1. (2 Points) Solve $e^{3\ln x} = 8$ for $x$.
   We can put the 3 on top of the $x$, and the $e$ and ln undo each other:
   \[8 = e^{3\ln x} = e^{\ln x^3} = x^3.\]
   we conclude that $x = 8^{1/3} = 2$.

2. (2 Points)
   a. What is the definition of the derivative?
   \[f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}\]
   b. Use the definition of the derivative to find $f'(x)$ where $f(x) = x^2$.
   \[f'(x) = \lim_{h \to 0} \frac{(x+h)^2 - x^2}{h} = \lim_{h \to 0} \frac{2xh + h^2}{h} = \lim_{h \to 0} (2x + h) = 2x.\]

3. (3 Points) Find the equation of the tangent line to the graph of $y = \frac{1}{2}x^2 + \frac{1}{4}$ when $x = -1$. (Note: You may use derivative rules to solve this problem).
   We need a point on the line. When $x = -1$, $y = \frac{1}{2} + 1 = \frac{3}{2}$. The point $(x_1, y_1) = (-1, \frac{3}{2})$ is a point on the tangent line.
   We need the slope, $m$ of the tangent line. To find this, we use the derivative: $y' = x - 2x^{-3}$. When $x = -1$, $m = y' = 1$.
   Plug these values into point slope form: $y - y_1 = m(x - x_1)$. We get $y - \frac{3}{2} = x + 1$.

4. (3 Points) Wisconsin’s quarterback Tyler Donovan throws a longball to receiver Luke Swan. Suppose the vertical height $y$ (feet) of the ball can be modeled with
   \[y(t) = -4t^2 + 16t + 5\]
   where $t$ is the number of seconds the ball has been in the air. Find the vertical height and speed of the ball at the end of 3 seconds. Is the ball is on its way up or down?
   To find the height of the ball, plug in $t = 3$ to the equation: $y(3) = 17$ feet.
   To find the speed of the ball, we first look at the velocity: $v(t) = y'(t) = -8t + 16$. Plugging in $t = 3$, we find that $y(3) = -8t + 16$. The speed at this time speed $= |v(3)| = 8$ feet per second.
   The ball is on its way down because the velocity is negative.