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

$636 = \frac{n}{2}(2(9)+(n-1)8)$

$636 \times 2 = n(18+8n-8)$

$\frac{636 \times 2}{2} = 5n + 4n^2$

$4n^2 + 5n - 636 = 0$

$4n^2 + 53n - 48n - 636 = 0$

$4n(n+53) - 48(n+53) = 0$

$(4n-48) = 0$ or $(n+53) = 0$

$n = \frac{48}{4} = 12$ or $n = -53$ (Rejected)

5. $S_n = \frac{n}{2}(a+a_n)$

$400 = \frac{n}{2}(5+45)$

$400 \times 2 = 50n$

$n = 16$

$a_n = 45$

$a+(n-1)d = 45$

$5+(16-1)d = 45$

$15d = 40$

$d = \frac{40}{15} = \frac{8}{3}$

6. $a_n = a+(n-1)d$

$350 = 17+(n-1)9$

$n-1 = \frac{333}{9} = 37$

$n = 37+1 = 38$

$S_{38} = \frac{38}{2}(17+350)$

$= 19 \times 367 = 6973$

7 $a_{22} = a + 21d = 149$

$a + 21(7) = 149$

$a = 149 - 147 = 2$

$S_{22} = \frac{22}{2}(a + a_{22})$

$= 11(2 + 149) = 11 \times 151 = 1661$

8 $a + d = 14$

$a + 2d = 18$

$a + 2d - a - d = 18 - 14$

$d = 4$

$a + d = 14$

$a + 4 = 14$

$a = 14 - 4 = 10$

$S_{51} = \frac{51}{2}(2 \times 10 + (51-1)4)$

$= \frac{51}{2}(20 + 200)$

$= 51 \times 110 = 5610$

9 $S_n = \frac{n}{2}(2a + (n-1)d)$

$49 = 2a + 6d + \frac{7}{2}$

$2a + 6d = 14$

$a + 3d = 7$ ..... (i)

$S_{17} = 289$

$\frac{17}{2}(2a + (17-1)d) = (289)$

$2a + 16d = 34$

$a + 8d = 17$ ..... (ii)

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eq (ii) - eq (i)

$a+8d-a-3d = 17-7$

$5d = 10$

$d = \frac{10}{5} = 2$

$a+3d = 7$

$a+3(2) = 7$

$a = 7-6 = 1$

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

$= \frac{n}{2}(2+2n-2)$

$= \frac{n}{2}(2n) = n^2$

10. i) $a_n = 3+4n$

$n = 1, 2, 3 \ldots$

$a_1 = 3+4\times1 = 7$

$a_2 = 3+4\times2 = 11 \quad d = 4$

$a_3 = 3+4\times3 = 15 \quad d = 4$

∴ The sequence of 7, 11, 15... is an AP.

$S_{15} = \frac{15}{2}(2\times7+(15-1)\times4)$

$= \frac{15}{2}\times70 = 525$

ii) $a_n = 9-5n$

$n = 1, 2, 3 \ldots$

$a_1 = 9-5\times1 = 4$

$a_2 = 9-5\times2 = -1 \quad d = -5$

$a_3 = 9-5\times3 = -6 \quad d = -5$

∴ The sequence of 4, -1, -6... is an AP.

