Math 124 Section 2 **QUIZ 11** Solutions **Nov 28, 2007**

Show your work in all problems.

1. Find the derivatives of the following functions:

(a) $k(x) = \underbrace{\boxed{x^3}}_{=f} \cdot \underbrace{\boxed{5^x}}_{=g}$

product rule: $(f \cdot g)' = f' \cdot g + f \cdot g'$

$$k'(x) = \underbrace{3x^2}_{f'} \cdot \underbrace{5^x}_{g} + \underbrace{x^3}_{f} \cdot \underbrace{5^x \ln(5)}_{g'}$$

(b) $s(t) = \dfrac{t^2+1}{3t-1}$ $\;t^2+1 = f$, $\;3t-1 = g$

quotient rule: $\left(\dfrac{f}{g}\right)' = \dfrac{f' g - f \cdot g'}{(g)^2}$

$$s'(t) = \frac{2t \cdot (3t-1) - (t^2+1) \cdot 3}{(3t-1)^2}$$

2. A company producing snowshoes wants to sell them at unit price p dollars. The quantity sold q depends on p, so we write $q = f(p)$. If we know $f(200) = 5000$ and $f'(200) = -30$, answer the following:

Similar to #35, 38 in 3.4

(a) Find the revenue when $p = 200$. (Revenue = selling price $\times$ quantity)

$$R(p) = p \cdot q = p \cdot f(p)$$

$$R(200) = 200 \cdot f(200) = 200 \cdot 5000 = \$1000000$$

(b) Find $\dfrac{dR}{dp}$ at $p = 200$.

r.o.c. in revenue as p changes

units of R': $\dfrac{\text{units of } R}{\text{units of } p} = \$/\$$

derivative of p is 1: $\dfrac{d}{dp}(p) = 1 \cdot p^0 = 1$

(just like $y = x$ has derivative $y' = 1$)

$$R(p) = \boxed{p} \cdot \boxed{f(p)}$$

$$R'(p) = 1 \cdot f(p) + p \cdot f'(p)$$

$$R'(200) = 1 \cdot f(200) + 200 \cdot f'(200) = 1 \cdot 5000 + 200 \cdot (-30)$$

$$= 5000 - 6000 = -1000 \ \$/\$$$

(c) Should they increase the selling price or decrease it to make more profit? Explain why using your answer to part (b).

Since $R'(200) < 0$ it means R decreases when p is near 200. Hence the company shouldn't increase the selling price.