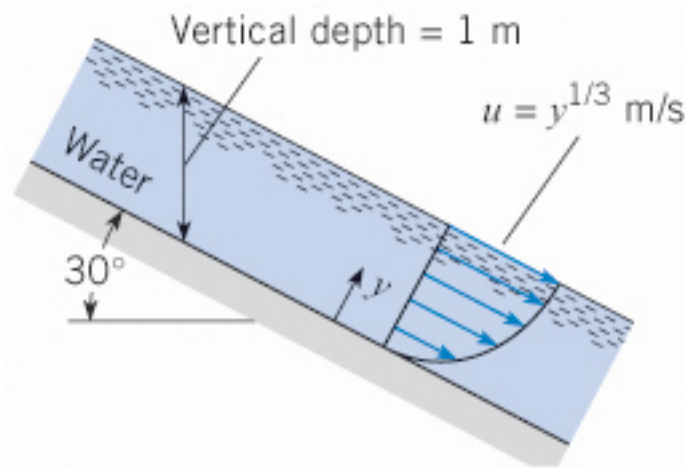


FLOW RATE (DISCHARGE)

Example Problem: Flow through rectangular channel [5.18]

Water flows through a rectangular channel as shown. The channel width is 1.5 m. Find the discharge in the channel.



Assumptions:

1. Steady flow
2. Incompressible flow

Solution:

The depth in the y – direction perpendicular to the channel is:

$$d = (\text{vertical depth}) \times \cos 30^\circ = 0.866 \text{ m}$$

$$\begin{aligned} Q &= \int_{\text{channel cross-section}} \vec{V} \cdot d\vec{A} = \int_0^d u w dy = \\ &= \int_0^{0.866} y^{1/3} (1.5) dy = 1.5 \int_0^{0.866} y^{1/3} dy = \frac{1.5}{4/3} [y^{4/3}]_0^{0.866} \Rightarrow \\ Q &= 0.93 \text{ m}^3 / \text{s} \end{aligned}$$