Chapter 4.6: Related Rates

Calculus I

College of the Atlantic. Fall 2016

1. A 3-meter ladder stands against a high wall. The foot of the ladder moves outward at a speed of 0.1 m/s when the foot is 1 meter from the wall. At that moment, how fast is the top of the ladder falling?

2. A hemispherical bowl of radius 10 cm contains water to a depth of h cm.

   (a) Find an expression for the radius of the surface of the water as a function of h.

   (b) The water level drops at a rate of 0.1 cm per hour. At what rate is the radius of the water decreasing when the depth is 5 cm?

Cortical Optimization

The following equation relates the conduction time τ to ϕ, the wire fraction in a sample of brain. The other variable, k and ϕ_0 are constant; they do not depend on ϕ.

$$\tau^4 = k^4 \frac{\phi_0}{\phi} \left[\frac{(1-\phi_0)}{(1-\phi)} \right]^{2/3} . \tag{1}$$

Take the derivative with respect to ϕ, set the derivative equal to zero, and solve for ϕ.