Hi everyone,

The real learning in mathematics happens when you actively engage with a problem, explore different methods, and work through challenges. Therefore, we strongly encourage you to use this solution key responsibly.

Please attempt all the problems on your own first, giving them your best and most honest effort. These solutions are to help you get unstuck on a problem after you have already tried your best.

Your effort and dedication are the true keys to success.

Exam Date: 23 November 2025

Syllabus: Sequences & Series

Sub: Mathematics **CT-07 CET - Solution** Prof. Chetan Sir

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1. The sum to infinity of $\frac{1}{7} + \frac{2}{7^2} + \frac{1}{7^3} + \frac{2}{7^4} + ...$ is

(A) $\frac{3}{16}$ (B) $\frac{1}{5}$ (C) $\frac{1}{24}$ (D) $\frac{1}{16}$

Answer: (A)
Solution: Let the sum be S.

$$S = \frac{1}{7} + \frac{2}{7^2} + \frac{1}{7^3} + \frac{2}{7^4} + \dots$$

We can split this into two infinite Geometric Progressions (G.P.s):

$$S = \left(\frac{1}{7} + \frac{1}{7^3} + \dots\right) + \left(\frac{2}{7^2} + \frac{2}{7^4} + \dots\right)$$

For the first series (S_1), we have first term $a = 1/7$ and common ratio $r = 1/49$:

$$S_1 = \frac{a}{1-r} = \frac{1/7}{1-1/49} = \frac{1/7}{48/49} = \frac{1}{7} \times \frac{49}{48} = \frac{7}{48}$$

For the second series (S_2), we have first term $a = 2/49$ and common ratio $r = 1/49$:

$$S_2 = \frac{a}{1-r} = \frac{2/49}{1-1/49} = \frac{2/49}{48/49} = \frac{2}{48}$$

The total sum S is the sum of these two parts:

$$S = S_1 + S_2 = \frac{7}{48} + \frac{2}{48} = \frac{9}{48} = \frac{3}{16}$$

2. If $3 + 3a + 3a^2 + \dots \infty = \frac{45}{8}$, then the value of a will be

(A) 15/23 (B) 7/15 (C) 7/8 (D) 15/7

Answer: (B)
Solution: The series is an infinite G.P. with first term $A = 3$ and common ratio $r = a$. The formula for sum to infinity is $S_\infty = \frac{A}{1-r}$.

$$\frac{3}{1-a} = \frac{45}{8}$$

Simplify the equation:

$$\frac{1}{1-a} = \frac{15}{8}$$

Cross-multiply to solve for a:

$$8 = 15(1-a)$$

$$
\begin{aligned}
8 &= 15 - 15a \\
15a &= 7 \\
a &= \frac{7}{15}
\end{aligned}
$$

3. The G.M. of roots of the equation $x^2 - 18x + 9 = 0$ is

(A) 3 (B) 4 (C) 2 (D) 1

Answer: (A)
Solution: Let the roots of the equation be α and β. From the properties of quadratic equations, the product of roots is given by c/a:

$$\alpha\beta = \frac{9}{1} = 9$$

The Geometric Mean (G.M.) of the roots is defined as $\sqrt{\alpha\beta}$.

$$\text{G.M.} = \sqrt{9} = 3$$

4. If the sum of an infinite G.P. be 9 and the sum of first two terms be 5, then the common ratio is

(A) 1/3 (B) 3/2 (C) 3/4 (D) 2/3

Answer: (D)
Solution: Let the G.P. be $a, ar, ar^2 \dots$. Given the sum to infinity is 9:

$$S_\infty = \frac{a}{1-r} = 9 \implies a = 9(1-r)$$

Given the sum of the first two terms is 5:

$$S_2 = a + ar = a(1+r) = 5$$

Substitute the expression for a into the second equation:

$$9(1-r)(1+r) = 5$$

Using the identity $(1-r)(1+r) = 1 - r^2$:

$$
\begin{aligned}
9(1-r^2) &= 5 \\
1 - r^2 &= \frac{5}{9} \\
r^2 &= 1 - \frac{5}{9} = \frac{4}{9}
\end{aligned}
$$

Taking the square root:

$$r = \pm\frac{2}{3}$$

Looking at the options, 2/3 is the correct choice.

