Name: —————————————————————————   —————— / 30

There are 30 points possible on this quiz. No aids (book, calculator, etc.) are permitted. Show all work for full credit.

1. **[15 points]** Compute the derivatives of the following functions. Simplify your answers.

   a. $f(r) = \dfrac{3}{r^5}$

   b. $f(x) = -\dfrac{1}{\sqrt{x}} + 2 + e^x$

   c. $f(x) = \dfrac{\sqrt{x} + 5}{x^2}$. Hint: Don't bother with the quotient rule.

   d. $f(x) = x^{\frac{1}{2}} e^x$

   e. $f(x) = \dfrac{x^2 - 1}{x^2 + 1}$

2. [5 points] A population of lynx is declining. The population at time t is

$$P(t) = \frac{800}{2+t}$$

where P is the number of lynx and where t is measured in years.

Compute the rate of change of the lynx population, with units, at time $t = 3$ years.

3. [6 points] A particle is moving along a line, and its position x as a function of time t is

$$x(t) = (t^2 - 2)e^t.$$

a. Compute the velocity of the particle. Simplify your expression.

b. Compute the acceleration of the particle. Simplify your expression.

4. [4 points] Find the formula for the tangent line to the curve $y = x - x^2$ at $x = 3$.