LECTURE: 3-2 THE PRODUCT AND QUOTIENT RULES [PART 2] AND INTRO TO 3-3

Recall the derivative rules we have so far:

- **Power rule:** $(x^n)' = nx^{n-1}$
- **Constant multiple rule:** $(cf(x))' = cf'(x)$
- **Sum/difference rule:** $(f \pm g)' = f' \pm g'$
- **Product rule:** $(fg)' = fg' + f'g$
- **Quotient rule:** $\left(\frac{f}{g}\right)' = \frac{gf' - fg'}{g^2}$

1. Differentiate the following.

(a) $f(x) = (x - 4\sqrt{x})e^x$

(b) $y = \dfrac{\sqrt{x}}{1 + 2x}$

(c) $g(x) = \dfrac{ax + b}{cx + d}$

2. Find the derivative in two ways: (i) product rule and (ii) first multiply out.

$f(x) = (x + x^2)(x^{-1} + 3)$

3. Find an equation of the tangent line and normal line to the given curve $y = 2\sqrt{x}e^x + 1$ at the point $(0, 1)$.

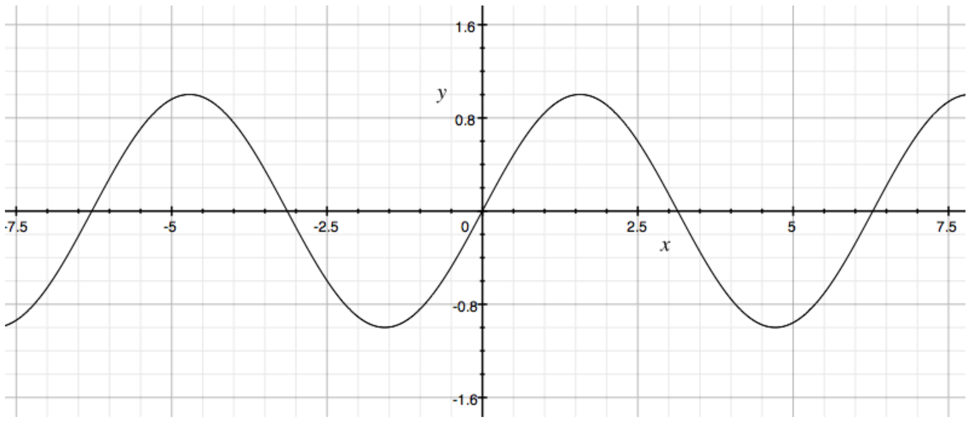
4. A manufacturer produces socks. The quantity q of these socks (measured in pairs of socks) that are sold are a function of the selling price p (in dollars), so we can write $q = f(p)$. Then the total revenue earned with a selling price p is $R(p) = pf(p)$.

(a) What does it mean to say $f(10) = 20,000$ and $f'(10) = 3,500$?

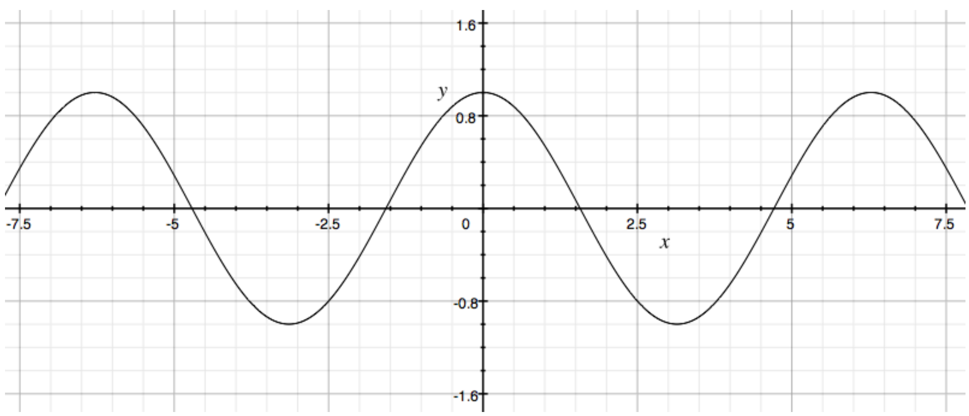
(b) Assuming the values in part (a), find $R'(10)$ and interpret your answer.

3-3: INTRO TO DERIVATIVES OF TRIGONOMETRIC FUNCTIONS

Example 1: Use the graph of $y = \sin x$ to sketch a graph of y'. Guess what y' is.



Example 2: Use the graph of $y = \cos x$ to sketch a graph of y'. Guess what y' is.



Example 3: Using the derivatives we just found, let us find the derivative of $f(x) = \tan x$. What is the domain of $f'(x)$?