This homework is due at lab next week, on Tuesday, February 25.

There is a quiz in class on Wednesday, February 26.

1. Prove that $\dfrac{d}{dx}\sqrt{f(x)} = \dfrac{f'(x)}{2\sqrt{f(x)}}$, using the definition of derivative. (This will, of course, be true only where $f(x) > 0$ and $f'(x)$ exists.) That is, let $h(x) = \sqrt{f(x)}$ and, assuming $f(a) > 0$ and $f'(a)$ exists, compute that $h'(a) = \dfrac{f'(x)}{2\sqrt{f(a)}}$, using the definition of $h'(a)$.

2. Compute each of the following derivatives. Show your work as a sequence of equalities where you apply individual differentiation rules in each step. In addition to the rules in Section 3.1, you can use the formula from problem 1 for $\frac{d}{dx}\sqrt{f(x)}$. Once you have found the derivative, you do not have to simplify your answer further.

a) $2x^5 - 7x^3 + x$ **b)** $\sqrt{5x^2+1}$ **c)** $(5x+1)\sqrt{x^4+3}$

d) $\dfrac{x^2-2x}{x^3-3}$ **e)** $6x^3 - \dfrac{\sqrt{x}}{2x+1}$

3. Although we have not yet covered derivatives of trigonometric functions, it is true that $\frac{d}{dx}\sin(x) = \cos(x)$ and $\frac{d}{dx}\cos(x) = -\sin(x)$. Let $f(x) = x^2\sin(x)\cos(x)$. Use the product rule **twice** to find the formula for $f'(x)$.

4. Assuming that $f(2) = 3$, $f'(2) = 7$, $g(2) = 4$ and $g'(2) = 5$, find $h'(2)$ for each of the following definitions of a function $h(x)$. Note that you are being asked to find the numerical value of $h'(2)$, not just a formula for $h'(x)$. But you will want to begin by finding a formula, using the rules for differentiation. Show your work!

a) $h(x) = f(x) + 2g(x)$ **b)** $h(x) = f(x)g(x)$ **c)** $h(x) = x^3 f(x)$ **d)** $h(x) = \dfrac{xf(x)}{g(x)}$

5. A point moves along a line, and its position at time t is given by $s(t) = \frac{3}{2}x^4 - 3x^2 + 2x + 5$. Find a formula for its velocity, $v(t)$, at time t and for its acceleration, $a(t)$, at time t. (Yes, this is trivial—it's just to remind you that the rules for differentiation can be used to find velocity and acceleration.)