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Where Minds Pollinate

Class 11
Mathematics

Chapter 4
Exercise 4.6
Notes

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Exercise # 4.6

Find the indicated term of the harmonic progression (A1-16)

1. $\frac{1}{9}, \frac{1}{12}, \frac{1}{15}, \dots$ 7th term

Sol:-

$$a_1 = \frac{1}{9}, \quad n = 7, \quad d = \frac{1}{12} - \frac{1}{9} = -\frac{1}{36}$$

$$\therefore \frac{1}{a_n} = \frac{1}{a_1 + (n-1)d}$$

$$\frac{1}{a_7} = \frac{1}{\frac{1}{9} + (7-1)\left(-\frac{1}{36}\right)} \Rightarrow \frac{1}{a_7} = \frac{1}{\frac{2}{9}}$$

2. $\frac{1}{11}, \frac{1}{9}, \frac{1}{7}, \dots$ 10th term

Sol:-

$$a_1 = 11, \quad n = 10, \quad d = \frac{1}{9} - \frac{1}{11} = -\frac{2}{99}$$

$$\therefore \frac{1}{a_n} = \frac{1}{a_1 + (n-1)d}$$

$$\frac{1}{a_{10}} = \frac{1}{11 + (10-1)\left(-\frac{2}{99}\right)} \Rightarrow \frac{1}{a_{10}} = \frac{1}{9}$$

3. $\frac{1}{18}, \frac{1}{13}, \frac{1}{8}, \dots$ 20th term

Sol:-

$$a_1 = 18, \quad n = 20, \quad d = 13 - 18 = -5$$

$$\therefore \frac{1}{a_n} = \frac{1}{a_1 + (n-1)d}$$

$$\frac{1}{a_{20}} = \frac{1}{18 + (20-1)(-5)} \Rightarrow \frac{1}{a_{20}} = -\frac{1}{77}$$

Hence, 20th term of H.P is $-\frac{1}{77}$

4. $\frac{1}{4}, \frac{1}{9}, \frac{1}{14}, \dots$ n^{th} term

Sol:-

$$a_1 = 4, \quad d = 9 - 4 = 5$$

for n^{th} term, $\frac{1}{a_n} = \frac{1}{a_1 + (n-1)d}$

$$\therefore \frac{1}{a_n} = \frac{1}{4 + (n-1)(5)} \Rightarrow \frac{1}{a_n} = \frac{1}{4 + 5n - 5}$$

$$\therefore \frac{1}{a_n} = \frac{1}{5n - 1} \rightarrow n^{\text{th}} \text{ term.}$$

5. $\frac{1}{27}, \frac{1}{20}, \frac{1}{13}, \dots$ n^{th} term

Sol:-

$$a_1 = 27, \quad d = 20 - 27 = -7$$

$$\therefore \frac{1}{a_n} = \frac{1}{a_1 + (n-1)d} \Rightarrow \frac{1}{a_n} = \frac{1}{27 + (n-1)(-7)}$$

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$$\therefore \text{for } n^{\text{th}} \text{ term, } \frac{1}{a_n} = \frac{1}{34-7n}$$

iii)

6. $\frac{1}{2}, \frac{1}{2\frac{1}{2}}, \frac{1}{3\frac{1}{2}}, \dots$ $n^{\text{th}} \text{ term}$

Sol:-

We have, $\frac{1}{2}, \frac{1}{2\frac{1}{2}}, \frac{1}{3\frac{1}{2}}, \dots$

$$\Rightarrow \frac{1}{2}, \frac{1}{5/2}, \frac{1}{7/2}, \dots$$

Here, $a_1 = 2$, $d = \frac{5}{2} - 2 = \frac{1}{2}$

$$\therefore \frac{1}{a_n} = \frac{1}{a_1 + (n-1)d} = \frac{1}{a_n} = \frac{1}{2 + (n-1)(\frac{1}{2})}$$

$$\frac{1}{a_n} = \frac{1}{2 + \frac{1}{2}n - \frac{1}{2}} \Rightarrow \frac{1}{3/2 + \frac{1}{2}(n)}$$

iv)

