1. [24 marks] No need to simplify your final answer in these questions.
   a) [6 marks] Compute the derivative $f'(x)$ for
   \[ f(x) = \sin(e^x + 1) + 5 \]
   
   b) [6 marks] Compute the derivative $f'(x)$ for
   \[ f(x) = x^2 e^{1/x^2} \]
   
   c) [6 marks] Compute the derivative $f'(x)$ for
   \[ f(x) = \ln(x \sin(x^2)) \]
   
   d) [6 marks] We are given $g(5) = 2$ and $g'(5) = 3$. Compute $f'(5)$ where
   \[ f(x) = \frac{x}{(g(x))^2} \]
2. [15 marks] Provide an estimate for $f(4.5)$ (as a fraction) using linear approximations where

$$f(x) = \sqrt{x} + 2$$

and you are given that $f(4) = 2$. 
3. [15 marks] Consider the Newton-Raphson method applied to $x^2 - x - 1$. Start with $x_0 = 1$ and compute $x_1, x_2$. Report $x_2$ as a fraction and compute $f(x_0), f(x_1), f(x_2)$. 
4. [15 marks] Consider the curve given by the equation

\[ x^2 y - 3y^2 = 1 \]

Compute the tangent line to the curve at the point \( x = 2, y = 1 \). The tangent line will have integer slope and intercept.
5. [15] A firm that produces calculus solution books has found that demand of $q$ books occurs with a price level of $p = 610 - 2q^2$.

a) [2] What are the ranges on $p$ and $q$ that would be imposed?

b) [5] Assuming the cost of production is $500 + 10q$, give the profit as a function of $q$.

c) [8] For what value of $q$ is the rate of change of the profit function (with respect to $q$) equal to zero.
6. [16] A 5m ladder is leaning up against a vertical wall with the ladder’s base 3m from the wall. The ladder’s base is slipping away from the wall at a rate of 3 m/minute. 
   a) [10] At what speed is the top of the ladder slipping down the wall.

   b) [6] At what rate (units of radians per minute) is the angle that the ladder makes with the wall increasing?