

1. Warm-up (Review of related rates from Calc 1): A cylindrical keg with radius 10 cm and height 25 cm has a drain hole at the bottom with an area of 2 cm^2 . The keg is draining at a constant rate of $200 \frac{\text{cm}^3}{\text{sec}}$.

(a) Find the depth of the liquid when there are 4 L of the liquid remaining. Use the fact that $1 \text{ L} = 1000 \text{ cm}^3$. Do you need to use calculus for this part?

(b) How fast is the height of the liquid dropping where there are 4 L remaining in the keg? Do you need calculus for this part?

(c) How long does it take for the tank to drain? Do you need calculus for this part?

2. According to the model of the previous problem, is the liquid coming out at a constant rate? Does this model fit with your experience?

3. Realistically, we expect the rate at which the liquid drains to depend on _____, _____, and the viscosity of the liquid.

We will soon learn to take these factors into consideration using differential equations.

5. Warm-up (Review of related rates from Calc 1): A conical funnel has radius 4 cm and height 8 cm. Coffee is draining from the funnel at a constant rate of $1.3 \text{ cm}^3/\text{sec}$.

(a) What is the depth of the coffee when there are 100 cm^3 of coffee remaining in the funnel? Do you need calculus for this part?

(b) How fast is the level dropping when there are 100 cm^3 of coffee in the funnel? Do you need calculus for this part?

(c) How long does it take for the funnel to drain? Do you need calculus for this part of the problem?

As in the first problem, it's not realistic that the funnel drains at a constant rate. We will again address this issue using differential equations.