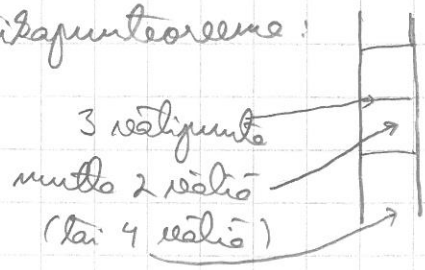
b) $\sum_{n=12}^{105} a_n = a_{12} + a_{13} + \dots + a_{105} = 94 \cdot \frac{-48+603}{2} = 26\,085$

$a_{12} = -48$, $a_{105} = 603$

$105 - 11$ kpl $= 94$ kpl

「Tikapuuteoreema:



」

4.6 $17{,}5 + 16 + 14{,}5 + \dots + (-68) = \frac{17{,}5 + (-68)}{2} \cdot 58 = -1464{,}5$

$+(-1{,}5)$ $+(-1{,}5)$

a_1 a_2 a_3 a_n

aritmeettinen summa

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

$\Leftrightarrow -68 = 17{,}5 + (n-1)(-1{,}5)$

$\Leftrightarrow -68 - 17{,}5 = (n-1)(-1{,}5) \mid :(-1{,}5)$

$\Leftrightarrow \frac{-68-17{,}5}{-1{,}5} = n-1$

$\Leftrightarrow n = \frac{-68-17{,}5}{-1{,}5} + 1 = 58$

4.9 aritmeettinen jono: $17, 28, 39, \dots$

a) $d = 28 - 17 = 39 - 28 = 11$

$a_n = a_1 + (n-1)d = 17 + (n-1)11 = 11n + 6$, $n = 1, 2, 3, \dots$

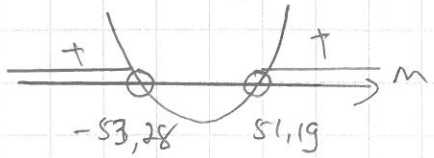
b) $a_1 + a_2 + \dots + a_{40} = 17 + 28 + \dots + \underbrace{(11 \cdot 40 + 6)}_{446} = \frac{17+446}{2} \cdot 40 = 9260$

c) $a_1 + a_2 + \dots + a_n = \frac{a_1 + a_n}{2} \cdot n = \frac{17 + (11n+6)}{2} \cdot n > 15\,000 \mid \cdot 2 > 0$

$\Leftrightarrow \left(17 + (11n+6)\right)n > 30\,000$

$\Leftrightarrow 11n^2 + 23n > 30\,000 \quad \Leftrightarrow 11n^2 + 23n - 30\,000 \boxed{> 0}$

Vastaava yhtälö: $11n^2 + 23n - 30\,000 = 0 \Leftrightarrow n \approx \begin{cases} 51{,}19 \\ -53{,}28 \end{cases}$



$n \in \mathbb{Z}_+ = \{1, 2, 3, \dots\} \Rightarrow n \geq 52$

$\Rightarrow$ vähintään 52 jäsentä

4.16 aritmeettinen jono: $x, x^2 - 8, 4x - 16, \dots$

$d = (x^2 - 8) - x = (4x - 16) - (x^2 - 8)$

$\Leftrightarrow 2x^2 - 5x = 0 \quad \Leftrightarrow x(2x - 5) = 0 \Leftrightarrow x = 0$ tai $2x - 5 = 0$

$\Leftrightarrow x = \frac{5}{2}$