Topic: Sequence and Series

Sub: Mathematics **JEE Main PYQ (2019-2025)** Prof. Chetan Sir

Arithmetic Progression (A.P.)

Finding Terms, Common Difference, and Basic Properties

1. The interior angles of a polygon with n sides, are in an A.P. with common difference 6°. If the largest interior angle of the polygon is 219° then n is equal to: **[JEE Main 2025]**

2. The 20^{th} term from the end of the progression $20, 19\frac{1}{4}, 18\frac{1}{2}, 17\frac{3}{4}, \ldots, -129\frac{1}{4}$ is: **[JEE Main 2024]**

(1) -118 (2) -110 (3) -115 (4) -100

3. In an A.P., the sixth term $a_6 = 2$. If $a_1a_4a_5$ is the greatest, then the common difference of the A.P., is equal to: **[JEE Main 2024]**

(1) $\frac{8}{5}$ (2) $\frac{3}{2}$ (3) $\frac{2}{3}$ (4) $\frac{5}{8}$

4. Let $a_1, a_2, ..., a_n$ be in A.P. If $a_5 = 2a_7$ and $a_{11} = 18$, then $12(\frac{1}{\sqrt{a_{10}}+\sqrt{a_{11}}} + \frac{1}{\sqrt{a_{11}}+\sqrt{a_{12}}} + ... + \frac{1}{\sqrt{a_{17}}+\sqrt{a_{18}}})$ is equal to: **[JEE Main 2023]**

5. Let $a_1, a_2, a_3, ...$ be an A.P. If $a_7 = 3$, the product a_1a_4 is minimum and the sum of its first n terms is zero, then $n! - 4a_{n(n+2)}$ is equal to: **[JEE Main 2023]**

(1) 24 (2) $\frac{33}{4}$ (3) $\frac{381}{4}$ (4) 9

6. Different A.P.'s are constructed with the first term 100, the last term 199, and integral common differences. The sum of the common differences of all such A.P's having at least 3 terms and at most 33 terms is: **[JEE Main 2022]**

7. The common difference of the A.P. $b_1, b_2, ..., b_m$ is 2 more than the common difference of A.P. $a_1, a_2, ..., a_n$. If $a_{40} = -159, a_{100} = -399$ and $b_{100} = a_{70}$, then b_1 is equal to: **[JEE Main 2020]**

(a) 81 (b) -127 (c) -81 (d) 127

8. If 19th term of a non-zero A.P. is zero, then its (49th term) : (29th term) is: **[JEE Main 2019]**

(a) 4 : 1 (b) 1 : 3 (c) 3 : 1 (d) 2 : 1

Sum of n Terms of an A.P. (S_n)

9. Consider an A. P. of positive integers, whose sum of the first three terms is 54 and the sum of the first twenty terms lies between 1600 and 1800. Then its 11^{th} term is: **[JEE Main 2025]**

(1) 90 (2) 84 (3) 122 (4) 108

10. Let $a_1, a_2, ..., a_{2024}$ be an Arithmetic Progression such that $a_1 + (a_5 + a_{10} + a_{15} + ... + a_{2020}) + a_{2024} = 2233$. Then $a_1 + a_2 + a_3 + ... + a_{2024}$ is equal to: **[JEE Main 2025]**

11. Let T_r be the r^{th} term of an A.P. If for some m, $n \in \mathbb{N}$, $T_m = \frac{1}{25}$, $T_{25} = \frac{1}{20}$ and $\sum_{r=1}^{25} T_r = 13$, then $5m\sum_{r=m}^{2m} T_r$ is equal to: **[JEE Main 2025]**

(1) 98 (2) 126 (3) 142 (4) 112

12. In an arithmetic progression, if $S_{40} = 1030$ and $S_{12} = 57$, then $S_{30} - S_{10}$ is equal to: **[JEE Main 2025]**

(1) 525 (2) 510 (3) 515 (4) 505

13. If the first term of an A.P. is 3 and the sum of its first four terms is equal to one-fifth of the sum of the next four terms, then the sum of the first 20 terms is equal to: **[JEE Main 2025]**

(1) -1080 (2) -1020 (3) -1200 (4) -120

14. Suppose that the number of terms in an A.P. is 2k, $k \in N$. If the sum of all odd terms of the A.P. is 40, the sum of all even terms is 55 and the last term of the A.P. exceeds the first term by 27, then k is equal to: **[JEE Main 2025]**

(1) 6 (2) 5 (3) 8 (4) 4

15. Let a_n be the n^{th} term of an A.P. If $S_n = a_1 + a_2 + a_3 + ... + a_n = 700$, $a_6 = 7$ and $S_7 = 7$ then a_n is equal to: **[JEE Main 2025]**

(A) 65 (B) 56 (C) 70 (D) 64

16. The number of terms of an A.P. is even; the sum of all the odd terms is 24, the sum of all the even terms is 30 and the last term exceeds the first by $\frac{21}{2}$. Then the number of terms which are integers in the A.P. is: **[JEE Main 2025]**

(A) 6 (B) 4 (C) 8 (D) 10

17. Let $a_1, a_2, a_3, \ldots$ be an A.P. such that $\sum_{k=1}^{12} a_{2k-1} = -\frac{72}{5}a_1$, $a_1 \neq 0$. If $\sum_{k=1}^{n} a_k = 0$, then n is: **[JEE Main 2025]**

(A) 18 (B) 17 (C) 11 (D) 10

18. Let S_n denote the sum of the first n terms of an arithmetic progression. If $S_{10} = 390$ and the ratio of the tenth and the fifth terms is 15 : 7, then $S_{15} - S_5$ is equal to: **[JEE Main 2024]**

(1) 800 (2) 890 (3) 790 (4) 690

19. Let S_n denote the sum of first n terms an arithmetic progression. If $S_{20} = 790$ and $S_{10} = 145$, then $S_{15} - S_5$ is: **[JEE Main 2024]**

(1) 395 (2) 390 (3) 405 (4) 410

20. Let $s_1, s_2, s_3, ..., s_{10}$ respectively be the sum of 12 terms of 10 A.Ps whose first terms are $1, 2, 3, ..., 10$ and the common differences are $1, 3, 5, ..., 19$ respectively. Then $\sum_{i=1}^{10} s_i$ is equal to: **[JEE Main 2023]**

(1) 7220 (2) 7360 (3) 7260 (4) 7380

21. Let $a_1 = 8, a_2, a_3, ..., a_n$ be an A.P. If the sum of its first four terms is 50 and the sum of its last four terms is 170, then the product of its middle two terms is: **[JEE Main 2023]**

22. Suppose $a_1, a_2, \ldots, a_n, \ldots$ be an arithmetic progression of natural numbers. If the ratio of the sum of the first five terms to the sum of first nine terms of the progression is 5 : 17 and $110 < a_{15} < 120$, then the sum of the first ten terms of the progression is equal to: **[JEE Main 2022]**

(A) 290 (B) 380 (C) 460 (D) 510

23. If $\{a_i\}_{i=1}^{n}$ where n is an even integer is an arithmetic progression with common difference 1, and $\sum_{i=1}^{n} a_i = 192$, $\sum_{i=1}^{n/2} a_{2i} = 120$, then n is equal to: **[JEE Main 2022]**

(A) 48 (B) 96 (C) 92 (D) 104

24. Let S_1 be the sum of first 2n terms of an arithmetic progression. Let S_2 be the sum of first 4n terms of the same arithmetic progression. If $(S_2 - S_1)$ is 1000, then the sum of the first 6n terms of the arithmetic progression is equal to: **[JEE Main 2021]**

(1) 1000 (2) 7000 (3) 5000 (4) 3000

25. Let S_n denote the sum of first n-terms of an arithmetic progression. If $S_{10} = 530, S_5 = 140$, then $S_{20} - S_6$ is equal to: **[JEE Main 2021]**

(1) 1862 (2) 1842 (3) 1852 (4) 1872

26. Let S_n be the sum of the first n terms of an arithmetic progression. If $S_{3n} = 3S_{2n}$, then the value of $\frac{S_{4n}}{S_{2n}}$ is: **[JEE Main 2021]**

(1) 6 (2) 4 (3) 2 (4) 8

27. Let $a_1, a_2, ..., a_{10}$ be an AP with common difference -3 and $b_1, b_2, ..., b_{10}$ be a GP with common ratio 2. Let $c_k = a_k + b_k, k = 1, 2, ..., 10$. If $c_2 = 12$ and $c_3 = 13$, then $\sum_{k=1}^{10} c_k$ is equal to: **[JEE Main 2021]**

28. If the first term of an A.P. is 3 and the sum of its first 25 terms is equal to the sum of its next 15 terms, then the common difference of this A.P. is: **[JEE Main 2020]**

(a) $\frac{1}{6}$ (b) $\frac{1}{5}$ (c) $\frac{1}{4}$ (d) $\frac{1}{7}$

29. In the sum of the series $20 + 19\frac{3}{5} + 19\frac{1}{5} + 18\frac{4}{5} + ...$ upto n^{th} term is 488 and then n^{th} term is negative, then : **[JEE Main 2020]**

(a) $n = 60$ (b) n^{th} term is -4
(c) $n = 41$ (d) n^{th} term is $-4\frac{2}{5}$

30. If the sum of first 11 terms of an A.P., $a_1, a_2, a_3, ...$ is 0 $(a_1 \neq 0)$, then the sum of the A.P., $a_1, a_3, a_5, ..., a_{23}$ is ka_1, where k is equal to: **[JEE Main 2020]**

(a) $-\frac{121}{10}$ (b) $\frac{121}{10}$ (c) $\frac{72}{5}$ (d) $-\frac{72}{5}$

