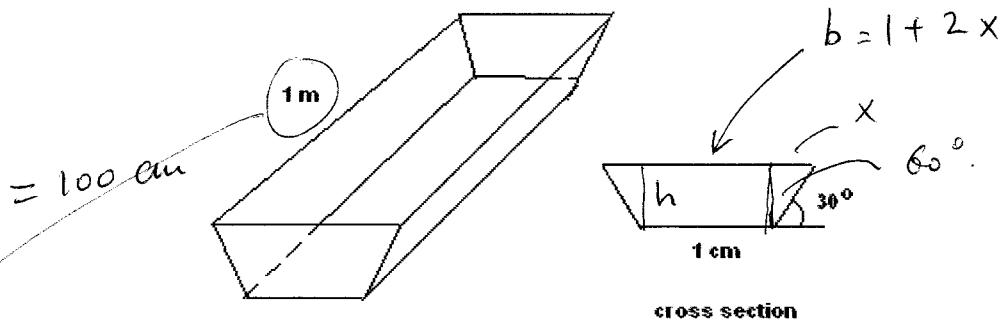


Calculus Worksheet: Rate of Change (2)

The cross section of the container on the right is an isosceles trapezoid whose angle, lower base are given below. The length of the container is 1 meter. If water

pours into the container at the rate of $10 \text{ cm}^3/\text{minute}$, find the rate $\frac{dh}{dt}$ of the height h of water in the container when $h = 1 \text{ cm}$.



$$b = a +$$

$$b = 1 + 2x, \quad x = h \tan 60^\circ$$

$$b = 1 + 2h \tan 60^\circ.$$

$$\text{area of cross section: } A = \frac{1}{2}(1)(1 + 2h \tan 60^\circ)h.$$

$$\text{Volume} = (1 \text{ m}) \times \text{area of cross section} = 50(1 + 2h \tan 60^\circ)h \text{ (cm}^3\text{)}$$

$$1 \text{ m} = 100 \text{ cm}.$$

$$\text{rate} = \frac{dV}{dt} = 10 \text{ cm}^3/\text{min.}$$

given

hence

$$10 = 50 \frac{dh}{dt} + 100 \cdot 2h \frac{dh}{dt} \tan 60^\circ.$$

$$\frac{dh}{dt} = \frac{10}{50 + 200h \tan 60^\circ} \approx 0.025 \text{ cm/min.}$$

$h = 1 \text{ cm}$: given