$$\therefore \frac{1}{a_n} = \frac{1}{\frac{n+3}{2}}$$

7. Find the 14th term of H.P $\frac{1}{4}, \frac{1}{7}, \frac{1}{10}, \frac{1}{13}, \dots$

Sol:-

$$a_1 = 4, d = 7 - 4 = 3, n = 14$$

$$\therefore \frac{1}{a_n} = \frac{1}{a_1 + (n-1)d} \Rightarrow \frac{1}{a_{14}} = \frac{1}{4 + (14-1)(3)}$$

$$\frac{1}{a_{14}} = \frac{1}{43}$$

8. Find the 8th term in H.P. $\frac{1}{7}, \frac{1}{6}, -1, -\frac{1}{3}, \dots$

Sol:-

$$a_1 = 7, d = 6 - 7 = -1, n = 8$$

$$\Rightarrow \frac{1}{a_8} = \frac{1}{7 + (8-1)(-1)}$$

$$\frac{1}{a_8} = \frac{1}{0} = \infty$$

9. 7, 4, 1, ... is arithmetic sequence, find 17th term in H.P

Sol:-

$$a_1 = 7, d = 4 - 7 = -3, n = 17$$

$$\because a_n = a_1 + (n-1)d$$

$$a_{17} = 7 + (17-1)(-3)$$

$$a_{17} = -41$$

$$\therefore \text{H.P is } \frac{1}{a_{17}} = -\frac{1}{41}$$

10. Find H.M between 9 and 11. Also find H, G and H and show that $AH = G^2$

Sol:-

$$a = 9, b = 11$$

$$H.M = \frac{2ab}{a+b} \Rightarrow \frac{2(9)(11)}{11+9} = 9.9$$

$$H = H.M \text{ between } 9 \text{ and } 11 = 9.9$$

$$A.M = A = \frac{a+b}{2} = \frac{11+9}{2} \Rightarrow 10$$

iii)

$$\text{and } G.M = G = \pm \sqrt{ab} \Rightarrow \pm \sqrt{9(11)}$$

$$G = \pm \sqrt{99}$$

$$\therefore AH = G^2$$

$$\Rightarrow (10)(9.9) = (\pm \sqrt{99})^2$$

$$99 = 99$$

Hence proved.

11. Find H.M between $\frac{2}{3}$ and $\frac{4}{7}$

Sol:-

$$a = 2/3, \quad b = 4/7$$

iv)

$$\therefore H.M = \frac{2ab}{a+b} = \frac{2(2/3)(4/7)}{2/3 + 4/7}$$

$$H.M = 8/13$$

12. Find four H.Ms between $\frac{1}{3}$ and $\frac{1}{11}$

Sol:-

According to given condition

$$\frac{1}{3}, \frac{1}{a_2}, \frac{1}{a_3}, \frac{1}{a_4}, \frac{1}{a_5}, \frac{1}{11}$$

where, $\frac{1}{a_1}, \frac{1}{a_2}, \frac{1}{a_3}, \frac{1}{a_4}, \frac{1}{a_5}$ are for H.Ms

corresponding A.P = $3, a_2, a_3, a_4, a_5, 11$

$$a_1 = 3, a_6 = 11$$

$$\therefore a_n = a_1 + (n-1)d$$

$$a_6 = a_1 + (6-1)d$$

$$11 = 3 + 5d$$

$$d = \frac{11-3}{5} \Rightarrow d = \frac{8}{5}$$

$$\Rightarrow a_2 = a_1 + (2-1)d$$

$$= 3 + (8/5)$$

$$a_2 = 23/5$$

$$\text{also, } a_3 = 3 + (3-1)(8/5)$$

$$a_3 = 31/5$$

$$\text{and } a_4 = 3 + (4-1)(8/5)$$

$$a_4 = 39/5$$

$$\text{lastly, } a_5 = 3 + (5-1)(8/5)$$

$$a_5 = 47/5$$

$$\therefore \text{A.P} = 3, \frac{23}{5}, \frac{31}{5}, \frac{39}{5}, \frac{47}{5}, 11$$

$$\text{So, Harmonic Progression} = \frac{1}{3}, \frac{1}{23/5}, \frac{1}{31/5}, \frac{1}{39/5}, \frac{1}{47/5}, \frac{1}{11}$$

$$\text{So, H.Ms} = \frac{1}{23/5}, \frac{1}{31/5}, \frac{1}{39/5}, \frac{1}{47/5}$$