31. If the 10^{th} term of an A.P. is $\frac{1}{20}$ and its 20^{th} term is $\frac{1}{10}$, then the sum of its first 200 terms is: **[JEE Main 2020]**

(a) 50 (b) $50\frac{1}{4}$ (c) 100 (d) $100\frac{1}{2}$

32. Five numbers are in A.P., whose sum is 25 and product is 2520. If one of these five numbers is $-\frac{1}{2}$, then the greatest number amongst them is: **[JEE Main 2020]**

(a) 27 (b) 7 (c) $\frac{21}{2}$ (d) 16

33. Let S_n denote the sum of the first n terms of an A.P. If $S_4 = 16$ and $S_6 = -48$, then S_{10} is equal to: **[JEE Main 2019]**

(a) -260 (b) -410 (c) -320 (d) -380

34. If $a_1, a_2, a_3, \ldots$ are in A.P. such that $a_1 + a_7 + a_{16} = 40$, then the sum of the first 15 terms of this A.P. is: **[JEE Main 2019]**

(a) 200 (b) 280 (c) 120 (d) 150

35. If $a_1, a_2, \ldots, a_n$ are in A.P. and $a_1 + a_4 + a_7 + ... + a_{16} = 114$, then $a_1 + a_6 + a_{11} + a_{16}$ is equal to: **[JEE Main 2019]**

(a) 98 (b) 76 (c) 38 (d) 64

36. If the sum and product of the first three terms in an A.P. are 33 and 1155, respectively, then a value of its 11^{th} term is: **[JEE Main 2019]**

(a) -35 (b) 25 (c) -36 (d) -25

37. Let $a_1, a_2, \ldots, a_{30}$ be an A.P., $S = \sum_{i=1}^{30} a_i$ and $T = \sum_{i=1}^{15} a_{(2i-1)}$. If $a_5 = 27$ and $S - 2T = 75$, then a_{10} is equal to: **[JEE Main 2019]**

(a) 52 (b) 57 (c) 47 (d) 42

Relationship between Terms and Sums (T_n vs S_n)

38. Let $< a_n >$ be a sequence such that $a_1 + a_2 + ... + a_n = \frac{n^2+3n}{(n+1)(n+2)}$. If $\sum_{k=1}^{10} \frac{1}{a_k} = p_1p_2p_3...p_m$, where $p_1, p_2, ...p_m$ are the first m prime numbers, then m is equal to: **[JEE Main 2023]**

(1) 5 (2) 8 (3) 6 (4) 7

39. Let $a_1, a_2, a_3, ...$ be an A. P. If $\frac{a_1+a_2+...+a_{10}}{a_1+a_2+...+a_p} = \frac{100}{p^2}, p \neq 10$, then $\frac{a_{11}}{a_{10}}$ is equal to: **[JEE Main 2021]**

(1) $\frac{19}{21}$ (2) $\frac{100}{121}$ (3) $\frac{21}{19}$ (4) $\frac{121}{100}$

40. Let $a_1, a_2, ..., a_n$ be a given A.P. whose common difference is an integer and $S_n = a_1 + a_2 + ... + a_n$. If $a_1 = 1, a_n = 300$ and $15 \leq n \leq 50$, then the ordered pair (S_{n-4}, a_{n-4}) is equal to: **[JEE Main 2020]**

(a) (2490,249) (b) (2480,249) (c) (2480,248) (d) (2490,248)

41. Let the sum of the first n terms of a non-constant A.P., $a_1, a_2, a_3, \ldots$ be $50n + \frac{n(n-7)}{2}A$, where A is a constant. If d is the common difference of this A.P., then the ordered pair (d, a_{50}) is equal to: **[JEE Main 2019]**

(a) $(50, 50 + 46A)$ (b) $(50, 50 + 45A)$
(c) $(A, 50 + 45A)$ (d) $(A, 50 + 46A)$

Problems involving two or more A.P.s / Common Terms

42. Let $A = \{1, 6, 11, 16, ...\}$ and $B = \{9, 16, 23, 30, ...\}$ be the sets consisting of the first 2025 terms of two arithmetic progressions. Then $n(A \cup B)$ is: **[JEE Main 2025]**

(A) 3814 (B) 4003 (C) 4027 (D) 3761

43. Let $3, 7, 11, 15, ..., 403$ and $2, 5, 8, 11, ..., 404$ be two arithmetic progressions. Then the sum, of the common terms in them, is equal to: **[JEE Main 2024]**

44. The number of common terms in the progressions $4, 9, 14, 19, \ldots,$ up to 25^{th} term and $3, 6, 9, 12, \ldots$ up to 37^{th} term is: **[JEE Main 2024]**

(1) 9 (2) 5 (3) 7 (4) 8

45. The 8^{th} common term of the series $S_1 = 3 + 7 + 11 + 15 + 19 + ...$ and $S_2 = 1 + 6 + 11 + 16 + 21 + ...$ is: **[JEE Main 2023]**

46. The sum of the common terms of the following three arithmetic progressions. $3, 7, 11, 15, ..., 399$, $2, 5, 8, 11, ..., 359$ and $2, 7, 12, 17, ..., 197$, is equal to: **[JEE Main 2023]**

47. Let 3, 6, 9, 12,... upto 78 terms and 5, 9, 13, 17,... upto 59 terms be two series. Then, the sum of the terms common to both the series is equal to: **[JEE Main 2022]**

48. Let $a_1, a_2, a_3....$ and $b_1, b_2, b_3....$ are A.P. and $a_1 = 2, a_{10} = 3, a_1b_1 = 1 = a_{10}b_{10}$ then a_4b_4 is equal to: **[JEE Main 2022]**

(A) $\frac{35}{27}$ (B) 1 (C) $\frac{27}{28}$ (D) $\frac{28}{27}$

49. Consider an arithmetic series and a geometric series having four initial terms from the set $\{11, 8, 21, 16, 26, 32, 4\}$. If the last terms of these series are the maximum possible four digit numbers, then the number of common terms in these two series is equal to: **[JEE Main 2021]**

50. The number of terms common to the two A.P.'s 3, 7, 11, ..., 407 and 2, 9, 16, ..., 709 is **[JEE Main 2020]**

Geometric Progression (G.P.)

Finding Terms, Common Ratio, and Basic Properties

51. Let a1, a2, a3, ... be a G.P. of increasing positive terms. If $a_1a_5 = 28$ and $a_2 + a_4 = 29$, then a6 is equal to: **[JEE Main 2025]**

(1) 628 (2) 812 (3) 526 (4) 784

52. Let $a_1, a_2, a_3, \ldots$ be a G.P. of increasing positive numbers. If $a_3a_5 = 729$ and $a_2 + a_4 = \frac{111}{4}$, then $24(a_1 + a_2 + a_3)$ is equal to: **[JEE Main 2025]**

(A) 128 (B) 129 (C) 131 (D) 130

53. Let a and b be two distinct positive real numbers. Let 11^{th} term of a GP, whose first term is a and third term is b, is equal to p^{th} term of another GP, whose first term is a and fifth term is b. Then p is equal to: **[JEE Main 2024]**

(1) 20 (2) 25 (3) 21 (4) 24

54. In an increasing geometric progression of positive terms, the sum of the second and sixth terms is $\frac{70}{3}$ and the product of the third and fifth terms is 49. Then the sum of the $4^{th}, 6^{th}$ and 8^{th} terms is equal to: **[JEE Main 2024]**

(1) 96 (2) 91 (3) 84 (4) 78

55. The 4^{th} term of a GP is 500 and its common ratio is $\frac{1}{m}, m \in N$. Let S_n denote the sum of the first n terms of this GP. If $S_6 > S_5 + 1$ and $S_7 < S_6 + \frac{1}{2}$, then the number of possible values of m is: **[JEE Main 2023]**

56. Let $a_1, a_2, a_3, ...$ be a G.P. of increasing positive numbers. Let the sum of its 6th and 8th terms be 2 and the product of its 3rd and 5^{th} terms be $\frac{1}{9}$. Then $6(a_2 + a_4)(a_4 + a_6)$ is equal to: **[JEE Main 2023]**

(1) 3 (2) $3\sqrt{3}$ (3) 2 (4) $2\sqrt{2}$

57. Let $a_1, a_2, a_3, ...$ be a G.P. of increasing positive numbers. If the product of fourth and sixth terms is 9 and the sum of fifth and seventh terms is 24, then $a_1a_9 + a_2a_4a_9 + a_5 + a_7$ is equal to: **[JEE Main 2023]**

58. Let $A_1, A_2, A_3, \ldots$ be an increasing geometric progression of positive real numbers. If $A_1A_3A_5A_7 = \frac{1}{1296}$ and $A_2 + A_4 = \frac{7}{36}$, then, the value of $A_6 + A_8 + A_{10}$ is equal to: **[JEE Main 2022]**

(A) 33 (B) 37 (C) 43 (D) 47

59. In an increasing, geometric series, the sum of the second and the sixth term is $\frac{25}{2}$ and the product of the third and fifth term is 25. Then, the sum of 4^{th}, 6^{th} and 8^{th} terms is equal to: **[JEE Main 2021]**

(1) 35 (2) 30 (3) 26 (4) 32

60. Let $a_1, a_2, ..., a_{10}$ be a G.P. If $\frac{a_3}{a_1} = 25$, then $\frac{a_9}{a_5}$ equals: **[JEE Main 2019]**

(a) 5^4 (b) $4(5^2)$ (c) 5^3 (d) $2(5^2)$

61. If a, b and c be three distinct real numbers in G.P. and $a+b+c = xb$, then x cannot be: **[JEE Main 2019]**

(a) -2 (b) -3 (c) 4 (d) 2

Sum of n Terms of a G.P. (S_n)