5. The third term of a G.P. is the square of first term. If the second term is 8, then the 6^{th} term is

(A) 120 (B) 124 (C) 128 (D) 132

Answer: (C)
Solution: Let the G.P. have first term a and common ratio r. Given $a_3 = a^2$:

$$ar^2 = a^2$$
$$r^2 = a \quad (\text{Assuming } a \neq 0)$$

Given the second term $a_2 = 8$:

$$ar = 8$$

Substitute $a = r^2$ into the equation $ar = 8$:

$$r^2 \cdot r = 8$$
$$r^3 = 8 \implies r = 2$$

Now find a:

$$a = r^2 = 2^2 = 4$$

We need to find the 6th term a_6:

$$a_6 = ar^5 = 4 \cdot (2)^5$$
$$a_6 = 4 \cdot 32 = 128$$

6. If the 10^{th} term of a geometric progression is 9 and 4^{th} term is 4, then its 7^{th} term is
(A) 6 (B) 36 (C) $\frac{4}{9}$ (D) $\frac{9}{4}$

Answer: (A)
Solution: Let the terms be $a_{10} = 9$ and $a_4 = 4$. Notice that the indices 4, 7, 10 are in Arithmetic Progression (difference of 3). In a G.P., terms equidistant from each other form a G.P. Thus, a_7 is the Geometric Mean of a_4 and a_{10}.

$$a_7^2 = a_4 \cdot a_{10}$$
$$a_7^2 = 4 \cdot 9 = 36$$

Taking the square root:

$$a_7 = \sqrt{36} = 6$$

7. Three numbers are in A.P. whose sum is 33 and product is 792, then the smallest number from these numbers is
(A) 4 (B) 8 (C) 11 (D) 14

Answer: (A)
Solution: Let the three numbers in A.P. be $a - d, a, a + d$. Given the sum is 33:

$$(a - d) + a + (a + d) = 33$$
$$3a = 33 \implies a = 11$$

Given the product is 792:

$$(11 - d)(11)(11 + d) = 792$$
$$11(121 - d^2) = 792$$

Divide by 11:

$$121 - d^2 = 72$$

$$d^2 = 121 - 72 = 49$$
$$d = \pm 7$$

If $d = 7$, the numbers are $11 - 7, 11, 11 + 7$, which are $4, 11, 18$. If $d = -7$, the numbers are $18, 11, 4$. In either case, the smallest number is 4.

8. If the sum of the 10 terms of an A.P. is 4 times to the sum of its 5 terms, then the ratio of first term and common difference is

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

Answer: (A)
Solution: Given $S_{10} = 4S_5$. Using the sum formula $S_n = \frac{n}{2}[2a + (n-1)d]$:

$$\frac{10}{2}[2a + 9d] = 4 \cdot \frac{5}{2}[2a + 4d]$$

Simplify the equation:

$$5[2a + 9d] = 10[2a + 4d]$$

Divide both sides by 5:

$$2a + 9d = 2[2a + 4d]$$
$$2a + 9d = 4a + 8d$$

Rearrange terms:

$$d = 2a$$

We need the ratio $a : d$:

$$\frac{a}{d} = \frac{1}{2}$$

The ratio is 1 : 2.

9. The sum of the first and third term of an arithmetic progression is 12 and the product of first and second term is 24, then first term is

(A) 1 (B) 8 (C) 4 (D) 6

Answer: (C)
Solution: Given $a_1 + a_3 = 12$. In an A.P., $a_1 + a_3 = 2a_2$ (since a_2 is the arithmetic mean).

$$2a_2 = 12 \implies a_2 = 6$$

Given the product of the first and second term is 24:

$$a_1 \cdot a_2 = 24$$

Substitute $a_2 = 6$:

$$a_1 \cdot 6 = 24$$
$$a_1 = 4$$

10. If the first term of an A.P. be 10, last term is 50 and the sum of all the terms is 300, then the number of terms are

(A) 5 (B) 8 (C) 10 (D) 15

Answer: (C)
Solution: We are given $a = 10$, $l = 50$, and $S_n = 300$. Using the sum formula involving the last term $S_n = \frac{n}{2}(a + l)$:

$$300 = \frac{n}{2}(10 + 50)$$
$$300 = \frac{n}{2}(60)$$
$$300 = 30n$$

Solving for n:

$$n = \frac{300}{30} = 10$$

11. The sum of $1 + 3 + 5 + 7 + \dots$ upto n terms is

(A) $(n + 1)^2$ (B) $(2n)^2$ (C) n^2 (D) $(n - 1)^2$

Answer: (C)
Solution: This series represents the sum of the first n odd natural numbers. This is an A.P. with $a = 1$ and $d = 2$.

