Task 5.2

Remark to step 4 in the example solution:

$$\underbrace{\frac{p_1 - p_2}{8 \mu l_2} \pi r_2^4}_{\text{RHS}} = \underbrace{\pi r_1^2}_{\text{Area}} \underbrace{\frac{l_1}{\Delta t}}_{\text{Velocity}} \qquad | \cdot \Delta t \; | : \text{RHS}$$

RHS (right hand side)

Area and Velocity in the big volume

replace $p_1 - p_2$ like so:

$$p_1 = \frac{F}{A_1} + p_a$$

$$p_2 = p_a$$

$$\Rightarrow p_1 - p_2 = \frac{F}{A_1} = \frac{F}{\pi r_1^2}$$

$$\frac{1}{p_1 - p_2} = \frac{\pi r_1^2}{F}$$

$$\Delta t = \frac{\pi r_1^2 l_1 \, 8 \mu \, l_2}{p_1 - p_2 \; \pi r_2^4}$$

$$= \frac{\pi r_1^2 l_1 l_2 \, 8 \mu}{\pi r_2^4} \frac{\pi r_1^2}{F}$$

$$= \frac{8 \mu l_1 l_2 \pi r_1^4}{F} \cdot \frac{1}{r_2^4}$$