62. If the sum of the second, fourth and sixth terms of a G.P. of positive terms is 21 and the sum of its eighth, tenth and twelfth terms is 15309, then the sum of its first nine terms is: **[JEE Main 2025]**

(A) 757 (B) 755 (C) 750 (D) 760

63. If in a G.P. of 64 terms, the sum of all the terms is 7 times the sum of the odd terms of the G.P, then the common ratio of the G.P. is equal to: **[JEE Main 2024]**

(1) 7 (2) 4 (3) 5 (4) 6

64. Let the first term a and the common ratio r of a geometric progression be positive integers. If the sum of squares of its first three terms is 33033, then the sum of these three terms is equal to: **[JEE Main 2023]**

(1) 241 (2) 231 (3) 210 (4) 220

65. If $a_1(>0), a_2, a_3, a_4, a_5$ are in a G.P., $a_2 + a_4 = 2a_3 + 1$ and $3a_2 + a_3 = 2a_4$, then $a_2 + a_4 + 2a_5$ is equal to: **[JEE Main 2022]**

66. The sum of first four terms of a geometric progression (G.P.) is $\frac{65}{12}$ and the sum of their respective reciprocals is $\frac{65}{18}$. If the product of first three terms of the G.P. is 1, and the third term is α, then 2α is: **[JEE Main 2021]**

67. If $2^{10} + 2^9 \cdot 3^1 + 2^8 \cdot 3^2 + \cdots + 2 \cdot 3^9 + 3^{10} = S - 2^{11}$, then S is equal to: **[JEE Main 2020]**

(a) $3^{11} - 2^{12}$ (b) 3^{11}
(c) $\frac{3^{11}}{2} + 2^{10}$ (d) $2 \cdot 3^{11}$

68. If the sum of the second, third and fourth terms of a positive term G.P. is 3 and the sum of its sixth, seventh and eighth terms is 243, then the sum of the first 50 terms of this G.P. is: **[JEE Main 2020]**

(a) $\frac{1}{26}(3^{49} - 1)$ (b) $\frac{1}{26}(3^{50} - 1)$
(c) $\frac{2}{13}(3^{50} - 1)$ (d) $\frac{1}{13}(3^{50} - 1)$

69. The sum of the first three terms of a G.P. is S and their product is 27. Then all such S lie in: **[JEE Main 2020]**

(a) $(-\infty, -9] \cup [3, \infty)$ (b) $[-3, 8)$
(c) $(-\infty, -3] \cup [9, \infty)$ (d) $(-\infty, -9]$

70. Let a_n be the n^{th} term of a G.P. of positive terms. If $\sum_{n=1}^{100} a_{2n+1} = 200$ and $\sum_{n=1}^{100} a_{2n} = 100$, then $\sum_{n=1}^{200} a_n$ is equal to: **[JEE Main 2020]**

(a) 300 (b) 225 (c) 175 (d) 150

71. Let $a_1, a_2, a_3, \ldots$ be a G. P. such that $a_1 < 0, a_1 + a_2 = 4$ and $a_3 + a_4 = 16$. If $\sum_{i=1}^{9} a_i = 4\lambda$, then λ is equal to: **[JEE Main 2020]**

(a) -513 (b) -171 (c) 171 (d) $\frac{511}{3}$

Sum of Infinite G.P.

72. Let a, ar, ar^2, ... be an infinite G.P. If $\sum_{n=0}^{\infty} ar^n = 57$ and $\sum_{n=0}^{\infty} a^3 r^{3n} = 9747$, then $a + 18r$ is equal to: **[JEE Main 2024]**

(1) 46 (2) 38 (3) 31 (4) 27

73. Let $\{a_k\}$ and $\{b_k\}$, $k \in \mathbb{N}$, be two G.P.s with common ratios r_1 and r_2 respectively such that $a_1 = b_1 = 4$ and $r_1 < r_2$. Let $c_k = a_k + b_k, k \in \mathbb{N}$. If $c_2 = 5$ and $c_3 = \frac{13}{4}$, then $\sum_{k=1}^{\infty} c_k - (12a_6 + 8b_4)$ is equal to: **[JEE Main 2023]**

74. Let the sum of an infinite G.P., whose first term is a and the common ratio is r, be 5. Let the sum of its first five terms be $\frac{98}{25}$. Then the sum of the first 21 terms of an AP, whose first term is $10ar$, nth term is a_n and the common difference is $10ar^2$, is equal to: **[JEE Main 2022]**

(A) $21a_{11}$ (B) $22a_{11}$ (C) $15a_{16}$ (D) $14a_{16}$

75. Let $a_1, a_2, a_3, ...$ be an A.P. If $\sum_{r=1}^{\infty} \frac{a_r}{2^r} = 4$, then $4a_2$ is equal to: **[JEE Main 2022]**

76. If the sum of an infinite GP a, ar, ar^2, ar^3,... is 15 and the sum of the squares of its each term is 150, then the sum of $ar^2, ar^4, ar^6, ...$ is: **[JEE Main 2021]**

(1) $\frac{5}{2}$ (2) $\frac{1}{2}$ (3) $\frac{25}{2}$ (4) $\frac{9}{2}$

77. The value of $(0.16)^{\log_{2.5}\left(\frac{1}{3}+\frac{1}{3^2}+\frac{1}{3^3}+\ldots\text{to }\infty\right)}$ is equal to: **[JEE Main 2020]**

78. The product $2^{\frac{1}{4}} \cdot 4^{\frac{1}{16}} \cdot 8^{\frac{1}{48}} \cdot 16^{\frac{1}{128}} \cdot \ldots$ to ∞ is equal to: **[JEE Main 2020]**

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

79. The sum of an infinite geometric series with positive terms is 3 and the sum of the cubes of its terms is $\frac{27}{19}$. Then the common ratio of this series is: **[JEE Main 2019]**

(a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $\frac{4}{9}$ (d) $\frac{2}{9}$

Harmonic Progression (H.P.)

80. If $x = \sum_{n=0}^{\infty} a^n, y = \sum_{n=0}^{\infty} b^n, z = \sum_{n=0}^{\infty} c^n$, where a, b, c are in A.P. and $|a| < 1, |b| < 1, |c| < 1, abc \neq 0$, then: **[JEE Main 2022]**

(A) x, y, z are in A.P.
(B) x, y, z are in G.P.
(C) $\frac{1}{x}, \frac{1}{y}, \frac{1}{z}$ are in A.P.
(D) $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 1 - (a + b + c)$

Relationship between Progressions (A.P., G.P., H.P.)

Terms of one progression forming another

81. Let x_1, x_2, x_3, x_4 be in a geometric progression. If 2, 7, 9, 5 are subtracted respectively from x_1, x_2, x_3, x_4, then the resulting numbers are in an arithmetic progression. Then the value of $\frac{1}{24}(x_1x_2x_3x_4)$ is: **[JEE Main 2025]**

(A) 18 (B) 216 (C) 36 (D) 72

82. Consider two sets A and B, each containing three numbers in A.P. Let the sum and the product of the elements of A be 36 and p respectively and the sum and the product of the elements of B be 36 and q respectively. Let d and D be the common differences of A.P.'s in A and B respectively such that $D = d + 3, d > 0$. If $\frac{p+q}{p-q} = \frac{19}{5}$ then $p - q$ is equal to: **[JEE Main 2025]**

(A) 540 (B) 450 (C) 600 (D) 630

83. Let 3, a, b, c be in A.P. and 3, $a - 1$, $b + 1$, $c + 9$ be in G.P. Then, the arithmetic mean of a, b and c is: **[JEE Main 2024]**

(1) -4 (2) -1 (3) 13 (4) 11

84. If each term of a geometric progression $a_1, a_2, a_3, ...$ with $a_1 = \frac{1}{8}$ and $a_2 \neq a_1$, is the arithmetic mean of the next two terms and $S_n = a_1 + a_2 + ... + a_n$, then $S_{20} - S_{18}$ is equal to: **[JEE Main 2024]**

(1) 2^{15} (2) -2^{18} (3) 2^{18} (4) -2^{15}

85. Let $2^{nd}, 8^{th}$ and 44^{th} terms of a non-constant A.P. be respectively the $1^{st}, 2^{nd}$ and 3^{rd} terms of a G.P. If the first term of A.P. is 1, then the sum of its first 20 terms is equal to: **[JEE Main 2024]**

(1) 980 (2) 960 (3) 990 (4) 970

86. Let the first three terms 2, p and q, with $q \neq 2$ of a G.P. be respectively the $7^{th}, 8^{th}$ and 13^{th} terms of an A.P. If the 5^{th} term of the G.P. is the n^{th} term of the A.P., then n is equal to: **[JEE Main 2024]**

(1) 163 (2) 151 (3) 177 (4) 169

87. Let three real numbers a, b, c be in arithmetic progression and $a + 1, b, c + 3$ be in geometric progression. If $a > 10$ and the arithmetic mean of a, b and c is 8, then the cube of the geometric mean of a, b and c is: **[JEE Main 2024]**

(1) 128 (2) 316 (3) 120 (4) 312

88. If $\log_e a, \log_e b, \log_e c$ are in an A.P. and $\log_e a - \log_e 2b, \log_e 2b - \log_e 3c, \log_e 3c - \log_e a$ are also in an A.P, then $a : b : c$ is equal to: **[JEE Main 2024]**

(1) 9 : 6 : 4 (2) 16 : 4 : 1 (3) 25 : 10 : 4 (4) 6 : 3 : 2

89. Let a, b, $c > 1$, a^3, b^3 and c^3 be in A.P., and $\log_a b, \log_c a$ and $\log_b c$ be in G.P. If the sum of first 20 terms of an A.P., whose first term is $\frac{a+4b+c}{3}$ and the common difference is $\frac{a-8b+c}{10}$, is -444, then abc is equal to: **[JEE Main 2023]**

