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۱) الف) عمومی

$t_n = 5, 9, 13, 17, \dots$ ($+4$, $+4$, $+4$)

$a_n = 4n+1$

ب) جمله دهم: $a_{10} = 4\times 10+1 = 41$

۲) الف) اجملات

$t_n = 6, 10, 14, 18, \dots$ ($+4$, $+4$, $+4$)

$a_n = 4n+2 \to a_{10} = 42$

$S_{10} = \frac{10}{2}(6+42) \to$ (48)

$5 \times 48 = 240$

ب) ۴ جمله

$t_n = 6, 10, 14, 18, 22, 26, 30, 34, \dots$

$4\times 8 = 32 \to a_{32} = 130 \to a_{31} = 126$

$t_n = 6, 10, 14, 18, \dots, 118, 122, 126, 130 \xrightarrow{\text{جمع}} 496$

۴ جمله هشتم

۳) ۲۳ و ۲۵

$1+\sqrt{3}, 2, 3-\sqrt{3}, \dots$ ($+1-\sqrt{3}$, $+1-\sqrt{3}$)

$a_n = 1+\sqrt{3}+(n-1)(1-\sqrt{3}) \to a_{23} = 1+\sqrt{3}+22(1-\sqrt{3}) \to$

$1+\sqrt{3}+22-22\sqrt{3} = 23-21\sqrt{3}$

$a_{25} = 1+\sqrt{3}+24(1-\sqrt{3}) = 1+\sqrt{3}+24-24\sqrt{3} = 25-23\sqrt{3}$

$a_{25}-a_{23} = 25-23\sqrt{3}-23+21\sqrt{3} = 2-2\sqrt{3}$

۴)

$a_n = 5^{2x}, 3\times 25^x, 5^y$

$3\times 25^x - 5^{2x} = d \to 3\times 5^{2x} - 5^{2x} = d$

$5^{2x}(3-1) = d \to 5^{2x}\times 2 = d$

$3\times 25^x + d = 5^y \to 3\times 5^{2x} + 5^{2x}\times 2 = 5^y \to 5^{2x}(3+2) = 5^y \to 5^{2x}\times 5^1 = 5^y \to$

$5^{2x+1} = 5^y$

$2x+1 = y$

$b_n = x, 2, y$

$\frac{x+y}{2} = 2 \to x+y = 4 \to y = 4-x$

$2x+1 = 4-x$

$3x = 3 \to x = 1$

$y = 3$

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(۵) جمله چهارم

$a_n: 2x-4, 2x-1, 4x, \dots$ (+۳ , ۳)

$2x-1+3=4x$

$2x+2=4x \to 2x=2 \to \boxed{x=\frac{1}{0/2}}$

$a_n = -3, 0, 3, 6$ (+۳ +۳ +۳) $\boxed{6 \leadsto \text{جمله چهارم}}$

(۶)

$a_n = 3, 5, 7, \dots \to a_n = 2n+1 \longrightarrow a_{20} = 41$ (+۲ +۲)

$b_n = 2, 5, 8, \dots \to b_n = 3n-1 \longrightarrow a_{20} = 59$ (+۳ +۳)

الگوی جملات مشترک $= 5, 11, \dots$ (+۶ +۶) $\quad a_n = 6n-1 \to 6n-1 < 41 \to 6n < 42$ $\boxed{n<7} \to \boxed{\text{۷ جمله مشترک}}$

(۷)

$a_1 + a_2 + a_3 = 21 \longrightarrow a_1 + a_1 + d + a_1 + 2d = 3a_1 + 3d = 21$

$a_1 + a_3 + a_5 = 105 \longrightarrow a_1 + a_1 + 2d + a_1 + 4d = 3a_1 + 6d = 105$

$3a_1 + 3d = 21 \to a_1 + d = 7 \quad \boxed{a_1 = -21}$ $\qquad 3d = 84 \quad \boxed{d = 28}$

$a_3 - a_2 + a_1 \to a_1 + 2d - a_1 - d + a_1 = d + a_1 \Rightarrow d + a_1 = 7$

$a_1 = -21$

$a_1 + d = x \times a_1$ (۷ , −۲۱)

$\boxed{x = -\frac{1}{3}}$

(۸)

$a_1 + a_2 + a_3 = 15 \to a_1 + a_1 + d + a_1 + 2d \Rightarrow 3a_1 + 3d = 15 \Rightarrow a_1 + d = 5$

$\boxed{a_1 = 5 - d}$

$a_4 + a_5 = a_1 + 3d + a_1 + 4d = 2a_1 + 7d = 25$

$a_1 + d = 5$
$2a_1 + 7d = 25$
$a_1 + 6d = 20$
$(5-d) + 6d = 20$
$5d = 15$
$\boxed{d = 3} \boxed{a_1 = 2}$

$a_n = 2 + 3(n-1) \to a_{10} = 2 + 3(9) \to \boxed{a_{10} = 29}$

Arman

$$S_9 = 9S_3$$

$$\frac{9}{2}(a_1+a_9) = 9\left(\frac{3}{2}(a_1+a_3)\right) \rightarrow$$

$$\frac{9}{2}(a_1+a_9) = 3 \times \frac{9}{2}(a_1+a_3) \rightarrow$$

$$a_1+a_1+8d = 3(a_1+a_1+2d) \rightarrow$$

$$2a_1+8d = 6a_1+6d \rightarrow 4a_1 = 2d \rightarrow \boxed{d = 2a_1}$$

$$\frac{a_{20}}{a_7} = \frac{a_1+19d}{a_1+6d} \rightarrow \frac{a_1+19(2a_1)}{a_1+6(2a_1)} \Rightarrow \frac{39a_1}{13a_1} = \boxed{3}$$

$a_1 = 11$

$a_7 = 35 \rightarrow a_7 = a_1 + 6d \rightarrow 6d = 24 \rightarrow \boxed{d = 4}$

$a_n = 11 + 4(n-1) \rightarrow a_5 = 11 + 4(4) \rightarrow \boxed{a_5 = 27}$

$b_n = 38, 35, 32, \ldots$

$b_1 = 38$

$b_5 = 23 \rightarrow b_5 = b_1 + (n-1)d \rightarrow 23 = 38 + 4d \rightarrow$

$4d = -15$

$\boxed{d = -3}$

$d = \frac{b - a}{n+1} \rightarrow -3 = \frac{19 - 31}{n+1} \rightarrow -3n - 3 = -12$

$3n = 9$

$\boxed{n = 3}$