+1 & 6 \\ 1 & p \end{pmatrix}$ does not have an inverse. ans: -3

110. If one root of $ax^2 + bx + c = 0$ is triple the other, which of the following is true ans: $3b^2 = 16ac$
111. The sum of the first n terms of a series is $1 - (\frac{3}{4})^n$. Find the first term and the common ratio? ans: $\frac{1}{4}, \frac{3}{4}$
112. $x - 1, x + 1$ are factors of the expression $x^3 + ax^2 + bx + c$ and it leaves a remainder 12 when divided by $x - 2$. Find a, b and c. ans: 1, -1, -1
113. In proving $\sum_{r=1}^n r(r+1)(r+2) = \frac{1}{4}n(n+1)(n+2)$ by induction, which of the following is true for $n = k + 1$. ans: $n(n+1)\left(\frac{n^2+5n+6}{4}\right)$
114. Find the sum of the first n terms of the series $\log 3 + \log 6 + \log 12 + \dots$ ans: $n \log 3 + \frac{n(n-1)}{2} \log 2$
115. Obtain the set of values of x for which $2|x-1| > |x+1|$ ans: $x < \frac{1}{3}$ or $x > 3$
116. Find the co-efficient of x^2 in $(3-x)^{10}$ ans: 295245
117. Find the sum to infinity of the series $1 + \frac{1}{2} + \frac{1}{4} + \dots$ ans: 2
118. Given that the expression $ax^3 + 8x^2 + bx + 6$ is exactly divisible by $x^2 - 2x - 3$, find the values of a and b. ans: -5, 19
119. Three consecutive terms of a geometric series have product 343 and sum $\frac{49}{2}$. Find the numbers. ans: $\frac{7}{2}, 7, 14$
120. Expand $\frac{3x+5}{(1-x)(1+3x)}$ as a series of ascending powers of x up to and including the term in x^2 and also state its range of validity. ans: $5 - 7x + 29x^2 + \dots$, $-\frac{1}{3} < x < \frac{1}{3}$
121. One of the following is not a factor of $x^3 - ax^2 - a^2x + a^3$ ans: $x - a^2$
122. The first three terms of a geometric progression are $k - 3, 2k - 4, 4k - 3$ in that order. Find the value of k . ans: 7
123. An equilateral triangle field has sides of length l . Find an expression for the area of the field, leaving your answer in surd form. ans: $\frac{\sqrt{3}}{4}l^2$
124. If the equation $x^2 - 3x + 1 = p(x - 3)$ has equal roots, find the possible value of p . ans: 5
125. Find the values of n for which the expression $(2n + 3)x^2 - 6x + 4 - n$ is a perfect square. ans: 3, $-\frac{1}{2}$
126. For what value of m is $9x^2 + mx + 16$ a perfect square? ans: -24
127. The domain of $g(x) = \sqrt{x}$ is ans: $[0, \infty)$
128. Find in surd form, the square root of $4 + 2\sqrt{3}$ ans: $\pm(1 + \sqrt{3})$

129. In a certain arithmetic progression, the sum of the first and fifth terms is 18 and the fifth term is 6 more than the third term. Find the sum of the first ten terms of the progression ans:165
130. If $a = 27^{\frac{2}{3}}$ and $b = 3^{-4}$. Find the value of ba^2 ans:1
131. Given the matrix $A = \begin{pmatrix} -1 & -4 \\ 1 & 3 \end{pmatrix}$. Find A^3 ? ans: $\begin{pmatrix} -5 & -12 \\ 3 & 7 \end{pmatrix}$
132. Find the set values of k for which $f(t) = t^2 + 3kt + k$ is greater than zero for all real values of t . ans: $k : k = 0, 0.1, 0.2, 0.3, 0.4$
133. Solve $\frac{x+4}{x+1} \leq \frac{x-2}{x-4}$ ans: $4 \leq x \leq 14$
134. Find the value of x satisfying the equation $\sqrt{3x+4} = 3 + \sqrt{x-3}$ ans:4
135. In an AP, the tenth term is 3 and the sum of the first six terms is 76.5. Find the sum of the first term and the common difference. ans:15.0
136. Solve $x^{\frac{1}{3}} - 3x^{-\frac{1}{3}} = 2$ ans:-1
137. Solve for x if $\log_3(x+2) = \log_9(6x+4)$
ans:0
138. Three consecutive terms of a geometric series have product 343 and sum $\frac{49}{2}$. Find the numbers. ans: $\frac{7}{2}, 7, 14$
139. Solve $\frac{1}{x+6} \geq \frac{2}{2-3x}$ ans: $-6 < x \leq -2$ or $x > \frac{2}{3}$