$$S_n = \frac{n}{2}[2a + (n - 1)d]$$
$$S_n = \frac{n}{2}[2(1) + (n - 1)2]$$

Simplify the expression inside the bracket:

$$S_n = \frac{n}{2}[2 + 2n - 2]$$
$$S_n = \frac{n}{2}[2n]$$
$$S_n = n^2$$

12. If the sum of the series $2 + 5 + 8 + 11 \dots$ is 60100, then the number of terms are

(A) 100 (B) 200 (C) 150 (D) 250

Answer: (B)
Solution: We have $a = 2$, $d = 3$, and $S_n = 60100$. Using the sum formula:

$$60100 = \frac{n}{2}[2(2) + (n - 1)3]$$
$$60100 = \frac{n}{2}[4 + 3n - 3]$$
$$60100 = \frac{n}{2}[3n + 1]$$

Multiply by 2:

$$120200 = 3n^2 + n$$
$$3n^2 + n - 120200 = 0$$

Solve for n using the quadratic formula:

$$n = \frac{-1 \pm \sqrt{1 - 4(3)(-120200)}}{6}$$
$$n = \frac{-1 \pm \sqrt{1 + 1442400}}{6}$$
$$n = \frac{-1 \pm \sqrt{1442401}}{6}$$

Calculate the square root ($\sqrt{1442401} = 1201$):

$$n = \frac{-1 + 1201}{6} = \frac{1200}{6} = 200$$

(We discard the negative root).

13. If $2x, x + 8, 3x + 1$ are in A.P., then the value of x will be
(A) 3 (B) 7 (C) 5 (D) -2

Answer: (C)
Solution: If three terms a, b, c are in A.P., then $2b = a + c$. Here, $a = 2x$, $b = x + 8$, and $c = 3x + 1$.

$$2(x + 8) = 2x + (3x + 1)$$

Expand and simplify:

$$2x + 16 = 5x + 1$$
$$16 - 1 = 5x - 2x$$
$$15 = 3x$$
$$x = 5$$

14. If the 9^{th} term of an A.P. is 35 and 19^{th} is 75, then its 20^{th} terms will be
(A) 78 (B) 79 (C) 80 (D) 81

Answer: (B)
Solution: We are given two equations based on the n^{th} term formula $T_n = a + (n - 1)d$:

$$a_9 = a + 8d = 35$$
$$a_{19} = a + 18d = 75$$

Subtract the first equation from the second:

$$(a + 18d) - (a + 8d) = 75 - 35$$
$$10d = 40$$
$$d = 4$$

Substitute $d = 4$ into the first equation to find a:

$$a + 8(4) = 35$$
$$a = 35 - 32 = 3$$

Now find the 20th term:

$$a_{20} = a + 19d$$
$$a_{20} = 3 + 19(4)$$
$$a_{20} = 3 + 76 = 79$$

15. If m^{th} terms of the series $63 + 65 + 67 + 69 + \ldots$ and $3 + 10 + 17 + 24 + \ldots$ be equal, then $m =$

(A) 11 (B) 12 (C) 13 (D) 15

Answer: (C)
Solution: For the first A.P.: $a = 63, d = 2$.

$$T_m = 63 + (m-1)2 = 63 + 2m - 2 = 61 + 2m$$

For the second A.P.: $A = 3, D = 7$.

$$T'_m = 3 + (m-1)7 = 3 + 7m - 7 = 7m - 4$$

Equate the m^{th} terms:

$$61 + 2m = 7m - 4$$

Solve for m:

$$61 + 4 = 7m - 2m$$
$$65 = 5m$$
$$m = 13$$

16. n^{th} term of the series $3.8 + 6.11 + 9.14 + 12.17 + \ldots$ will be

(A) $3n(3n+5)$ (B) $3n(n+5)$ (C) $n(3n+5)$ (D) $n(n+5)$

Answer: (A)
Solution: The series is formed by the product of corresponding terms of two A.P.s. The first factors are $3, 6, 9, 12 \ldots$. This is an A.P. with $a = 3, d = 3$.

$$T_{n,1} = 3n$$

The second factors are $8, 11, 14, 17 \ldots$. This is an A.P. with $a = 8, d = 3$.

