

Einheitenübung

$$a) m = 800\,000 \text{ g} \stackrel{!}{=} 800 \text{ kg}$$

$$v = 42 \frac{\text{km}}{\text{h}} \stackrel{!}{=} 42 \cdot \frac{1000 \text{ m}}{3600 \text{ s}} = 42 \cdot \frac{5}{18} \frac{\text{m}}{\text{s}} = 11 \frac{2}{3} \frac{\text{m}}{\text{s}}$$

$$\Rightarrow p = 800 \cdot 11.66 \frac{\text{kg m}}{\text{s}} = 9333 \frac{1}{3} \frac{\text{kg m}}{\text{s}}$$

$$b) t = 0.5 \text{ min} \stackrel{!}{=} 30 \text{ s}$$

$$a = \frac{v - v_0}{t} = \frac{v}{t} = \frac{11.66 \frac{\text{m}}{\text{s}}}{30 \text{ s}} = \frac{7}{18} \frac{\text{m}}{\text{s}^2} = 0.388 \frac{\text{m}}{\text{s}^2}$$

$$c) F = m \cdot a = 800 \cdot \frac{7}{18} \text{ N} = 311.11 \text{ N} \stackrel{!}{=} \frac{2800}{9} \text{ N}$$

$$d) s = 3 \times 10^4 \text{ mm} = 30 \text{ m}$$

$$E = F \cdot s = 311.11 \cdot 30 \text{ Nm} = 9333 \frac{1}{3} \text{ J}$$

Aufgabe 1

$$\Delta x \Delta p \geq \frac{h}{4\pi}$$

$$m = 0.2 \text{ kg}$$

$$\Delta x = 0.0001 \text{ cm} \stackrel{!}{=} 1 \times 10^{-4} \text{ cm} = 1 \times 10^{-7} \text{ m}$$

$$a) t = 1 \text{ h} \stackrel{!}{=} 3600 \text{ s}$$

$$b) t = 1 \text{ y} \stackrel{!}{=} 3.154 \times 10^7 \text{ s}$$

$$c) t = 100 \text{ y} \stackrel{!}{=} 3.154 \times 10^9 \text{ s}$$

$$d) t = 4 \times 10^6 \text{ y} \stackrel{!}{=} 1.26 \times 10^{14} \text{ s}$$

$$p \geq \frac{h}{4\pi} \cdot \frac{1}{\Delta x}$$

$$p = m \cdot v \quad \Rightarrow \quad v = \frac{p}{m}$$

$$s = v \cdot t = \frac{p t}{m}$$

$$\Rightarrow s \geq \frac{t}{m} \frac{h}{4\pi} \frac{1}{\Delta x}$$

$$\Rightarrow s(1 \text{ h}) = 9.48 \times 10^{-24} \frac{\text{m}}{\text{m}}$$

$$s(1 \text{ y}) = 8.31 \times 10^{-20} \frac{\text{m}}{\text{m}}$$

$$s(100 \text{ y}) = 8.31 \times 10^{-18} \frac{\text{m}}{\text{m}}$$

$$s(4 \times 10^6 \text{ y}) = 3.32 \times 10^{-10} \frac{\text{m}}{\text{m}}$$

Messbar ab $s = \Delta x$

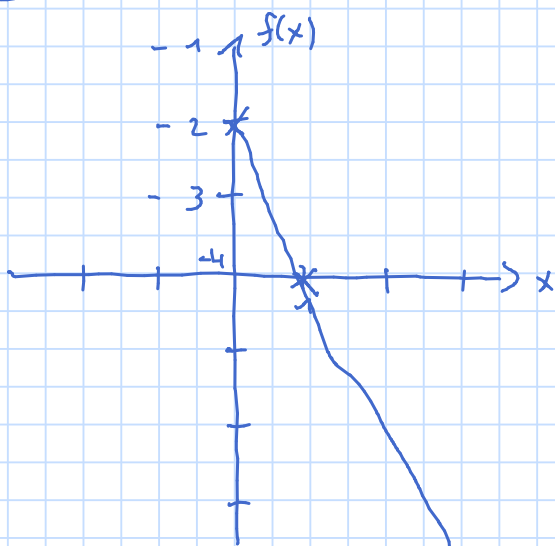
$$\Rightarrow \Delta x \geq \frac{t}{m} \frac{h}{4\pi} \frac{1}{\Delta x} \quad | \cdot \frac{4\pi m \Delta x}{h}$$

