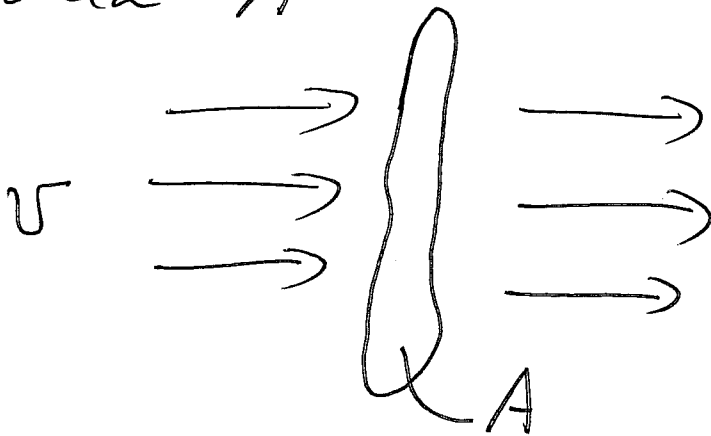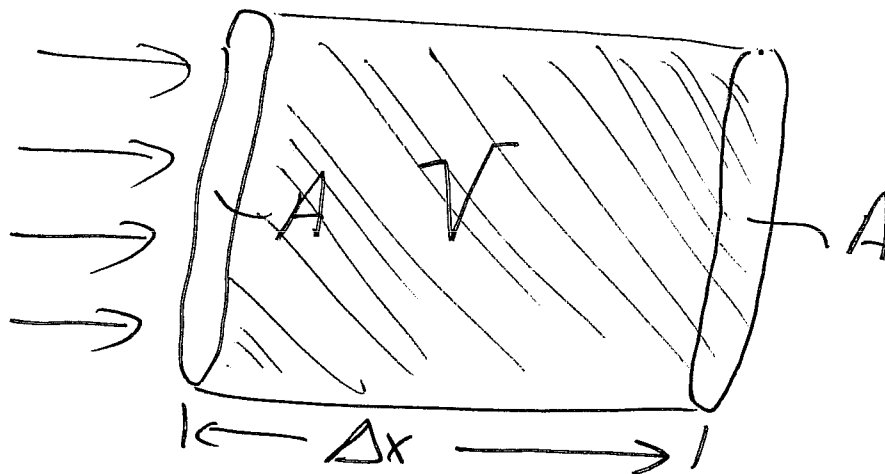What is the
Relationship between
Volumetric Flow Rate Q
and velocity?

Consider a fluid moving with
velocity v through a cross-sectional
area A

After time Δt, a volume of fluid
will have passed through A:

The height of the volume Δx is related to the fluid velocity by

$$v = \frac{\Delta x}{\Delta t}$$

The volume of the fluid is

$$V = volume = (height)(cross\text{-}section)$$

$$V = \Delta x \, A$$

The volumetric flow rate Q is equal to $V/\Delta t$. Therefore

$$\frac{V}{\Delta t} = \frac{\Delta x}{\Delta t} A$$

$$\boxed{Q = v \, A}$$

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