

Name: _____

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20 points possible. A scientific or graphing calculator is permitted (for problem #3 in particular), but no other aids are allowed. Show all work and use proper notation for full credit.

1. **[6 points]** The fluid in a cylindrical tank with radius 5 m is draining at a rate of $2 \text{ m}^3/\text{min}$. How fast is the height of the water changing?

2. **[6 points]**

- a. Find the linearization of $f(x) = \sqrt{x}$ at $a = 16$.

- b. Use part a. to estimate $\sqrt{17}$.

3. [8 points] Suppose the temperature of a liquid substance (in $^{\circ}$ F) undergoing a chemical reaction t minutes after its start is modeled by the function

$$T(t) = \ln(t^2 - t + 1).$$

- a. What is the initial temperature of the liquid?
- b. Find the time t from $[0, 10]$ where the temperature T is at its maximum and minimum values.