Math 11- Optional Review Homework For Exam 2

1. Compute the derivative for each of the following functions:

   (a) $f(x) = \dfrac{x^3 + \dfrac{1}{x^8}}{x^2}$

   (b) $f(x) = \sin^2\left(3x - \dfrac{1}{x^2}\right)$

   (c) $f(x) = x^2 \tan(3x - \sin x)$

   (d) $f(x) = \dfrac{x^3 + (x^5 + 3x)^7}{\sqrt{x^2 - 7x}}$

   (e) $f(x) = \dfrac{1}{\cos\left(\dfrac{1}{x} - \dfrac{1}{x^7} + x\right)}$

   (f) $h(x) = \sqrt{\sqrt{x} + \cos(x^2 + \sqrt{x})}$

   (g) $g(y) = y^2 \cos\sqrt{y}$

   (h) $f(t) = (3t - 1)^7(4t + 3)^9$

   (i) $w(x) = \left(x + \sqrt{x^4 + 1}\right)^5$

   (j) $f(x) = \sqrt{x}(x^2 + 3x - 2009)$

   (k) $f(x) = \dfrac{\sqrt{\sin(3x^2 + 17x)}}{\cos^3(4x)}$

   (l) $f(x) = \sqrt{\sin(\cos(3x^2 + 17x)}$

   (m) $f(x) = \cos^3\left(\dfrac{3 - \dfrac{8}{x^2}}{x^2 + 9}\right)$

2. Compute y' where $xy + y^3 = 4x^2\cos(x^2)$.

3. Evaluate each of the following limits:

   (a) $\lim\limits_{x \to 0} \dfrac{\sin(6x)}{8x} =$

   (b) $\lim\limits_{x \to 0} \dfrac{\sin(6x)}{\cos x + x} =$

   (c) $\lim\limits_{x \to 0} \dfrac{3x - 8x^2}{\sin(4x)} =$

   (d) $\lim\limits_{x \to \infty} \dfrac{3x - 8x^2}{7x^2 + 5x - 9}$

   (e) $\lim\limits_{x \to \infty} \dfrac{9x^{18} + 7x^3 - 2010}{6x^{31} + 2x^7 + 5}$

   (f) $\lim\limits_{x \to \infty} \dfrac{x^{12} + x^4 - 2010}{6x^9 + x^2}$

4. Consider the function $f(x) = \dfrac{1}{x^2 - 4}$. Discuss domain, intervals of increase or decrease, local extreme value(s), concavity, inflection point(s), and any horizontal and vertical asymptotes. Use this information to give a detailed and labelled sketch of the curve.

5. Consider the function $f(x) = x^2(x-1)^2$. Discuss domain, intervals of increase or decrease, local extreme value(s), concavity, inflection point(s), and any horizontal and vertical asymptotes. Use this information to give a detailed and labelled sketch of the curve.

6. A conical water tank (point facing down) with radius of 3 meters at the top and height of 8 meters is leaking water. At the moment when the water is 2 meters from the top of the tank water is leaking at a rate of 1 cubic meter per minute. How fast is the water level decreasing at that moment?