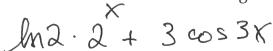## MAT3-121 Calculus of a Single Variable
Quiz 3 November 9, 2016

solution

name

1. (2 pts.) Give the derivative of the following function: $2^x + \sin 3x$

$$\ln 2 \cdot 2^x + 3 \cos 3x$$

2. (2 pts.) Give an anti-derivative of the following functions:

   a. $\cos x$

   $\sin x$

   b. e^x

   e^x

3. (4 pts.) a. Suppose you are on a small planet which has a constant gravitational force of -5 m/s² and no air. Give the differential equation that governs the vertical position of falling objects (ignore friction). Do not solve.

   $$h''(t) = -5$$

b. A fruit fly colony grows at the instantaneous rate of 10% per day—that is at a rate proportional to the population itself (with k = .1). Suppose the initial fruit fly population is 1000 flies. Set up the Initial Value Problem that models this physical system. Do not solve.

$$P'(t) = .1 \cdot P(t) \qquad P(0) = 1000$$

4. (2 pts.) Give the derivative of $f(x) = \sqrt{x} \ln(x)$

$$\frac{1}{2\sqrt{x}} \ln x + \sqrt{x} \cdot \frac{1}{x}$$

5. (2 pts.) Use the quotient rule to derive the derivative of $\tan(x)$.

$$\tan x = \frac{\sin x}{\cos x} \qquad \left(\frac{\sin x}{\cos x}\right)' = \frac{\cos x \cdot \cos x - \sin x(-\sin x)}{(\cos x)^2}$$

$$= \frac{1}{(\cos x)^2} = (\sec x)^2$$