$$T_{n,2} = 8 + (n-1)3 = 8 + 3n - 3 = 3n + 5$$

The n^{th} term of the combined series is the product of these terms:

$$T_n = 3n(3n+5)$$

17. The geometric mean of two numbers is 6 and their arithmetic mean is 6.5. The numbers are

(A) (3,12) (B) (4,9) (C) (2,18) (D) (7,6)

Answer: (B)
Solution: Let the numbers be a and b. Given G.M. is 6:

$$\sqrt{ab} = 6 \implies ab = 36$$

Given A.M. is 6.5:

$$\frac{a+b}{2} = 6.5 \implies a + b = 13$$

We need two numbers that sum to 13 and multiply to 36. We can form a quadratic equation $x^2 - (a+b)x + ab = 0$:

$$x^2 - 13x + 36 = 0$$

Factor the quadratic:

$$(x-4)(x-9) = 0$$

The numbers are 4 and 9.

18. If $|x| < 1$, then the sum of the series $1 + 2x + 3x^2 + 4x^3 + \ldots \infty$ will be
(A) $\frac{1}{1-x}$ (B) $\frac{1}{1+x}$ (C) $\frac{1}{(1+x)^2}$ (D) $\frac{1}{(1-x)^2}$

Answer: (D)
Solution: Let the sum be S.

$$S = 1 + 2x + 3x^2 + 4x^3 + \ldots$$

Multiply by x:

$$xS = x + 2x^2 + 3x^3 + \ldots$$

Subtract the second equation from the first:

$$S(1-x) = 1 + (2-1)x + (3-2)x^2 + \ldots$$
$$S(1-x) = 1 + x + x^2 + \ldots$$

The RHS is an infinite G.P. with sum $\frac{1}{1-x}$:

$$S(1-x) = \frac{1}{1-x}$$

Solve for S:

$$S = \frac{1}{(1-x)^2}$$

19. If a, b, c are in A.P., then $3^a, 3^b, 3^c$ shall be in
(A) A.P. (B) G.P. (C) H.P. (D) None of these

Answer: (B)
Solution: Given a, b, c are in A.P., we know:

$$2b = a + c$$

Let the terms be $x = 3^a, y = 3^b, z = 3^c$. To check if they are in G.P., we check if $y^2 = xz$.

$$y^2 = (3^b)^2 = 3^{2b}$$

Calculate xz:

$$xz = 3^a \cdot 3^c = 3^{a+c}$$

Since $2b = a + c$, we have $3^{2b} = 3^{a+c}$, which means $y^2 = xz$. Therefore, the terms are in Geometric Progression (G.P.).

20. $11^2 + 12^2 + 13^2 + \ldots 20^2 =$
(A) 2481 (B) 2483 (C) 2485 (D) 2487

Answer: (C)
Solution: We can write the sum as the sum of squares up to 20 minus the sum of squares up to 10.

$$\text{Sum} = \sum_{k=1}^{20} k^2 - \sum_{k=1}^{10} k^2$$

Using the formula $\sum n^2 = \frac{n(n+1)(2n+1)}{6}$: For $n = 20$:

$$\sum_{k=1}^{20} k^2 = \frac{20(21)(41)}{6} = 10 \cdot 7 \cdot 41 = 2870$$

For $n = 10$:

$$\sum_{k=1}^{10} k^2 = \frac{10(11)(21)}{6} = 5 \cdot 11 \cdot 7 = 385$$

Subtract to find the result:

$$\text{Result} = 2870 - 385 = 2485$$

21. The sum of n terms of the following series $1.2 + 2.3 + 3.4 + 4.5 + \ldots$ shall be
(A) n^3
(B) $\frac{1}{3}n(n+1)(n+2)$
(C) $\frac{1}{6}n(n+1)(n+2)$
(D) $\frac{1}{3}n(n+1)(2n+1)$

Answer: (B)
Solution: The k^{th} term is given by $T_k = k(k+1) = k^2 + k$. The sum of n terms is:

$$S_n = \sum_{k=1}^{n}(k^2 + k) = \sum k^2 + \sum k$$

Substitute the standard formulas:

$$S_n = \frac{n(n+1)(2n+1)}{6} + \frac{n(n+1)}{2}$$

Factor out $\frac{n(n+1)}{2}$:

$$S_n = \frac{n(n+1)}{2}\left[\frac{2n+1}{3} + 1\right]$$

Simplify the term in brackets:

$$\frac{2n+1}{3} + \frac{3}{3} = \frac{2n+4}{3} = \frac{2(n+2)}{3}$$

Substitute back:

$$S_n = \frac{n(n+1)}{2} \cdot \frac{2(n+2)}{3}$$
$$S_n = \frac{n(n+1)(n+2)}{3}$$

