Section 3.2: The Product and Quotient Rules

These notes reflect material from our text, *Calculus, Concepts and Contexts, Third Edition*, by James Stewart, published by Brooks/Cole, Pacific Grove, CA, 2005.

Key points from Stewart, Section 3.2: $(fg)' = fg' + f'g$ *and* $(\frac{f}{g})' = \frac{f'g - fg'}{g^2}$.

The Derivative

Recall that if $f(x)$ is a function, the *derivative at* $x = a$ is given by

$$f'(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

provided that this limit exists.

Rules to Calculate Derivatives of Products and Quotients

Let $f'(x)$ and $g'(x)$ denote the derivative functions of $f(x)$ and $g(x)$ respectively.

Product Rule

$$\frac{d}{dx}\big(f(x) \cdot g(x)\big) = f'(x) \cdot g(x) + f(x) \cdot g'(x)$$

Quotient Rule

$$\frac{d}{dx}\Big(\frac{f(x)}{g(x)}\Big) = \frac{f'(x)g(x) - f(x)g'(x)}{(g(x))^2}$$

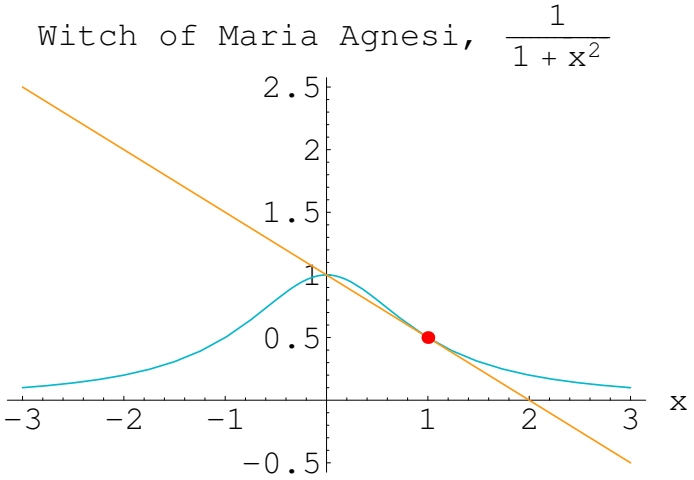

Fig. What is the equation of the tangent line to the Witch of Maria Agnesi at $x = 1$*?.*

Rules for Derivatives (so far)

$(cf)' = cf'$

$(f \pm g)' = f' \pm g'$

$(fg)' = fg' + f'g$

$(\frac{f}{g})' = \frac{f'g - fg'}{g^2}$

Exercises

Exercises for Section 3.2, pp 198–200: 1, 2 (two ways), 3, 5, 9, 15, 21, 23 (Maria Agnesi), 31, 33, 36, 39 (income), 41, 43 (how many?)