$S_{15} = \frac{15}{2}(2\times 4 + (15-1)(-5))$

$= \frac{15}{2}(-61) = -465$

11. $S_n = 4n - n^2$

$n = 1, 2, 3 \ldots$

$S_1 = 4\times 1 - 1^2 = 4 - 1 = 3$

$a_1 = 3$

$S_2 = 4\times 2 - 2^2 = 8 - 4 = 4$

$a_1 + a_2 = 4$

$3 + a_2 = 4$

$a_2 = 4 - 3 = 1$

$d = a_2 - a_1 = 1 - 3 = -2$

$a_3 = a_2 + d = 1 + (-2) = -1$

$a_{10} = a + 9d = 3 + 9(-2) = 3 - 18 = -15$

$a_n = a + (n-1)d$

$= 3 + (n-1) - 2 = 3 - 2n + 2 = 5 - 2n$

12. $6, 12, 18 \ldots 240$

$a = 6, \; d = 12 - 6 = 6$

$a_{40} = 6 + (40-1)\times 6 = 240$

$S_{40} = \frac{40}{2}(a + a_{40})$

$= 20(6 + 240) = 20 \times 246 = 4920$

13. $8, 16, 32 \ldots 120$

$a = 8, \; d = 16 - 8 = 8$

$a_{15} = 8 + (15-1)\times 8 = 120$

$S_{15} = \frac{15}{2}(a + a_{15}) = \frac{15}{2}(8 + 120)$

$= \frac{15}{2}(128) = 960$

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14. 1, 3, 5, 7, 9. ---- 49

$a = 1$, $d = 2$, $a_n = 49$

$a_n = a + (n-1)d$

$49 = 1 + (n-1)2$

$(n-1) = 49 - 1 = \frac{48}{2} = 24$

$n = 24 + 1 = 25$

$S_{25} = \frac{25}{2}(a + a_{25}) = \frac{25}{2}(1 + 49) = \frac{25}{2}(50)$

$= 25 \times 25 = 625$

15. $a = ₹200$, $d = ₹50$, $n = 30$

$S_{30} = \frac{30}{2}(2a + (30-1)d)$

$= 15(2 \times 200 + 29 \times 50)$

$= 15(1850) = ₹27,750$

16. 1st Prize - ₹a

2nd Prize - ₹(a-20)

3rd Prize - ₹(a-20-20) = ₹(a-40)

$a_1 = a$, $d = ₹(a-20-a) = -₹20$

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

$S_7 = \frac{7}{2}(2a + (7-1)d)$

$700 = \frac{7}{2}(2a + 6d) = \frac{7}{2}(2a + 6(-20))$

$700 \times \frac{2}{7} = 2a - 120$

$200 + 120 = 2a$

$320 = 2a$

$a = \frac{320}{2} = ₹160$

∴ The seven prizes are ₹160, ₹140, ₹120, ₹100, ₹80, ₹60, ₹40.

17. $1, 2, 3, 4, 5 \ldots\ldots 12$

$a = 1, d = 1, n = 12$

$S_{12} = \frac{12}{2}(2a + (n-1)d)$

$= 6(2 \times 1 + (12-1) \times 1)$

$= 6(2 + 11) = 6 \times 13 = 78.$

$\therefore$ Total no. of trees planted by 3 section.

$= 78 \times 3 = \underline{234}.$

18. $R_1 = 0.5\text{cm}, R_2 = 1.0\text{cm}, R_3 = 1.5\text{cm}$

$a = 0.5\text{cm}, d = 0.5\text{cm}.$

length of spiral = 13 consecutive semicircles.

$= \pi R_1 + \pi R_2 + \pi R_3 + \ldots\ldots \pi R_{13}$

$= \pi(R_1 + R_2 + R_3 \ldots\ldots R_{13})$

$= \pi(0.5 + 1.0 + 1.5 + \ldots\ldots 13^{th} \text{ term})$

$= \pi\left(\frac{13}{2}(2 \times 0.5 + (13-1)(0.5))\right)$

$= \pi\left(\frac{13}{2}(1 + 12 \times 0.5)\right)$

$= \pi \times \left(\frac{13}{2}(7)\right) = \frac{22}{7} \times \frac{13}{2} \times 7 = \underline{143\text{cm}}.$

19. Let the no. of rows be 'n' and no. of logs in the top row be 'a'.

$a_n = 20, d = 1, S_n = 200$

$a_n = a + (n-1)d$

$20 = a + (n-1)1$

$a + n = 20 + 1 = 21$

$S_n = \frac{n}{2}(a + a_n)$

$200 = \frac{n}{2}(a + 20)$

$200 \times 2 = (n[a + 20])$

$400 = na + 20n$

$n(21 - n) + 20n = 400$

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$21n - n^2 + 20n = 400$

$n^2 - 41n + 400 = 0$

$n^2 - 25n - 16n + 400 = 0$

$n(n-25) - 16(n-25) = 0$

$(n-16)(n-25) = 0$

$n = 16$ or 25.

Taking $n = 16$,

$a + (n-1)d = 20$

$a + (16-1)d = 20$

$a + 15d = 20$ $\quad a + 15 \times 1 = 20$

$a = 20 - 15 = 5$

Taking $n = 25$,

$a + (n-1)d$

$a + (25-1)1 = 20$

$a = 20 - 24 = -4$ (Rejected)

$\therefore n = 16, a = 5$.

20. Distance between first potato and bucket = 5m.

Distance between next two potatoes = 3m (each)

$\therefore$ Series are 5m, 8m, 11m.

$a = 5m, d = 3m$.

$\therefore$ Total distance travelled for 10 potatoes,

$2[5 + 8 + 11 + \ldots + 10 \text{ terms}]$

$= 2\left(\frac{10}{2}[2 \times 5 + (10-1)3]\right)$

$= 2(5(10+27))$

$= 2(37 \times 5)$

$= 37 \times 10 = \underline{370}$ m.