MATH 141 Sample Exam 2

Question 1 Find the equation of the tangent line to the curve defined by $x^2y + x\sin(x-y) = \pi/2$ at the point $(\frac{\pi}{2}, 0)$.

Question 2 Compute the derivatives of the following functions (do not simplify):
a) $f(x) = 4x^3 - \sqrt[3]{x - x^4}$
b) $f(x) = \dfrac{1-x}{1+\tan x}$
c) $f(x) = x^2\cos^5(2x)$
d) $f(x) = \cos(\sin(2x^2 - 9x + 13))$

Question 3 Show that the function $f(x) = x + \dfrac{1}{x}$ satisfies the hypotheses of the Mean Value Theorem on the interval $[1, 2]$, and find all numbers $c \in (1, 2)$ that satisfy the conclusion of that theorem.

Question 4 Water is flowing at a rate of 50 ft^3/min from a shallow concrete conical reservoir of base radius 45 feet and height 6 feet. How fast is the water level falling when the water is 5 feet deep? How fast is the radius of the water's surface changing then?

Question 5 A rocket is launched whose height at time t is $\sqrt{10t + 100}$ kilometers. A spectator standing 5 kilometers away observes the rocket's launch. How fast is the angle of inclination from the spectator's eye to the rocket changing 2 minutes after launch.

Question 6 Let $f(x) = 3x^4 - 4x^3 - 12x^2 + 5$. Sketch the graph of this function on the axes below indicating the y–intercept (x–intercepts are too hard to compute), all critical points, relative or absolute extrema, and the intervals on which $f(x)$ is increasing and decreasing, concave up and down and any inflection points.

Question 7 Do the same thing as in previous problem for the function $f(x) = 5x^{2/5} - 2x$.

Question 8 Do the same thing as in previous problem for the function $f(x) = \dfrac{x}{x^2 - 9}$. Include asymptotes.