(1) 343 (2) 216 (3) $\frac{343}{8}$ (4) $\frac{125}{8}$

90. For the two positive numbers a, b, if a, b and $\frac{1}{18}$ are in a geometric progression, while $\frac{1}{a}, 10$ and $\frac{1}{b}$ are in an arithmetic progression, then $16a + 12b$ is equal to: **[JEE Main 2023]**

91. Let $0 < z < y < x$ be three real numbers such that $\frac{1}{x}, \frac{1}{y}, \frac{1}{z}$ are in an arithmetic progression and $x, \sqrt{2}y, z$ are in a geometric progression. If $xy + yz + zx = \frac{3}{\sqrt{2}}xyz$, then $3(x+y+z)^2$ is equal to: **[JEE Main 2023]**

92. For three positive integers p, q, r, $x^{pq^2} = y^{qr} = z^{p^2 r}$ and $r = pq + 1$ such that 3, $3\log_y x$, $3\log_z y$, $7\log_x z$ are in A.P. with common difference $\frac{1}{2}$. Then $r - p - q$ is equal to: **[JEE Main 2023]**

(1) 2 (2) 6 (3) 12 (4) -6

93. Three numbers are in an increasing geometric progression with common ratio r. If the middle number is doubled, then the new numbers are in an arithmetic progression with common difference d. If the fourth term of GP is $3r^2$, then $r^2 - d$ is equal to: **[JEE Main 2021]**

(1) $7 - 7\sqrt{3}$ (2) $7 + \sqrt{3}$ (3) $7 - \sqrt{3}$ (4) $7 + 3\sqrt{3}$

94. Let $\frac{1}{16}$, a and b be in G.P. and $\frac{1}{a}$, $\frac{1}{b}$, 6 be in A.P., where $a, b > 0$. Then $72(a + b)$ is equal to: **[JEE Main 2021]**

95. If $3^{2\sin 2\alpha - 1}, 14$ and $3^{4 - 2\sin 2\alpha}$ are the first three terms of an A.P. for some α, then the sixth term of this A.P is: **[JEE Main 2020]**

(a) 66 (b) 81 (c) 65 (d) 78

96. Let a, b and c be in G.P. with common ratio r, where $a \neq 0$ and $0 < r \leq \frac{1}{2}$. If 3a, 7b and 15c are the first three terms of an A.P., then the 4th term of this A.P. is: **[JEE Main 2019]**

(a) $\frac{2}{3}a$ (b) $5a$ (c) $\frac{7}{3}a$ (d) a

97. The product of three consecutive terms of a G.P. is 512. If 4 is added to each of the first and the second of these terms, the three terms now form an A.P. Then the sum of the original three terms of the given G.P. is: **[JEE Main 2019]**

(a) 36 (b) 32 (c) 24 (d) 28

98. Let a, b and c be the $7^{th}, 11^{th}$ and 13^{th} terms respectively of a non-constant A.P. If these are also the three consecutive terms of a G.P., then $\frac{a}{c}$ is equal to: **[JEE Main 2019]**

(a) 2 (b) $\frac{1}{2}$ (c) $\frac{7}{13}$ (d) 4

Progressions involving roots of equations

99. The roots of the quadratic equation $3x^2 - px + q = 0$ are 10^{th} and 11^{th} terms of an arithmetic progression with common difference $\frac{3}{2}$. If the sum of the first 11 terms of this arithmetic progression is 88, then $q - 2p$ is equal to: **[JEE Main 2025]**

100. For $p, q \in R$, consider the real valued function $f(x) = (x-p)^2 - q$, $x \in R$ and $q > 0$. Let a_1, a_2, a_3 and a_4 be in an arithmetic progression with mean p and positive common difference. If $|f(a_i)| = 500$ for all $i = 1, 2, 3, 4$, then the absolute difference between the roots of $f(x) = 0$ is: **[JEE Main 2022]**

101. If the arithmetic mean and geometric mean of the pth and qth terms of the sequence $-16, 8, -4, 2, \ldots$ satisfy the equation $4x^2 - 9x + 5 = 0$, then $p + q$ is equal to: **[JEE Main 2021]**

Insertion of Means (A.M. and G.M.)

102. Let A_1 and A_2 be two arithmetic means and G_1, G_2 and G_3 be three geometric means of two distinct positive numbers. Then $G_1^4 + G_2^4 + G_3^4 + G_1^2 G_3^2$ is equal to: **[JEE Main 2023]**

(1) $(A_1 + A_2)^2 G_1 G_3$
(2) $2(A_1 + A_2) G_1 G_3$
(3) $(A_1 + A_2) G_1^2 G_3^2$
(4) $2(A_1 + A_2) G_1^2 G_3^2$

103. If n arithmetic means are inserted between a and 100 such that the ratio of the first mean to the last mean is 1 : 7 and $a + n = 33$, then the value of n is: **[JEE Main 2022]**

(A) 21 (B) 22 (C) 23 (D) 24

104. If m arithmetic means (A.Ms) and three geometric means (G.Ms) are inserted between 3 and 243 such that 4^{th} A.M. is equal to 2^{nd} G.M., then m is equal to: **[JEE Main 2020]**

AM-GM-HM Inequality and Other Inequalities

105. For $x \geq 0$ the least value of K, for which $4^{1+x} + 4^{1-x}$, $\frac{K}{2}$, $16^x + 16^{-x}$ are three consecutive terms of an A.P., is equal to: **[JEE Main 2024]**

(1) 8 (2) 4 (3) 10 (4) 16

106. Let a, b, c and d be positive real numbers such that $a + b + c + d = 11$. If the maximum value of $a^5 b^3 c^2 d$ is 3750β, then the value of β is: **[JEE Main 2023]**

(1) 90 (2) 110 (3) 55 (4) 108

107. The minimum value of $f(x) = a^{a^x} + a^{1-a^x}$, where a, $x \in R$ and $a > 0$, is equal to: **[JEE Main 2021]**

(1) $a + \frac{1}{a}$ (2) $a + 1$ (3) 2a (4) $2\sqrt{a}$

108. Let f: $R \to R$ be such that for all $x \in R$, $(2^{1+x} + 2^{1-x})$, f(x) and $(3^x + 3^{-x})$ are in A.P., then the minimum value of f(x) is: **[JEE Main 2020]**

(a) 2 (b) 3 (c) 0 (d) 4

Special Series and Summations

Arithmetico-Geometric Progression (A.G.P.)

109. If $7 = 5 + \frac{1}{7}(5 + \alpha) + \frac{1}{7^2}(5 + 2\alpha) + \frac{1}{7^3}(5 + 3\alpha) + \ldots\infty$, then the value of α is: **[JEE Main 2025]**

(1) $\frac{6}{7}$ (2) 6 (3) $\frac{1}{7}$ (4) 1

110. If $8 = 3 + \frac{1}{4}(3 + p) + \frac{1}{4^2}(3 + 2p) + \frac{1}{4^3}(3 + 3p) + \ldots\infty$, then the value of p is: **[JEE Main 2024]**

111. For $k \in \mathbb{N}$, if the sum of the series $1 + \frac{4}{k} + \frac{8}{k^2} + \frac{13}{k^3} + \frac{19}{k^4} + \ldots$ is 10, then the value of k is: **[JEE Main 2023]**

112. Let $S = 109 + \frac{108}{5} + \frac{107}{5^2} + \ldots + \frac{2}{5^{107}} + \frac{1}{5^{108}}$. Then the value of $(16S - (25)^{-54})$ is: **[JEE Main 2023]**

113. Suppose $a_1, a_2 = 2, a_3, a_4$ be in an arithmetico-geometric progression. If the common ratio of the corresponding geometric progression is 2 and the sum of all 5 terms of the arithmetico-geometric progression is $\frac{49}{2}$, then a_4 is equal to: **[JEE Main 2023]**

114. The sum $1 + 2 \cdot 3 + 3 \cdot 3^2 + ... + 10 \cdot 3^9$ is equal to: **[JEE Main 2022]**

(A) $\frac{2 \cdot 3^{12}+10}{4}$ (B) $\frac{19 \cdot 3^{10}+1}{4}$
(C) $5 \cdot 3^{10} - 2$ (D) $\frac{9 \cdot 3^{10}+1}{2}$

115. Let $S = 2 + \frac{6}{7} + \frac{12}{7^2} + \frac{20}{7^3} + \frac{30}{7^4} + \ldots$, then 4S is equal to: **[JEE Main 2022]**

(A) $(\frac{7}{3})^2$ (B) $\frac{7^3}{3^2}$ (C) $(\frac{7}{3})^3$ (D) $4 \cdot (\frac{7}{3})^3$

116. The sum of the infinite series $1 + \frac{2}{3} + \frac{7}{3^2} + \frac{12}{3^3} + \frac{17}{3^4} + \frac{22}{3^5} + \ldots$ is equal to: **[JEE Main 2021]**

(1) $\frac{9}{4}$ (2) $\frac{15}{4}$ (3) $\frac{13}{4}$ (4) $\frac{11}{4}$

117. If $S = \frac{7}{5} + \frac{9}{5^2} + \frac{13}{5^3} + \frac{19}{5^4} + \ldots$, then 160S is equal to: **[JEE Main 2021]**

118. Let S be the sum of the first 9 terms of the series : $\{x + ka\} + \{x^2 + (k+2)a\} + \{x^3 + (k+4)a\} + \{x^4 + (k+6)a\} + \ldots$ where $a \neq 0$ and $x \neq 1$. If $S = \frac{x^{10} - x + 45a(x-1)}{x-1}$, then k is equal to: **[JEE Main 2020]**

