Math 261 - Lab 18 **Newton's Method and Antidifferentiation** **Name:** _____

Show all work for credit.

1. Approximate a real root of the following function using Newton's method. Give your answer to six decimal places. Show your work, including your initial guess and all intermediate results.

   $f(x) = 8x^3 - 9x^2 + 12x - 15$

2. Consider $\sqrt{21}$.

   (a) What function would you choose if you wanted to use Newton's method to approximate $\sqrt{21}$?

   (b) Approximate $\sqrt{21}$ using this function. Show your work, including your initial guess and all intermediate results.

3. What single function would you use to approximate $\sqrt{21} + \sqrt{37}$ using Newton's method?

4. Find a general antiderivative $F(x)$ for each of the following functions.

(a) $f(x) = 3x^2 + 2x + 1$

(b) $f(x) = 5 \sin x$

(c) $f(x) = \sin(5x)$

(d) $f(x) = \tan^2(x)$

5. Evaluate each of the following integrals.

(a) $\displaystyle\int \left(\frac{3}{t^3} + 2t + 1\right) dt$

(b) $\displaystyle\int \frac{x^2 - 2x + 5}{\sqrt{x}} dx$

(c) $\displaystyle\int (2x + 3)^2 dx$

(d) $\displaystyle\int \frac{1}{\sin^2 y} dy$

(e) $\displaystyle\frac{d}{dx} \int (x^2 + 4)^5 dx$

(f) $\displaystyle\int \frac{d}{dx} \left(\tan(x^2 + 7)\right) dx$

(g) $\displaystyle\int k^3 dx =$

(h) $\displaystyle\int k^3 dk =$

6. Solve the differential equation subject to the given conditions.

   (a) $f'(x) = x^2 + x;\ f(0) = 4$

   (b) $\dfrac{dy}{dx} = \dfrac{1}{\sqrt{3x+1}};\ y = 2$ when $x = 1$

7. Jill throws a rock straight upward from ground level alongside a tree. The rock rises until it is even with the top of the tree then falls back to the ground. It remains aloft for 4 seconds. How tall is the tree? (Gravity produces a constant acceleration of 32 ft/sec^2.)