Reading Stewart §2.3 and 2.4.

1. Differentiate the following functions, and simplify your answers. You may (and should) use the differentiation rules. Remember that sometimes you may want to rewrite the function a bit before you start differentiating, to make your life easier.

   a) $f(x) = \pi^2$ b) $F(t) = t^5 - 7t^3 - 4t$ c) $g(x) = x^3(1 - 4x^2)$

   d) $h(x) = x^{5/3} - x^{3/5}$ e) $M(x) = \dfrac{x^2 - 3x + 7}{\sqrt{x}}$ f) $G(w) = \sqrt{2w} + \dfrac{\sqrt{2}}{w}$

2. Differentiate the following functions by any legal method. Simplify your answers.

   a) $f(x) = \dfrac{x^3 + 4x + 2}{x^2 - 3}$ b) $F(y) = \left(\dfrac{1}{y^2} - \dfrac{5}{y^3}\right)(5y + y^2)$

   c) $g(v) = \dfrac{v^3 - v\sqrt{v} + 1}{2v}$ d) $h(v) = \dfrac{2v}{v^3 - v\sqrt{v} + 1}$

3. Find (and simplify) an equation for the tangent line to the curve $y = \dfrac{3x}{x+2}$ at the point where $x = 1$.

4. Find the first and second derivatives of the function $f(x) = 3x^4 - \sqrt{x} + \dfrac{5}{x^3}$. Simplify your answers.

5. A particle is moving in a straight line with position s (in meters) at time t (in hours) given by the formula $s(t) = t^4 - 3t^2 + 4t + 1$. Find both the particle's velocity and its acceleration at time $t = 2$. (Don't forget to use the correct units in your answers!)

6. Let $f(x)$ and $g(x)$ be differentiable functions such that

$$f(5) = 2, \qquad f'(5) = 4,$$
$$g(5) = -3, \qquad g'(5) = 3.$$

   a) Let $h(x) = f(x)g(x)$. Find $h'(5)$.

   b) Let $k(x) = \dfrac{f(x)}{g(x)}$. Find $k'(5)$.

7. Find all points on the curve $y = 2x^3 + 3x^2 - 12x + 5$ where the tangent line is horizontal.

8. **This problem has been removed from this assignment. It will be on an assignment next week instead.**

   ~~Differentiate the following functions by any legal method. Simplify your answers.~~

   a) ~~$f(x) = x \sin x + 3 \cot x$~~ b) ~~$g(\theta) = \sec\theta \tan\theta$~~ c) ~~$h(t) =$~~ $\dfrac{\cos t}{1 - \sin t}$