22. The n^{th} term of series $\frac{1}{1} + \frac{1+2}{2} + \frac{1+2+3}{3} + \ldots$ will be
(A) $\frac{n+1}{2}$
(B) $\frac{n-1}{2}$
(C) $\frac{n^2+1}{2}$
(D) $\frac{n^2-1}{2}$

Answer: (A)
Solution: The numerator of the n^{th} term is the sum of the first n natural numbers:

$$\text{Num} = 1 + 2 + \cdots + n = \frac{n(n+1)}{2}$$

The denominator of the n^{th} term is simply n.

$$T_n = \frac{\frac{n(n+1)}{2}}{n}$$

Simplify:

$$T_n = \frac{n(n+1)}{2n} = \frac{n+1}{2}$$

23. The sum of $1^3 + 2^3 + 3^3 + 4^3 + \cdots + 15^3$ is
(A) 22000 (B) 10,000 (C) 14,400 (D) 15,000

Answer: (C)
Solution: The formula for the sum of cubes is $\sum n^3 = \left[\frac{n(n+1)}{2}\right]^2$. For $n = 15$:

$$\text{Sum} = \left[\frac{15(16)}{2}\right]^2$$
$$\text{Sum} = (15 \cdot 8)^2$$
$$\text{Sum} = (120)^2 = 14400$$

24. $2^{1/4}.4^{1/8}.8^{1/16}.16^{1/32}\ldots$ is equal to
(A) 1 (B) 2 (C) $\frac{3}{2}$ (D) $\frac{5}{2}$

Answer: (B)
Solution: Write the bases as powers of 2:

$$\text{Exp} = 2^{1/4} \cdot (2^2)^{1/8} \cdot (2^3)^{1/16} \cdot (2^4)^{1/32}\ldots$$

Combine the exponents:

$$\text{Exp} = 2^{(1/4+2/8+3/16+4/32+\ldots)}$$

Let the exponent be S:

$$S = \frac{1}{4} + \frac{2}{8} + \frac{3}{16} + \frac{4}{32} + \ldots$$

Multiply S by 1/2:

$$\frac{1}{2}S = \frac{1}{8} + \frac{2}{16} + \frac{3}{32} + \ldots$$

Subtract the second equation from the first:

$$S - \frac{1}{2}S = \frac{1}{4} + \left(\frac{1}{8} + \frac{1}{16} + \ldots\right)$$

The terms in brackets form an infinite G.P. with $a = 1/8, r = 1/2$.

$$\frac{S}{2} = \frac{1}{4} + \frac{1/8}{1 - 1/2}$$

$$\frac{S}{2} = \frac{1}{4} + \frac{1/8}{1/2} = \frac{1}{4} + \frac{1}{4} = \frac{1}{2}$$

So $S = 1$. The value is:

$$2^S = 2^1 = 2$$

25. The sum of infinite terms of the following series $1 + \frac{4}{5} + \frac{7}{5^2} + \frac{10}{5^3} + \ldots$ will be

(A) $\frac{3}{16}$ (B) $\frac{35}{8}$ (C) $\frac{35}{4}$ (D) $\frac{35}{16}$

Answer: (D)
Solution: This is an Arithmetico-Geometric Progression (AGP) with $a = 1, d = 3, r = 1/5$.

$$S = 1 + \frac{4}{5} + \frac{7}{25} + \frac{10}{125} \ldots$$

Multiply by 1/5:

$$\frac{1}{5}S = \frac{1}{5} + \frac{4}{25} + \frac{7}{125} \ldots$$

Subtract the equations:

$$S - \frac{1}{5}S = 1 + \frac{3}{5} + \frac{3}{25} + \frac{3}{125} \ldots$$

Simplify:

$$\frac{4}{5}S = 1 + 3\left(\frac{1}{5} + \frac{1}{25} + \ldots\right)$$

The term in brackets is an infinite G.P.:

$$\frac{4}{5}S = 1 + 3\left(\frac{1/5}{1 - 1/5}\right)$$
$$\frac{4}{5}S = 1 + 3\left(\frac{1/5}{4/5}\right) = 1 + \frac{3}{4} = \frac{7}{4}$$

Solve for S:

$$S = \frac{7}{4} \times \frac{5}{4} = \frac{35}{16}$$