

Homework 0.
Preliminary Math Exam
(ungraded)

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 *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) $y = ba^x$
 - (d) $y = bx^a$
 - (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 *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 *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?