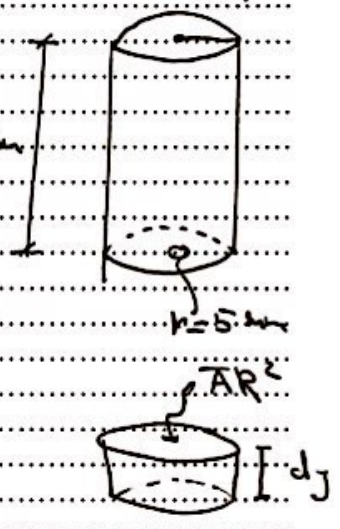
Engineering Analysis & Numerical Methods

Example 1:- A right circular cylinder of radius 3m and hight 10 m. There is a hail of radius 5 mm at the bottom of tank. Find the depth of water as a function of time? When the tank will be empty ?

Solution is: $\frac{dV}{dt} = Q_{in} - Q_{out}$



$$\frac{dV}{dt} = -\sqrt{2gy}\,\frac{\pi d^2}{4}$$

$$dV = \pi R^2\, dy$$

$$\pi R^2 \frac{dy}{dt} = -\sqrt{2g}\,\frac{\pi d^2}{4} y^{1/2}$$

$$\frac{dy}{y^{1/2}} = \frac{-\sqrt{2g}\,\pi d^2}{4\pi R^2}\, dt$$

$$2y^{1/2} = -\frac{\sqrt{2g}}{4R^2} d^2 t + c$$

at $t=0$, $y = H = 10$ m

$$2\sqrt{10} = -\frac{\sqrt{2(9.8)}}{4(3)^2}\left(\frac{10}{1000}\right)^2 (0) + c$$

$$\therefore c = 2\sqrt{10} \Rightarrow 2\sqrt{y} = -1.23 * 10^{-5} t + 2\sqrt{10}$$

at $y=0$, $t=?$

$$0 = -1.23 * 10^{-5} t + 2\sqrt{10} \Rightarrow t = \quad \text{sec}$$