



New York City College of Technology

Related Rates

Alexander Dyson

11/25/2017

MAT1475, Calculus I

The owners of Greenwich St. Jewelers want to predict how national interest rates effect yearly sales. The current interest rate r is 4% and the owners want to prepare for an 0.8% rise in rates for the year 2020. Using past historical data on sales performance and yearly interest rates the owners were able to derive a simple function that describes the relationship between yearly sales S and r rates below:

$$S = \frac{150000}{\sqrt{r^2+5}} - \frac{4900r^2}{3}$$

Where S is in thousands of dollars. Find  $\frac{dS}{dt}$

**Solution:**

$$S = \frac{150000}{\sqrt{r^2+5}} - \frac{4900r^2}{3} \tag{1}$$

$$S = 150000(r^2+5)^{-1/2} - \frac{4900r^2}{3} \tag{2}$$

$$(1) \quad \frac{dS}{dt} = 150000 \frac{d}{dt}(r^2+5)^{-1/2} - \frac{d}{dt}\left(\frac{4900r^2}{3}\right)$$

$$(2) \quad \frac{dS}{dt} = 150000\left(\frac{-1}{2}\right)(r^2+5)^{-1/2-(1)}(2r \frac{dr}{dt}) - \left(\frac{4900*2r}{3} \frac{dr}{dt}\right)$$

$$(3) \quad \frac{dS}{dt} = -75000(r^2+5)^{-3/2}(2r \frac{dr}{dt}) - \left(\frac{9800r}{3} \frac{dr}{dt}\right)$$

**(4) Plug in given values:**  $\frac{dS}{dt} = -75000(0.04^2+5)^{-3/2}(2(0.04)(0.008)) - \frac{(9800(0.04))(0.008)}{3}$

**(5)**  $\frac{dS}{dt} = -5.3365$  , since S is in thousands we simply multiply this final rate by 1000.

$\frac{dS}{dt} = 1000(-5.3365) = -\$5,336.50$  , with current interest rates at 4%, if they rise another 0.8% next year, Greenwich St. Jewelers can expect a reduction in demand, thus a reduction in yearly sales of about **\$5,336.50**