(a) -5 (b) 1 (c) -3 (d) 3

119. The sum $\sum_{k=1}^{20} k \frac{1}{2^k}$ is equal to: **[JEE Main 2019]**

(a) $2 - \frac{3}{2^{17}}$ (b) $1 - \frac{11}{2^{20}}$ (c) $2 - \frac{11}{2^{19}}$ (d) $2 - \frac{21}{2^{20}}$

Summation using Method of Differences (V_n Method)

120. For positive integers n, if $4a_n = (n^2 + 5n + 6)$ and $S_n = \sum_{k=1}^{n} \left(\frac{1}{a_k}\right)$, then the value of $507 S_{2025}$ is: **[JEE Main 2025]**

(1) 540 (2) 675 (3) 1350 (4) 135

121. Let $S_n = \frac{1}{2} + \frac{1}{6} + \frac{1}{12} + \frac{1}{20} + ...$ upto n terms. If the sum of the first six terms of an A.P. with first term -p and common difference p is $\sqrt{2026 S_{2025}}$, then the absolute difference between 20^{th} and 15^{th} terms of the A.P. is: **[JEE Main 2025]**

(1) 20 (2) 90 (3) 45 (4) 25

122. If the sum of the first 10 terms of the series $\frac{4 \cdot 1}{1+4 \cdot 1^4} + \frac{4 \cdot 2}{1+4 \cdot 2^4} + \frac{4 \cdot 3}{1+4 \cdot 3^4} + ...$ is $\frac{m}{n}$, where $gcd(m,n) = 1$, then $m + n$ is equal to: **[JEE Main 2025]**

123. If the sum of the first 20 terms of the series $\frac{4 \cdot 1}{4+3 \cdot 1^2+1^4} + \frac{4 \cdot 2}{4+3 \cdot 2^2+2^4} + \frac{4 \cdot 3}{4+3 \cdot 3^2+3^4} + \ldots$ is $\frac{m}{n}$, where m and n are coprime, then $m + n$ is equal to: **[JEE Main 2025]**

(A) 423 (B) 421 (C) 422 (D) 420

124. If $\frac{1}{\sqrt{1}+\sqrt{2}} + \frac{1}{\sqrt{2}+\sqrt{3}} + ... + \frac{1}{\sqrt{99}+\sqrt{100}} = m$ and $\frac{1}{1 \cdot 2} + \frac{1}{2 \cdot 3} + ... + \frac{1}{99 \cdot 100} = n$, then the point (m, n) lies on the line: **[JEE Main 2024]**

(1) $11(x-1) - 100(y-2) = 0$ (2) $11x - 100y = 0$
(3) $11(x-2) - 100(y-1) = 0$ (4) $11(x-1) - 100y = 0$

125. The sum of the series $\frac{1}{1-3 \cdot 1^2+1^4} + \frac{2}{1-3 \cdot 2^2+2^4} + \frac{3}{1-3 \cdot 3^2+3^4} + ...$ up to 10 terms is: **[JEE Main 2024]**

(1) $\frac{45}{109}$ (2) $-\frac{45}{109}$ (3) $\frac{55}{109}$ (4) $-\frac{55}{109}$

126. If the sum of the series $\frac{1}{1 \cdot (1+d)} + \frac{1}{(1+d)(1+2d)} + ... + \frac{1}{(1+9d)(1+10d)}$ is equal to 5, then 50d is equal to: **[JEE Main 2024]**

(1) 10 (2) 5 (3) 15 (4) 20

127. If the sum of the series $(\frac{1}{2}-\frac{1}{3})+(\frac{1}{2^2}-\frac{1}{2\cdot3}+\frac{1}{3^2})+(\frac{1}{2^3}-\frac{1}{2^2\cdot3}+\frac{1}{2\cdot3^2}-\frac{1}{3^3})+\dots$ is $\frac{\alpha}{\beta}$, where α and β are co-prime, then $\alpha+3\beta$ is equal to: **[JEE Main 2023]**

128. If $a_n=\frac{-2}{4n^2-16n+15}$, then $a_1+a_2+\cdots+a_{25}$ is equal to: **[JEE Main 2023]**

(1) $\frac{51}{144}$ (2) $\frac{49}{138}$ (3) $\frac{50}{141}$ (4) $\frac{52}{147}$

129. The sum to 10 terms of the series $\frac{1}{1+1^2+1^4}+\frac{2}{1+2^2+2^4}+\frac{3}{1+3^2+3^4}+\dots$ is: **[JEE Main 2023]**

(1) $\frac{59}{111}$ (2) $\frac{55}{111}$ (3) $\frac{56}{111}$ (4) $\frac{58}{111}$

130. Let $a_1,a_2,...,a_n$ be n positive consecutive terms of an arithmetic progression. If $d>0$ is its common difference, then $\lim_{n\to\infty}\sqrt{\frac{d}{n}}(\frac{1}{\sqrt{a_1}+\sqrt{a_2}}+\frac{1}{\sqrt{a_2}+\sqrt{a_3}}+\dots+\frac{1}{\sqrt{a_{n-1}}+\sqrt{a_n}})$ is: **[JEE Main 2023]**

(1) $\frac{1}{\sqrt{d}}$ (2) $\sqrt{d}$ (3) 1 (4) 2

131. The sum $\sum_{n=1}^{21}\frac{3}{(4n-1)(4n+3)}$ is equal to: **[JEE Main 2022]**

(A) $\frac{7}{87}$ (B) $\frac{7}{29}$ (C) $\frac{14}{87}$ (D) $\frac{21}{29}$

132. If $\sum_{k=1}^{10}\frac{k}{k^4+k^2+1}=\frac{m}{n}$, where m and n are co-prime, then $m+n$ is equal to: **[JEE Main 2022]**

133. If $\frac{1}{(20-a)(40-a)}+\frac{1}{(40-a)(60-a)}+\cdots+\frac{1}{(180-a)(200-a)}=\frac{1}{256}$, then the maximum value of a is: **[JEE Main 2022]**

(A) 198 (B) 202 (C) 212 (D) 218

134. If $\frac{1}{2\times3\times4}+\frac{1}{3\times4\times5}+\frac{1}{4\times5\times6}+\dots+\frac{1}{100\times101\times102}=\frac{k}{101}$, then 34k is equal to: **[JEE Main 2022]**

135. If the sum of the first ten terms of the series $\frac{1}{5}+\frac{2}{65}+\frac{3}{325}+\frac{4}{1025}+\frac{5}{2501}+\dots$ is $\frac{m}{n}$, where m and n are co-prime numbers, then $m+n$ is equal to: **[JEE Main 2022]**

136. The sum $\frac{1}{3^2-1}+\frac{1}{5^2-1}+\frac{1}{7^2-1}+\dots+\frac{1}{(201)^2-1}$ is equal to: **[JEE Main 2021]**

(1) $\frac{101}{404}$ (2) $\frac{25}{101}$ (3) $\frac{101}{408}$ (4) $\frac{99}{400}$

137. For $k\in N$, let $\frac{1}{\alpha(\alpha+1)(\alpha+2)...(\alpha+20)}=\sum_{K=0}^{20}\frac{A_k}{\alpha+k}$, where $\alpha>0$. Then the value of $100(\frac{A_{14}+A_{15}}{A_{13}})^2$ is equal to: **[JEE Main 2021]**

138. The sum of 10 terms of the series $\frac{3}{1^2\times2^2}+\frac{5}{2^2\times3^2}+\frac{7}{3^2\times4^2}+\dots$ is: **[JEE Main 2021]**

(1) 1 (2) $\frac{120}{121}$ (3) $\frac{99}{100}$ (4) $\frac{143}{144}$

139. Let $a_1,a_2,\dots,a_{21}$ be an AP such that $\sum_{n=1}^{20}\frac{1}{a_na_{n+1}}=\frac{4}{9}$. If the sum of this AP is 189, then a_6a_{16} is equal to: **[JEE Main 2021]**

(1) 57 (2) 72 (3) 48 (4) 36

140. The sum of the series $\frac{1}{x+1}+\frac{2}{x^2+1}+\frac{2^2}{x^4+1}+\dots+\frac{2^{100}}{x^{2^{100}}+1}$ when $x=2$ is: **[JEE Main 2021]**

(1) $1+\frac{2^{101}}{4^{101}-1}$ (2) $1+\frac{2^{100}}{4^{101}-1}$
(3) $1-\frac{2^{100}}{4^{100}-1}$ (4) $1-\frac{2^{101}}{4^{101}-1}$

Summation involving $\Sigma n,\Sigma n^2,\Sigma n^3$

141. The sum of the series $1+3+5^2+7+9^2+\dots$ upto 40 terms is equal to: **[JEE Main 2025]**

(A) 40870 (B) 41880 (C) 43890 (D) 33980

142. The sum $1+3+11+25+45+71+...$ upto 20 terms, is equal to: **[JEE Main 2025]**

(A) 7240 (B) 8124 (C) 7130 (D) 6982

143. Let $\alpha = \sum_{n=1}^{10} n(\frac{n^2}{2}+\frac{3n}{2}-1)^2$ and $\beta = \sum_{n=1}^{10} n^4$. If $4\alpha-\beta = 55k+40$, then k is equal to: **[JEE Main 2024]**

144. The value of $\frac{1\times2^2+2\times3^2+...+100\times(101)^2}{1^2\times2+2^2\times3+....+100^2\times101}$ is: **[JEE Main 2024]**

