(More Challenging) Related Rates Practice Problems

Math 1210

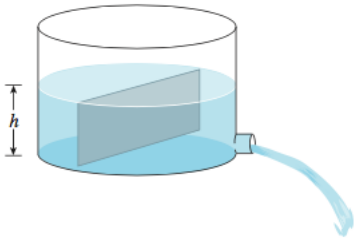
November 7, 2018

Problem 1

Water flows from a tank of constant cross-sectional area 50 ft^2 through an orifice of constant cross-sectional area 1.4 ft^2 located at the bottom of the tank (see the figure). Initially the height of the water in the tank was 20 ft, and its height t sec later is given by the equation

$$2\sqrt{h} + \frac{1}{25}t - 2\sqrt{20} = 0 \qquad (0 \le t \le 50\sqrt{20})$$

How fast was the height of the water decreasing when its height was 8 ft?



Problem 2

A water trough is 10 m long and a cross-section has the shape of an icosceles trapezoid that is 30 cm wide at the bottom, 80 cm wide at the top, and has height 50 cm. If the trough is being

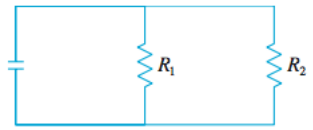
filled with water at the rate of 0.2 m^3/min, how fast is the water level rising when the water is 30 cm deep.

Problem 3

If two resistors with resistances R_1 and R_2 are connected in parallel, as in the figure, then the total resistance R, measured in ohms (Ω), is given by

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

If R_1 and R_2 are increasing at rates 0.3Ω/s and 0.2Ω/s, respectively, how fast is R changing when $R_1 = 80\Omega$ and $R_2 = 100\Omega$?



Problem 4

Boyle's Law states that when a sample of gas is compressed at a constant temperature, the pressure P and volume V satisfy the equation $PV = C$, where C is a constant. Suppose that at

a certain instant the volume is 600 cm^3, the pressure is 150 kPa/min. At what rate is the volume decreasing at this instant?