Basic Derivative Rules

1. Give two explanations for the identity $\dfrac{d}{d\theta}(\sin(\theta)) = -\dfrac{d}{d\theta}(\sin(\theta + \pi))$.

2. A cube grows in volume as the length of its edges grow (expanding from a single corner). How quickly does the volume of an $8\ in^3$ cube grow with respect to its growing side lengths? After you determine the growth rate, make a geometric argument supporting your claim.

3. Consider a right triangle has base length x and an area of 2. Suppose that the base length begins to change but the area remains fixed at 2. If the base length is 5 and begins to decrease, what is the rate of change of the height?

4. In chemistry, pH is a scale used to measure the acidity of a solution. The pH of a solution is defined by the equation
$$\mathrm{pH} = -\log_{10}(x)$$
where x represents the concentration of hydrogen ions. Compute the rate of change of pH with respect to hydrogen ion concentration when the pH is 2. (*Note that* pH *is a single quantity, not the product of* p *and* H.)

5. Without using the chain rule, why is the derivative of $f(x) = \ln(x^5) = \dfrac{5}{x}$