(1) $\frac{32}{31}$ (2) $\frac{31}{30}$ (3) $\frac{306}{305}$ (4) $\frac{305}{301}$

145. The sum of the first 20 terms of the series $5+11+19+29+41+\ldots$ is: **[JEE Main 2023]**

(1) 3520 (2) 3450 (3) 3250 (4) 3420

146. Let a_n be n^{th} term of the series $5+8+14+23+35+50+\ldots$ and $S_n = \sum_{k=1}^{n} a_k$. Then $S_{30}-a_{40}$ is equal to: **[JEE Main 2023]**

(1) 11310 (2) 11260 (3) 11290 (4) 11280

147. If $S_n = 4+11+21+34+50+...$ to n terms, then $\frac{1}{60}(S_{29}-S_9)$ is equal to: **[JEE Main 2023]**

(1) 223 (2) 226 (3) 220 (4) 227

148. The sum to 20 terms of the series $2\cdot2^2-3^2+2\cdot4^2-5^2+2\cdot6^2-...$ is equal to: **[JEE Main 2023]**

149. If $\frac{1^3+2^3+3^3+\cdots+n \text{ terms}}{1\cdot3+2\cdot5+3\cdot7+\cdots+n \text{ terms}} = \frac{9}{5}$, then the value of n is: **[JEE Main 2023]**

150. The sum of the series $1^2-2\cdot3^2+3\cdot5^2-4\cdot7^2+5\cdot9^2-...-10\cdot21^2$ is: **[JEE Main 2023]**

151. The sum of the infinite series $1^2-2\cdot3^2+3\cdot5^2-....+15\cdot29^2$ is: **[JEE Main 2023]**

152. Consider two G.Ps. $2, 2^2, 2^3, ...$ and $4, 4^2, 4^3, \ldots$ of 60 and n terms respectively. If the geometric mean of all the $60+n$ terms is $(2)^{\frac{225}{8}}$, then $\sum_{k=1}^{n} k(n-k)$ is equal to: **[JEE Main 2022]**

(A) 560 (B) 1540 (C) 1330 (D) 2600

153. The series of positive multiples of 3 is divided into sets: 3, 6, 9,12, 15, 18, 21, 24, 27,... Then the sum of the elements in the 11^{th} set is equal to: **[JEE Main 2022]**

154. The sum of the series $\frac{2^3-1^3}{1\times7}+\frac{4^3-3^3+2^3-1^3}{2\times11}+\frac{6^3-5^3+4^3-3^3+2^3-1^3}{3\times15}+...+\frac{30^3-29^3+...+2^3-1^3}{15\times63}$ is equal to: **[JEE Main 2022]**

155. Let $A = \sum_{i=1}^{10}\sum_{j=1}^{10} min\{i,j\}$ and $B = \sum_{i=1}^{10}\sum_{j=1}^{10} max\{i,j\}$. Then $A+B$ is equal to: **[JEE Main 2022]**

156. The sum, $\sum_{n=1}^{7} \frac{n(n+1)(2n+1)}{4}$ is equal to: **[JEE Main 2020]**

157. The sum $\sum_{k=1}^{20}(1+2+3+...+k)$ is: **[JEE Main 2020]**

158. If the sum of the first 40 terms of the series, $3+4+8+9+13+14+18+19+...$ is $(102)m$, then m is equal to: **[JEE Main 2020]**

(a) 20 (b) 25 (c) 5 (d) 10

159. The sum $\frac{3\times1^3}{1^2}+\frac{5\times(1^3+2^3)}{1^2+2^2}+\frac{7\times(1^3+2^3+3^3)}{1^2+2^2+3^2}+\ldots$ upto 10^{th} term, is: **[JEE Main 2019]**

(a) 680 (b) 600 (c) 660 (d) 620

160. The sum $1+\frac{1^3+2^3}{1+2}+\frac{1^3+2^3+3^3}{1+2+3}+...+\frac{1^3+2^3+...+15^3}{1+2+...+15}-\frac{1}{2}(1+2+...+15)$ is equal to: **[JEE Main 2019]**

(a) 620 (b) 1240 (c) 1860 (d) 660

161. The sum of the series $1+2\times3+3\times5+4\times7+...$ upto 11^{th} term is: **[JEE Main 2019]**

(a) 915 (b) 946 (c) 945 (d) 916

162. Let $S_k=\frac{1+2+3+...+k}{k}$. If $S_1^2+S_2^2+....+S_{10}^2=\frac{5}{12}A$. Then A is equal to: **[JEE Main 2019]**

(a) 283 (b) 301 (c) 303 (d) 156

163. If the sum of the first 15 terms of the series $(\frac{3}{4})^3+(1\frac{1}{2})^3+(2\frac{1}{4})^3+3^3+(3\frac{3}{4})^3+...$ is equal to 225k, then k is equal to: **[JEE Main 2019]**

(a) 108 (b) 27 (c) 54 (d) 9

164. The sum of the following series $1+6+\frac{9(1^2+2^2+3^2)}{7}+\frac{12(1^2+2^2+3^2+4^2)}{9}+\frac{15(1^2+2^2+\cdots+5^2)}{11}+\ldots$ up to 15 terms, is: **[JEE Main 2019]**

(a) 7520 (b) 7510 (c) 7830 (d) 7820

165. The sum of the series $1\cdot2\cdot3+2\cdot3\cdot4+...+$ upto n terms is: **[JEE Main 2023]**

Summation involving Factorials and Exponentials

166. The value of $\lim_{n\to\infty}\left(\sum_{k=1}^{n}\frac{k^3+6k^2+11k+5}{(k+3)!}\right)$ is: **[JEE Main 2025]**

(1) 4/3 (2) 2 (3) 7/3 (4) 5/3

167. The sum $1+\frac{1+3}{2!}+\frac{1+3+5}{3!}+\frac{1+3+5+7}{4!}+...$ upto ∞ terms, is equal to: **[JEE Main 2025]**

(A) 3e (B) 2e (C) 4e (D) 6e

168. Let $\sum_{n=0}^{\infty}\frac{n^3((2n)!)+(2n-1)(n!)}{(n!)((2n)!)}=ae+\frac{b}{e}+c$, where a,b, $c\in\mathbb{Z}$ and $e=\sum_{n=0}^{\infty}\frac{1}{n!}$. Then a^2-b+c is equal to: **[JEE Main 2023]**

169. $\sum_{r=1}^{20}(r^2+1)(r!)$ is equal to: **[JEE Main 2022]**

(A) $22!-21!$ (B) $22!-2(21!)$
(C) $21!-2(20!)$ (D) $21!-20!$

170. If $\sum_{r=1}^{10}r!(r^3+6r^2+2r+5)=\alpha(11!)$, then the value of α is equal to: **[JEE Main 2021]**

171. The sum of the series $\sum_{n=1}^{\infty}\frac{n^2+6n+10}{(2n+1)!}$ is equal to: **[JEE Main 2021]**

(1) $\frac{41}{8}e+\frac{19}{8}e^{-1}-10$ (2) $-\frac{41}{8}e+\frac{19}{8}e^{-1}-10$
(3) $\frac{41}{8}e-\frac{19}{8}e^{-1}-10$ (4) $\frac{41}{8}e+\frac{19}{8}e^{-1}+10$

172. Let $S_n=1\cdot(n-1)+2\cdot(n-2)+3\cdot(n-3)+...+(n-1)\cdot1, n\geq4$. The sum $\sum_{n=4}^{\infty}\left(\frac{2S_n}{n!}-\frac{1}{(n-2)!}\right)$ is equal to: **[JEE Main 2021]**

(1) $\frac{e-1}{3}$ (2) $\frac{e-2}{6}$ (3) $\frac{e}{3}$ (4) $\frac{e}{6}$

Summation involving Log

173. If $0 < x < 1$ and $y = \frac{1}{2}x^2 + \frac{2}{3}x^3 + \frac{3}{4}x^4 + \ldots$, then the value of e^{1+y} at $x = \frac{1}{2}$ is: **[JEE Main 2021]**

(1) $\frac{1}{2}e^2$ (2) $2e$ (3) $\frac{1}{2}\sqrt{e}$ (4) $2e^2$

174. If $0 < x < 1$, then $\frac{3}{2}x^2 + \frac{5}{3}x^3 + \frac{7}{4}x^4 + \ldots$, is equal to: **[JEE Main 2021]**

(1) $x\left(\frac{1+x}{1-x}\right) + \log_e(1-x)$ (2) $x\left(\frac{1-x}{1+x}\right) + \log_e(1-x)$
(3) $\frac{1-x}{1+x} + \log_e(1-x)$ (4) $\frac{1+x}{1-x} + log_e(1-x)$

175. If $\log_3 2, \log_3(2^x - 5), \log_3(2^x - \frac{7}{2})$ are in an arithmetic progression, then the value of x is equal to: **[JEE Main 2021]**

176. If $\tan(\frac{\pi}{9}), x, \tan(\frac{7\pi}{18})$ are in arithmetic progression and $\tan(\frac{\pi}{9}), y, \tan(\frac{5\pi}{18})$ are also in arithmetic progression, then $|x - 2y|$ is equal to: **[JEE Main 2021]**

(1) 4 (2) 3 (3) 0 (4) 1

177. Let $S_n(x) = \log_{a^{1/2}} x + \log_{a^{1/3}} x + \log_{a^{1/6}} x + \log_{a^{1/11}} x + \log_{a^{1/18}} x + \log_{a^{1/27}} x + \ldots$ up to n-terms, where $a > 1$. If $S_{24}(x) = 1093$ and $S_{12}(2x) = 265$, then value of a is equal to: **[JEE Main 2021]**

