

4. [13 points]

- a. [6 points] A cylindrical tank with height 8 m and radius of 8 m is standing on one of its circular ends. The tank is initially empty. Water is added at a rate of $2 \text{ m}^3 / \text{min}$. A valve at the bottom of the tank releases water at a rate proportional to the water's depth (proportionality constant = k). Let $V(t)$ be the volume of the water in the tank at time t , and $h(t)$ be the depth of the water at time t .

i. Find a formula for $V(t)$ in terms of $h(t)$. $V(t) =$ _____

- ii. Find the differential equation satisfied by $V(t)$. Include the appropriate initial conditions.

Differential equation: _____ Initial condition: _____

- b. [7 points] Let $M(t)$ be the balance in dollars in a bank account t years after the initial deposit. The function $M(t)$ satisfies the differential equation

$$\frac{dM}{dt} = \frac{1}{100}M - a.$$

where a is a positive constant. Find a formula for $M(t)$ if the initial deposit is 1,000 dollars. Your answer may depend on a .