25 September 2014 **Derivatives**

(1) Differentiate the following functions.

(a) $f(x) = 6x^5 - 10x^4 + \frac{1}{2}x^2 - \frac{9x}{5} + 2$

(b) $g(x) = 1/x$ (hint: write it as x^{-1})

(c) $h(x) = \dfrac{x^2 - x + 2}{\sqrt{x}}$

(d) $p(t) = (2t - 3)^2$

(e) $r(t) = \dfrac{t - \sqrt{t}}{t^{1/3}}$

(2) Find an equation of the tangent line to the curve $y = \sqrt[4]{x}$ at the point $(1, 1)$.

(3) For what values of x does the graph of $f(x) = 3x^2 - x^3$ have a horizontal tangent line?

(4) Find equations of **both** lines that are tangent to the curve $y = 1 + x^3$ and parallel to the line $12x - y = 1$.

(5) Evaluate $\lim_{x \to 1} \dfrac{x^{1000} - 1}{x - 1}$. (hint: this is a worksheet about derivatives).

(6) Suppose that $y = ax^2 + bx$ has tangent line $y = 3x - 2$ at $x = 1$. Find a and b.

(7) Let $f(x) = a^x$ for some $a > 1$.

(a) Write $f'(0)$ as a limit (you will not be able to simplify very far).

(b) Show that $f'(x) = f'(0) \cdot a^x$.

(c) Wouldn't it be nice if there were a choice of a for which $f'(0) = 1$?