These questions and topics represent a sample of the mathematical skills expected for this course. However, this exam will not factor into your final grade and there is no minimum score required to remain in this class.

1 Algebra

Let \( f(x) = 5 - 2x \) and \( g(x) = 1 + \frac{x}{4} \)

1. At what value of \( x \) does \( f(x) \) equal 0?

2. At what value of \( x \) does \( g(x) \) equal 11?

3. Is it possible to express \( x \) as a function of \( g \)? Why or why not? If so, do it.

4. Characterize the intersection of \( f(x) \) and \( g(x) \).

2 Differentiation

1. Let \( f(x) \) be a differentiable function. Express the derivative of this function as a limit.

2. Find the derivatives of the following functions. (i.e. new function of \( x \)).
   
   (a) \( f(x) = 5 - 2x \).
   (b) \( f(x) = x^2 - 3x \)
   (c) \( f(x) = e^x \)
   (d) \( f(x) = \log x \)

3. \( f(x) \) is twice differentiable on \((a, c)\). Let \( a < b < c \). Suppose that \( f(b) > f(x) \) for all \( x \in (a, c) \setminus b \). What can you say about \( f'(x) \)? What can you say about \( f''(x) \)?
3 Logs and Exponents

Note \( \log x \) indicates the \textit{natural log} unless otherwise specified. \( e \) indicates the the number \( e \) (i.e. 2.71...), the base of the natural log.

1. Solve for \( x \).
   (a) \( y = e^x \)
   (b) \( y = a^x \)
   (c) \( y = b a^x \)
   (d) \( y = b x^a \)
   (e) \( y = \log(kx) \)

4 Probability

1. Suppose that the W&L lacrosse team plays its first game tomorrow. Let \( p \) be the probability that it will rain tomorrow. Let \( q_r \) be the probability that W&L will win if it rains. Let \( q_n \) be the probability that W&L will win if it does not rain. Assume that W&L will either win or lose - no ties or canceled games.

   (a) If \( p = 0 \), what is the probability that W&L will win tomorrow?
   (b) What is the probability that W&L will win \textit{and} it will rain?
   (c) What is the unconditional probability that W&L will win tomorrow? (HINT: It may help to make a 2x2 table of all possible outcomes and their joint probabilities.)
   (d) How much would you expect to earn \textit{on average} from a lottery that paid out \( y \) when W&L either loses in the rain or wins in dry weather and pays out nothing otherwise?