HWK #2. Due Wed 2/7, Thurs 2/8
4.1: 14, 18, 31, 71
4.2: 8, 12, 20, 28, 31

HWK #3. Due Tues 2/13, Wed 2/14
Solutions will be available 2/15
4.3: 22, 28, 36, 46
4.4: 2, 8, 18, 38b

Not HWK. 4.5: 1, 7, 9, 11

Prelim 1: Tues 2/20 covers 3.3-4.5

Feb 1 lecture

Rule 1: \((x^p)' = px^{p-1}\)
Rule 2: \((cf)' = cf'\)
Rule 3. \((f+g)' = f' + g'\)
Rule 4. \((fg)' = f'g + fg'\)
Rule 5. \((1/g)' = -g'/g^2\)

The crow and the snail by Reto Zach

Sea gulls and crows feed on various types of mollusks by lifting them into the air and dropping them onto a rock to break open their shells. Biologists have observed that northwestern crows consistently drop a type of mollusk called a whelk from a mean height of about 5 meters.

Practice Problem 45 on page 236
http://illuminations.nctm.org/LessonDetail.aspx?ID=L482

Find \(W'\)
Where is \(W' = 0\)?

\[(fg)' = f'g + fg'\] \[(1/h)' = -1/h^2\]

\[W = H\left(1 + \frac{20}{H - 1}\right)\]

\[W' = \left(1 + \frac{20}{H - 1}\right) + H \cdot \frac{-1}{(H - 1)^2}\]

\[= 1 + \frac{20(H - 1) - 20H}{(H - 1)^2} = 1 - \frac{20}{(H - 1)^2}\]

\[W' = 0\] when \((H - 1)^2 = 20\)
\[H = 1 + \sqrt{20} = 5.57\]
Minimum at 5.57

Rule 6. \((f/g)' = \frac{f'g - fg'}{g^2}\)

\[
\left(\frac{f}{g}\right)' = \left(f \cdot \frac{1}{g}\right)' = f' \cdot \frac{1}{g} + f \cdot \frac{-g'}{g^2} = \frac{f'g - fg'}{g^2}
\]

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

Find the derivative of

\[
\frac{x^2 - 1}{x + 1}
\]

\[
\left(\frac{x^2 - 1}{x + 1}\right)' = \frac{(2x)(x+1)-(x^2 - 1)(1)}{(x+1)^2} = \frac{2x^2 + 2x - x^2 + 1}{(x+1)^2} = \frac{x^2 + 2x + 1}{(x+1)^2} = 1
\]

since \(\frac{(x+1)(x-1)}{(x+1)} = x - 1\)

Michalis-Menten Kinetics (42 on p.235)

The growth rate of a population in the presence of a quantity \(x\) of food is

\[
f(x) = \frac{Kx}{A + x}
\]

Find \(f'(x)\)
\[(f/g)' = (f'g - fg') / g^2\]

\[
\left( \frac{Kx}{A + x} \right)' = \frac{K(A + x) - (Kx)(1)}{(A + x)^2} = \frac{KA}{(A + x)^2} > 0
\]

so the function is increasing

\[f(x) = 5x/(2+x) \quad f'(x) = 10/(2+x)^2\]

Find the derivative of

\[8x + 6 \quad \sqrt{x}\]

\[f(x) = \frac{8x + 6}{x^{1/2}} = 8x^{1/2} + 6x^{-1/2}\]

\[f'(x) = 8(1/2)x^{-1/2} + 6(-1/2)x^{-3/2} = 4x^{-1/2} - 3x^{-3/2}\]