1

$V = 1000\,cm^3$

$1000cm^3 = \pi r^2 h$

$\frac{1000cm^3}{\pi r^2} = h$

$A = 2\pi r^2 + 2\pi r \cdot \frac{1000cm^3}{\pi r^2}$

$= 2\pi r^2 + \frac{2000cm^3 \pi r}{\pi r^2}$

$A_1 = 2\pi r^2$

$A_2 = \frac{2000cm^3}{r}$

$f(r) = 0.02\frac{ct}{cm^2} \cdot 2\pi r^2 + \frac{0.04\frac{ct}{cm^2} \cdot 2000cm^3}{r}$

$= 0.04\pi r^2 + \frac{80}{r}$

$f(r)' = 0.08\pi r + \frac{-80}{r^2}$

$0 = 0.08\pi r - \frac{80}{r^2}$

$\frac{80}{r^2} = 0.08\pi r$

$80 = 0.08\pi r^3$

$r^3 = \frac{80}{0.08\pi}$

$r = \sqrt[3]{\frac{1000}{\pi}} \approx 6.83\,cm$

with height and V formulas -> $h = r$

alternative:

$f(r^*)' = 0.08\pi r + \frac{-0.8}{r^2}$

$0 = 0.08\pi r - \frac{0.8}{r^2}$

$\frac{0.8}{r^2} = 0.08\pi r$

$0.8 = 0.08\pi r^3$

$\frac{0.8}{0.08\pi} = r^3$

$r = \sqrt[3]{\frac{10}{\pi}} = 1.47\,cm$

$h = \frac{1000cm^3}{\pi 2.16cm^2} = 147.37cm$

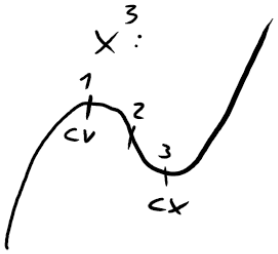
2 a) $f(x) = x^3 - 6x^2 + 9x + 15 + 13$

$f'(x) = 3x^2 - 12x + 9$ — $\frac{12 \pm \sqrt{(-12)^2 - 4 \cdot 3 \cdot 9}}{6}$ $x_1 = 3$ $x_2 = 1$

$f''(x) = 6x - 12$ ⟶ $x_1 = 2$

$f'''(x) = 6$

$f^{(4)}(x) = 0$



smi for $x \in]-\infty; 1]$

smd for $x \in [1; 3]$

smi for $x \in [3; \infty[$

concave for $x \in]-\infty; 2]$

convex for $x \in [2; \infty[$

b) $f(x) = \sin\left(\frac{1}{x}\right)$

$f'(x) = \cos\left(\frac{1}{x}\right) \cdot \frac{d}{dx} \cdot \frac{1}{x}$

$= \cos\left(\frac{1}{x}\right) \cdot \frac{-1}{x^2}$

$= \frac{-\cos\left(\frac{1}{x}\right)}{x^2}$ ⟶ $0 = \frac{-\cos\left(\frac{1}{x}\right)}{x^2}$

$f'(x) = 0$ for

$x = \frac{1}{\frac{\pi}{2} + k\pi}$, $k \in \mathbb{Z}$

$f''(x) = \frac{\sin\left(\frac{1}{x}\right) \cdot \frac{-1}{x^2} \cdot x^2 - -\cos\left(\frac{1}{x}\right) \cdot 2x}{x^4}$

$= \frac{-\sin\left(\frac{1}{x}\right) + 2x\cos\left(\frac{1}{x}\right)}{x^4}$

$f''(x) = 0$ for

$x =$

⟶ $2x\cos\left(\frac{1}{x}\right) - \sin\left(\frac{1}{x}\right) = 0$

$2x\cos\left(\frac{1}{x}\right) = \sin\left(\frac{1}{x}\right)$