178. If sum of the first 21 terms of the series $\log_{9^{1/2}} x + \log_{9^{1/3}} x + \log_{9^{1/4}} x + ...$, where $x > 0$ is 504, then x is equal to: **[JEE Main 2021]**

(1) 243 (2) 9 (3) 7 (4) 81

179. If the sum of the first 20 terms of the series $\log_{(7^{1/2})} x + \log_{(7^{1/3})} x + \log_{(7^{1/4})} x + ...$ is 460, then x is equal to: **[JEE Main 2020]**

(a) 7^2 (b) $7^{1/2}$ (c) e^2 (d) $7^{46/21}$

Miscellaneous Problems

Geometric Applications of Progressions

180. Let ABC be an equilateral triangle. A new triangle is formed by joining the middle points of all sides of the triangle ABC and the same process is repeated infinitely many times. If P is the sum of perimeters and Q is the sum of areas of all the triangles formed in this process, then : **[JEE Main 2024]**

(1) $P^2 = 6\sqrt{3}Q$ (2) $P^2 = 36\sqrt{3}Q$
(3) $P = 36\sqrt{3}Q^2$ (4) $P^2 = 72\sqrt{3}Q$

181. If three successive terms of a G.P. with common ratio $r(r > 1)$ are the lengths of the sides of a triangle and $[r]$ denotes the greatest integer less than or equal to r, then $3[r] + [-r]$ is equal to: **[JEE Main 2024]**

182. Let $A_1, A_2, A_3, \ldots$ be squares such that for each $n \geq 1$, the length of the side of A_n equals the length of diagonal of A_{n+1}. If the length of the side of A_1 is 12 cm, then the smallest value of n for which area of A_n is less than one, is: **[JEE Main 2021]**

183. Some identical balls are arranged in rows to form an equilateral triangle. The first row consists of one ball, the second row consists of two balls and so on. If 99 more identical balls are added to the total number of balls used in forming the equilateral triangle, then all these balls can be arranged in a square whose each side contains exactly 2 balls less than the number of balls each side of the triangle contains. Then the number of balls used to form the equilateral triangle is: **[JEE Main 2019]**

(a) 157 (b) 262 (c) 225 (d) 190

Recurrence Relations and Sequences

184. Let $\langle a_n \rangle$ be a sequence such that $a_0 = 0, a_1 = \frac{1}{2}$ and $2a_{n+2} = 5a_{n+1} - 3a_n, n = 0, 1, 2, 3, ...$ Then $\sum_{k=1}^{100} a_k$ is equal to: **[JEE Main 2025]**

(1) $3a_{99} - 100$ (2) $3a_{100} - 100$ (3) $3a_{99} + 100$ (4) $3a_{100} + 100$

185. Let the first term of a series be $T_1 = 6$ and its r^{th} term $T_r = 3T_{r-1} + 6^r, r = 2, 3, \ldots, n$. If the sum of the first n terms of this series is $\frac{1}{5}(n^2 - 12n + 39)(4 \cdot 6^n - 5 \cdot 3^n + 1)$, then n is equal to: **[JEE Main 2024]**

186. Let $a_1 = b_1 = 1$ and $a_n = a_{n-1} + (n-1)$, $b_n = b_{n-1} + a_{n-1}$, for $n \geq 2$. If $S = \sum_{n=1}^{10} \frac{b_n}{2^n}$ and $T = \sum_{n=1}^{8} \frac{n}{2^{n-1}}$, then $2^7(2S - T)$ is equal to: **[JEE Main 2023]**

187. Let $a_1 = b_1 = 1$, $a_n = a_{n-1} + 2$ and $b_n = a_n + b_{n-1}$ for every natural number $n \geq 2$. Then $\sum_{n=1}^{15} a_n \cdot b_n$ is equal to: **[JEE Main 2022]**

188. Consider the sequence $a_1, a_2, a_3, \ldots$ such that $a_1 = 1, a_2 = 2$ and $a_{n+2} = \frac{2}{a_{n+1}} + a_n$ for $n = 1, 2, 3, \ldots$. If $\left(\frac{a_1 + \frac{1}{a_2}}{a_3}\right)\left(\frac{a_2 + \frac{1}{a_3}}{a_4}\right) \ldots \left(\frac{a_{30} + \frac{1}{a_{31}}}{a_{32}}\right) = 2^{\alpha}({}^{61}C_{31})$, then α is equal to: **[JEE Main 2022]**

(A) -30 (B) -31 (C) -60 (D) -61

189. Let $\{a_n\}_{n=0}^{\infty}$ be a sequence such that $a_0 = a_1 = 0$ and $a_{n+2} = 3a_{n+1} - 2a_n + 1, \forall n \geq 0$. Then $a_{25}a_{23} - 2a_{25}a_{22} - 2a_{23}a_{24} + 4a_{22}a_{24}$ is equal to: **[JEE Main 2022]**

(A) 483 (B) 528 (C) 575 (D) 624

190. Let $\{a_n\}_{n=0}^{\infty}$ be a sequence such that $a_0 = a_1 = 0$ and $a_{n+2} = 2a_{n+1} - a_n + 1$ for all $n \geq 0$. Then, $\sum_{n=2}^{\infty} \frac{a_n}{7^n}$ is equal to: **[JEE Main 2022]**

(A) $\frac{6}{343}$ (B) $\frac{7}{216}$ (C) $\frac{8}{343}$ (D) $\frac{49}{216}$

191. Let $\{a_n\}_{n=1}^{\infty}$ be a sequence such that $a_1 = 1, a_2 = 1$ and $a_{n+2} = 2a_{n+1} + a_n$ for all $n \geq 1$. Then the value of $47 \sum_{n=1}^{\infty} \frac{a_n}{2^{3n}}$ is equal to: **[JEE Main 2021]**

Other Miscellaneous Problems

192. If $\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + ...\infty = \frac{\pi^4}{90}$,
$\frac{1}{1^4} + \frac{1}{3^4} + \frac{1}{5^4} + ...\infty = \alpha$, and
$\frac{1}{2^4} + \frac{1}{4^4} + \frac{1}{6^4} + ...\infty = \beta$, then $\frac{\alpha}{\beta}$ is equal to: **[JEE Main 2025]**

(A) 23 (B) 14 (C) 18 (D) 15

193. A software company sets up m number of computer systems to finish an assignment in 17 days. If 4 computer systems crashed on the start of the second day, 4 more computer systems crashed on the start of the third day and so on, then it took 8 more days to finish the assignment. The value of m is equal to: **[JEE Main 2024]**

(1) 150 (2) 180 (3) 160 (4) 125

194. If $S(x) = (1 + x) + 2(1 + x)^2 + 3(1 + x)^3 + \cdots + 60(1 + x)^{60}$, $x \neq 0$, and $(60)^2 S(60) = a(b)^b + b$, where a, $b \in N$ then $(a + b)$ equal to: **[JEE Main 2024]**

195. If the set $R = \{(a, b) : a + 5b = 42, a, b \in \mathbb{N}\}$ has m elements and $\sum_{n=1}^{m}(1 - i^{n!}) = x + iy$, where $i = \sqrt{-1}$, then the value of $m + x + y$ is: **[JEE Main 2024]**

(1) 12 (2) 4 (3) 8 (4) 5

196. An arithmetic progression is written in the following way

$$\begin{array}{cccc} & & 2 & \\ & 5 & 8 & \\ 11 & 14 & 17 & \\ 20 & 23 & 26 & 29 \\ & \cdots\cdots & & \end{array}$$

The sum of all the terms of the 10^{th} row is: **[JEE Main 2024]**

197. Let the positive integers be written in the form:

$$\begin{array}{cccc} & & 1 & \\ & 2 & 3 & \\ 4 & 5 & 6 & \\ 7 & 8 & 9 & 10 \\ & \cdots\cdots & & \end{array}$$

If the k^{th} row contains exactly k numbers for every natural number k, then the row in which the number 5310 will be, is: **[JEE Main 2024]**

198. If $\left(\frac{1}{\alpha+1}+\frac{1}{\alpha+2}+...+\frac{1}{\alpha+1012}\right)-\left(\frac{1}{1\cdot 2}+\frac{1}{3\cdot 4}+...+\frac{1}{2023\cdot 2024}\right)=\frac{1}{2024}$, then α is equal to: **[JEE Main 2024]**

199. If $1+\frac{\sqrt{3}-\sqrt{2}}{2\sqrt{3}}+\frac{5-2\sqrt{6}}{18}+\frac{9\sqrt{3}-11\sqrt{2}}{36\sqrt{3}}+\frac{49-20\sqrt{6}}{180}+...$ upto $\infty = 2+\left(\sqrt{\frac{b}{a}}+1\right)\log_e\left(\frac{a}{b}\right)$, where a and b are integers with $gcd(a,b)=1$, then $11a+18b$ is equal to: **[JEE Main 2024]**

200. If $gcd(m,n)=1$ and $1^2-2^2+3^2-4^2+...+(2021)^2-(2022)^2+(2023)^2=1012m^2n$, then m^2-n^2 is equal to: **[JEE Main 2023]**

(1) 240 (2) 200 (3) 220 (4) 180

201. If $(20)^{19}+2(21)(20)^{18}+3(21)^2(20)^{17}+...+20(21)^{19}=k(20)^{19}$, then k is equal to: **[JEE Main 2023]**

202. Let $x_1,x_2,...,x_{100}$ be in an arithmetic progression, with $x_1=2$ and their mean equal to 200. If $y_i=i(x_i-i), 1\le i\le 100$, then the mean of $y_1,y_2,...,y_{100}$ is: **[JEE Main 2023]**

