Math 116 Practice Exam 1

1) Find the first derivative for the following functions.

    a) (2 points) $f(x) = e^{\tan(x)}, \ -\pi/2 < x < \pi/2$

    b) (2 points) $h(x) = \arctan(\cos(x))$

    c) (2 points) $g(x) = x^5 \log_2(x^4), \ x \neq 0$

2) (10 points) Solve the following non-calculus problem.

The half-life of the isotope polonium-210 is approximately 138 days. Irene Joliot-Curie (joint winner of the Nobel prize in 1935) came in contact with this isotope after a sealed container containing the element exploded in her laboratory. She died 10 years later of leukemia. A (single) lethal dose of polonium is estimated to be .089 micrograms. Supposing one comes into contact with this amount, how much polonium will remain in one's body after 10 years? Recall that all exponential decay formulas express time in years.

3) Evaluate the following indefinite integrals.

a) (8 points) $\int \dfrac{\sec^2(x)}{1 + \tan(x)} \, dx$

b) (10 points) $\int 5x^3 \cdot e^{-7x} \, dx$

4) Compute the following limits.

a) (6 points) $\lim\limits_{x \to 0} \dfrac{\cos(x) - x - 1}{\sin(7x)}$

b) (8 points) $\lim\limits_{x \to 1^-} ((x - 1)\sec(\pi x/2))$

c) (10 points) $\lim\limits_{x \to \infty} \left(\dfrac{x^2 + 4}{x^2}\right)^{x^2}$

5) Evaluate the following definite integrals.

a) (4 points) $\displaystyle\int_0^{\pi/6} \sin^2(x)\sin(2x)\ dx$

b) (5 points) $\displaystyle\int_1^2 x^5 \arctan(x^3)\ dx$