

$$4-7 \text{ a) } v = v_0 + at \quad v = 0 \frac{\text{m}}{\text{s}} + 4,0 \frac{\text{m}}{\text{s}^2} \cdot 10 \text{ s} = \underline{40 \frac{\text{m}}{\text{s}}}$$

$$\text{b) } v_k = \frac{v + v_0}{2} = \frac{40 \frac{\text{m}}{\text{s}}}{2} = \underline{20 \frac{\text{m}}{\text{s}}}$$

$$\text{c) } s = v_k t = 20 \frac{\text{m}}{\text{s}} \cdot 10,0 \text{ s} = \underline{200 \text{ m}}$$

$$4-8 \text{ a) } a_k = \frac{\Delta v}{\Delta t} = \frac{0 \frac{\text{m}}{\text{s}} - 45:3,6 \frac{\text{m}}{\text{s}}}{4,0 \text{ s}} = -3,125 \frac{\text{m}}{\text{s}^2} \approx -3,1 \frac{\text{m}}{\text{s}^2}$$

$$\text{b) } s = v_0 t + \frac{1}{2} a t^2 = \left(45:3,6 \frac{\text{m}}{\text{s}} \right) \cdot 4,0 \text{ s} + \frac{1}{2} \cdot 3,125 \frac{\text{m}}{\text{s}^2} \cdot (4,0 \text{ s})^2 = 25 \text{ m}$$

$$\text{c) } \text{Matkan reaktioaika } s = v_0 t = 45:3,6 \frac{\text{m}}{\text{s}} \cdot 0,50 \text{ s} = 6,25 \text{ m}$$

$$\text{Koko matka } s = 25 \text{ m} + 6,25 \text{ m} = 31,25 \text{ m} \approx \underline{31 \text{ m}}$$

$$4-9 \text{ Lopun hidastuksessa matka } s = 420 \text{ m} - 55 \text{ m} - 330 \text{ m} = 35 \text{ m}$$

$$\text{hidastusaika } t = 7,8 \text{ s}$$

$$\text{loppunopeus } v = 0 \frac{\text{m}}{\text{s}}$$

$$s = \frac{v_0 + v}{2} \cdot t$$

$$v_0 = \frac{2 \cdot s}{t} = \frac{70 \text{ m}}{7,8 \text{ s}} = 8,97 \dots \frac{\text{m}}{\text{s}} \approx 9,0 \frac{\text{m}}{\text{s}}$$

$$4-11 \quad v_0 = 8,0 \frac{\text{m}}{\text{s}} \quad s = 5,0 \text{ m}$$

$$v = 0 \frac{\text{m}}{\text{s}} \quad a = ?$$

$$\text{matka } s = \frac{v_0 + v}{2} \cdot t$$

$$t = \frac{2s}{v_0} = \frac{2 \cdot 5,0 \text{ m}}{8,0 \frac{\text{m}}{\text{s}}} = 1,25 \text{ s}$$

$$a = \frac{v - v_0}{t} = \underline{-6,4 \frac{\text{m}}{\text{s}^2}}$$

$$4-14 \quad v_0 = 22 \frac{\text{m}}{\text{s}} \quad a = 5,4 \frac{\text{m}}{\text{s}^2}$$

$$s = 25 \text{ m}$$

$$t = ?$$

$$s = v_0 t + \frac{1}{2} a t^2$$

$$\frac{1}{2} a t^2 + v_0 t - s = 0$$

$$0,5 \cdot 5,4 \cdot t^2 + 22 \cdot t - 25 = 0$$

$$2,7 t^2 + 22 t - 25 = 0$$

$$a x^2 + b x + c = 0$$

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$t_{1,2} = \frac{-22 \pm \sqrt{22^2 - 4 \cdot 2,7 \cdot (-25)}}{2 \cdot 2,7}$$

$$t_1 = 1,0109 \dots \text{ s} \approx 1,0 \text{ s}$$

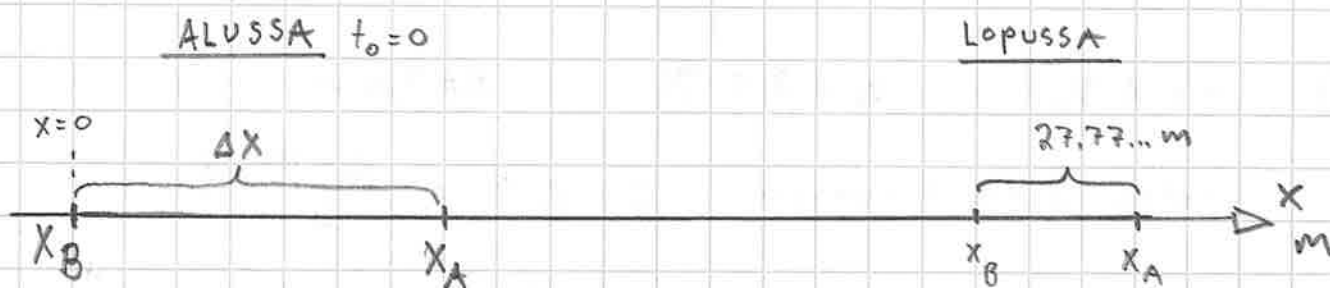
$$(t_2 = -9,159 \dots \text{ s})$$

4-15) Autot liikkuvat x-akselilla, 0-kohta on B: alkupaikka
hetkellä $t_0 = 0$

Tilanteen kesto aika = A:n kiihdytysaika, eli kun
alkunopeus $v_0 = 0$, loppunopeus $v = 50 \text{ km/h} = 13,88... \text{ m/s}$ ja
kiihtyvyys $a = 1,2 \text{ m/s}^2$, niin... $a = \frac{\Delta v}{\Delta t}$ mistä

$$\text{aika } \Delta t = \frac{\Delta v}{a} = \frac{13,88... \text{ m/s}}{1,2} = 11,574... \text{ s} \quad \text{eli } t = 11,574... \text{ s}$$

Autojen välimatka alussa on Δx ja lopussa 2 sekunnin
turvaväli, mikä on metreinä $s = v t_1 = 13,88... \text{ m/s} \cdot 2 \text{ s} = 27,77... \text{ m}$



Siis A:n kiihdytysajan $t = 11,574... \text{ s}$ kuluttua autojen väli-
matka $x_A - x_B = 27,77... \text{ m}$

$$\Delta x + \frac{1}{2} a t^2 - v_{0B} t = 27,77... \text{ m}$$

$$\Delta x = 27,77... \text{ m} + v_{0B} t - \frac{1}{2} a t^2$$

$$\Delta x = 27,77... \text{ m} + 13,88... \text{ m/s} \cdot 11,574... \text{ s} - \frac{1}{2} \cdot 1,2 \text{ m/s}^2 \cdot (11,574... \text{ s})^2$$

$$\Delta x = 108,1... \text{ m} \approx \underline{\underline{110 \text{ m}}}$$