(1) 10100 (2) 10101.50 (3) 10049.50 (4) 10051.50

203. The sum of the series $1^2-2\cdot 3^2+3\cdot 5^2-4\cdot 7^2+5\cdot 9^2-...-10\cdot 21^2$ is: **[JEE Main 2023]**

204. If $\frac{6}{3^{12}}+\frac{10}{3^{11}}+\frac{20}{3^{10}}+\frac{40}{3^9}+\cdots+\frac{10240}{3}=2^n\cdot m$, where m is odd, then m.n is equal to: **[JEE Main 2022]**

205. If $\frac{1}{2\cdot 3^{10}}+\frac{1}{2^2\cdot 3^9}+...+\frac{1}{2^{10}\cdot 3}=\frac{K}{2^{10}\cdot 3^{10}}$, then the remainder when K is divided by 6 is: **[JEE Main 2022]**

(A) 1 (B) 2 (C) 3 (D) 5

206. The greatest integer less than or equal to the sum of first 100 terms of the sequence $\frac{1}{3},\frac{5}{9},\frac{19}{27},\frac{65}{81},...$ is equal to: **[JEE Main 2022]**

207. If $A = \sum_{n=1}^{\infty} \frac{1}{(3+(-1)^n)^n}$ and $B = \sum_{n=1}^{\infty} \frac{(-1)^n}{(3+(-1)^n)^n}$, then $\frac{A}{B}$ is equal to: **[JEE Main 2022]**

(A) $\frac{11}{9}$ (B) 1 (C) $-\frac{11}{9}$ (D) $-\frac{11}{3}$

208. Let for $n = 1, 2, ..., 50$, S_n be the sum of the infinite geometric progression whose first term is n^2 and whose common ratio is $\frac{1}{(n+1)^2}$. Then the value of $\frac{1}{26} + \sum_{n=1}^{50}(S_n + \frac{2}{n+1} - n - 1)$ is equal to: **[JEE Main 2022]**

209. The sum of the infinite series $1 + \frac{5}{6} + \frac{12}{6^2} + \frac{22}{6^3} + \frac{35}{6^4} + \frac{51}{6^5} + \frac{70}{6^6} + ...$ is equal to: **[JEE Main 2022]**

(A) $\frac{425}{216}$ (B) $\frac{429}{216}$ (C) $\frac{288}{125}$ (D) $\frac{280}{125}$

210. Let α, β are natural numbers such that $100^{\alpha} - 199\beta = (100)(100) + (99)(101) + (98)(102) + \cdots + (1)(199)$, then the slope of the line passing through (α, β) and origin is: **[JEE Main 2021]**

(1) 540 (2) 550 (3) 530 (4) 510

211. If the value of $(1 + \frac{2}{3} + \frac{6}{3^2} + \frac{10}{3^3} + \ldots \text{upto } \infty)^{\log_{0.25}(\frac{1}{3} + \frac{1}{3^2} + \ldots\infty)}$ is l, then l^2 is equal to: **[JEE Main 2021]**

212. If $[x]$ be the greatest integer less than or equal to x, then $\sum_{n=8}^{100}\left[\frac{(-1)^n n}{2}\right]$ is equal to: **[JEE Main 2021]**

(1) 0 (2) 4 (3) -2 (4) 2

213. The sum of the series $1 \cdot 2 \cdot 3 + 2 \cdot 3 \cdot 4 + ... +$ upto n terms is: **[JEE Main 2023]**

214. If $\tan(\frac{\pi}{9}), x, \tan(\frac{7\pi}{18})$ are in arithmetic progression and $\tan(\frac{\pi}{9}), y, \tan(\frac{5\pi}{18})$ are also in arithmetic progression, then $|x - 2y|$ is equal to: **[JEE Main 2021]**

(1) 4 (2) 3 (3) 0 (4) 1

215. Let $S_n(x) = \log_{a^{1/2}} x + \log_{a^{1/3}} x + \log_{a^{1/6}} x + \log_{a^{1/11}} x + \log_{a^{1/18}} x + \log_{a^{1/27}} x + \ldots$ up to n-terms, where $a > 1$. If $S_{24}(x) = 1093$ and $S_{12}(2x) = 265$, then value of a is equal to: **[JEE Main 2021]**

216. The sum of the infinite series $1^2 - 2 \cdot 3^2 + 3 \cdot 5^2 - .... + 15 \cdot 29^2$ is: **[JEE Main 2023]**

217. The sum of all those terms, of the arithmetic progression 3, 8, 13, ..., 373, which are not divisible by 3, is equal to: **[JEE Main 2023]**

218. The sum of the series $\frac{1}{x+1} + \frac{2}{x^2+1} + \frac{2^2}{x^4+1} + ... + \frac{2^{100}}{x^{2^{100}}+1}$ when $x = 2$ is: **[JEE Main 2021]**

(1) $1 + \frac{2^{101}}{4^{101}-1}$ (2) $1 + \frac{2^{100}}{4^{101}-1}$

(3) $1 - \frac{2^{100}}{4^{100}-1}$ (4) $1 - \frac{2^{101}}{4^{101}-1}$

219. Let a, b, $c > 1$, a^3, b^3 and c^3 be in A.P., and $\log_a b, \log_c a$ and $\log_b c$ be in G.P. If the sum of first 20 terms of an A.P., whose first term is $\frac{a+4b+c}{3}$ and the common difference is $\frac{a-8b+c}{10}$, is -444, then abc is equal to: **[JEE Main 2023]**

(1) 343 (2) 216 (3) $\frac{343}{8}$ (4) $\frac{125}{8}$

Answer Key

1	(20)	**2**	(C)	**3**	(D)	**4**	(8)	**5**	(A)	**6**	(53)	**7**	(C)	**8**	(C)
9	(A)	**10**	(11132)	**11**	(B)	**12**	(C)	**13**	(A)	**14**	(B)	**15**	(D)	**16**	(B)
17	(C)	**18**	(C)	**19**	(A)	**20**	(C)	**21**	(754)	**22**	(B)	**23**	(B)	**24**	(D)
25	(A)	**26**	(A)	**27**	(2021)	**28**	(A)	**29**	(B)	**30**	(D)	**31**	(D)	**32**	(D)
33	(C)	**34**	(A)	**35**	(B)	**36**	(D)	**37**	(A)	**38**	(C)	**39**	(C)	**40**	(D)
41	(D)	**42**	(D)	**43**	(6699)	**44**	(C)	**45**	(151)	**46**	(321)	**47**	(2223)	**48**	(D)
49	(3)	**50**	(14)	**51**	(D)	**52**	(B)	**53**	(C)	**54**	(B)	**55**	(12)	**56**	(A)
57	(60)	**58**	(C)	**59**	(A)	**60**	(A)	**61**	(D)	**62**	(A)	**63**	(D)	**64**	(B)
65	(40)	**66**	(3)	**67**	(B)	**68**	(B)	**69**	(C)	**70**	(D)	**71**	(B)	**72**	(C)
73	(9)	**74**	(A)	**75**	(16)	**76**	(B)	**77**	(4)	**78**	(A)	**79**	(B)	**80**	(C)
81	(B)	**82**	(A)	**83**	(D)	**84**	(D)	**85**	(D)	**86**	(A)	**87**	(C)	**88**	(A)
89	(B)	**90**	(3)	**91**	(150)	**92**	(A)	**93**	(B)	**94**	(14)	**95**	(A)	**96**	(D)
97	(D)	**98**	(D)	**99**	(474)	**100**	(50)	**101**	(10)	**102**	(A)	**103**	(C)	**104**	(39)
105	(C)	**106**	(A)	**107**	(D)	**108**	(B)	**109**	(B)	**110**	(9)	**111**	(2)	**112**	(2175)
113	(16)	**114**	(B)	**115**	(C)	**116**	(C)	**117**	(305)	**118**	(C)	**119**	(C)	**120**	(B)
121	(D)	**122**	(441)	**123**	(B)	**124**	(B)	**125**	(D)	**126**	(B)	**127**	(7)	**128**	(C)
129	(B)	**130**	(C)	**131**	(B)	**132**	(166)	**133**	(C)	**134**	(286)	**135**	(276)	**136**	(B)
137	(9)	**138**	(B)	**139**	(B)	**140**	(D)	**141**	(B)	**142**	(D)	**143**	(353)	**144**	(D)
145	(A)	**146**	(C)	**147**	(A)	**148**	(1310)	**149**	(5)	**150**	(M)	**151**	(6952)	**152**	(C)
153	(6993)	**154**	(120)	**155**	(1100)	**156**	(504)	**157**	(1540)	**158**	(A)	**159**	(C)	**160**	(A)
161	(B)	**162**	(C)	**163**	(B)	**164**	(D)	**165**	(M)	**166**	(D)	**167**	(B)	**168**	(26)
169	(B)	**170**	(160)	**171**	(C)	**172**	(A)	**173**	(A)	**174**	(A)	**175**	(3)	**176**	(C)
177	(16)	**178**	(D)	**179**	(A)	**180**	(B)	**181**	(1)	**182**	(9)	**183**	(D)	**184**	(B)
185	(6)	**186**	(461)	**187**	(27560)	**188**	(C)	**189**	(B)	**190**	(B)	**191**	(7)	**192**	(D)
193	(C)	**194**	(3660)	**195**	(A)	**196**	(1505)	**197**	(103)	**198**	(1011)	**199**	(76)	**200**	(A)
201	(400)	**202**	(C)	**203**	(M)	**204**	(12)	**205**	(D)	**206**	(98)	**207**	(C)	**208**	(41651)
209	(C)	**210**	(B)	**211**	(3)	**212**	(B)	**213**	(M)	**214**	(C)	**215**	(16)	**216**	(6952)
217	(9525)	**218**	(D)	**219**	(B)										