$$\Leftrightarrow \frac{4\pi m \Delta x^2}{h} \geq t$$

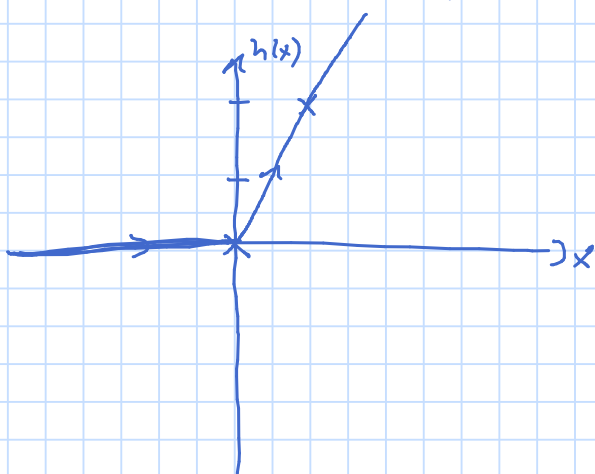
$$\Rightarrow 3.8 \times 10^{19} \text{ s} \geq t$$

Aufgabe 2

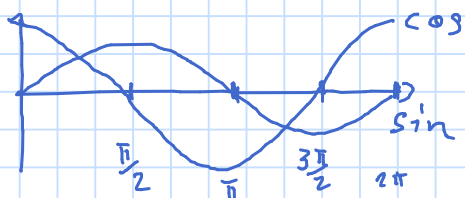
a)



b)



c)
d)



Aufgabe 3

$$a) \quad 5(2x-3) < 3x+20 - 9(2-x)$$

$$\Leftrightarrow 10x - 15 < 3x + 20 - 18 + 9x \quad | \text{Zusammenfassen}$$

$$\Leftrightarrow 10x - 15 < 12x + 2 \quad | -10x - 2$$

$$\Leftrightarrow -17 < 2x \quad | \div 2$$

$$\Leftrightarrow -\frac{17}{2} < x$$

$$\begin{aligned}
 \text{b) } & (2x+3)^2 + 8 \geq (x-5)(x+5) + 3x(x-3) & | \text{ ausmultiplizieren} \\
 \Leftrightarrow & 4x^2 + 12x + 17 \geq x^2 - 25 + 3x^2 - 9x & | \text{ zusammenfassen} \\
 \Leftrightarrow & 4x^2 + 12x + 17 \geq 4x^2 - 9x - 25 & | -4x^2 \quad | +9x \quad | -17 \\
 \Leftrightarrow & 21x \geq -42 & | : 21 \\
 \Leftrightarrow & x \geq -2 & //
 \end{aligned}$$

$$\begin{aligned}
 \text{c) } & \frac{2-x}{2} - 1 < \frac{3}{6} (3-2x) & | \frac{2}{2} - \frac{x}{2} - \frac{2}{2} = -\frac{x}{2}, \quad \frac{3}{6} = \frac{1}{2} \\
 \Leftrightarrow & -\frac{x}{2} < \frac{3}{2} - x & | +x \\
 \Leftrightarrow & \frac{x}{2} < \frac{3}{2} & | \cdot 2 \\
 \Leftrightarrow & x < 3 & //
 \end{aligned}$$

$$\begin{aligned}
 \text{d) } & \frac{x+4}{3} - \frac{x-3}{4} > \frac{x+4}{2} & | \text{ LHS auf einen Nenner bringen} \\
 \Leftrightarrow & \frac{4x+16-3x+9}{12} > \frac{x+4}{2} & | \text{ zusammenfassen} \\
 \Leftrightarrow & \frac{x+25}{12} > \frac{x+4}{2} & | \cdot 12 \\
 \Leftrightarrow & x+25 > 6x+24 & | -x \quad -24 \\
 \Leftrightarrow & 1 > 5x & | 1-24 = -23 \quad | \div 5 \\
 \Leftrightarrow & \frac{1}{5} > x & //
 \end{aligned}$$

Aufgabe 4

$$t_0 = 0$$

$$s_0 = 0$$

$$v_1 = 20 \frac{\text{m}}{\text{s}} \quad f(t) = t \cdot v_1$$

$$a_2 = 0.15 \frac{\text{m}}{\text{s}^2} \quad g(t) = t^2 a_2$$

$$f(t) = g(t)$$

$$\Rightarrow t v_1 = t^2 a_2 \quad t \neq 0$$

$$\frac{v_1}{a_2} = t$$

$$\Rightarrow t_1 = \frac{20}{0.15} \text{ s} = 133.\overline{33} \text{ s} \stackrel{!}{=} \underline{\underline{2.22 \text{ min}}}$$

$$f(t_1) = g(t_1) = \underline{\underline{2666,53 \text{ m}}}$$