Please note: some students may know some differential calculus. As a reminder to those students, **you may not take any derivatives** in this assignment. Instead, you must justify your answers some other way.

1. Consider the function $f(x) = |x|$. So $f(x) = x$ if $x \geq 0$ and $f(x) = -x$ if $x < 0$.

a) Suppose $h > 0$. Using the definition of $f(x)$, compute $m(h)$, the slope of the secant line connecting $(0, f(0))$ with $(h, f(h))$. For full credit, you must show your computation; don't just write down an answer.

b) Suppose $h < 0$. Using the definition of $f(x)$, compute $m(h)$, the slope of the secant line connecting $(0, f(0))$ with $(h, f(h))$. For full credit, you must show your computation.

c) Graph the function $m(h)$ for $-2 \leq h \leq 2$, omitting, of course, $h = 0$.

d) What is $\lim_{h \to 0} m(h)$?

e) What is the slope of the tangent line to $y = f(x)$ at $x = 0$?

f) Graph the function $f(x)$ for $-2 \leq x \leq 2$ and explain why your answer to part e) is reasonable.

2. [This problem will be due next week] Ice is growing over a pond. The thickness of the ice is given by $D(t) = \sqrt{t}$ where D is measured in centimeters and $t \geq 0$ is measured in days.

a) What is the average rate of change of the ice thickness over the time interval $t \in [1, 1+h]$? What are the units of your answer?

b) Write the value of the instantaneous rate of change of the ice thickness at time $t = 1$ as a limit involving your answer to part a).

c) Compute the value of the limit to exactly compute the instantaneous rate of change at time $t = 1$.

d) Repeat the previous steps for time $t = 0$ rather than time $t = 1$.

e) Sketch the curve $D(t) = \sqrt{t}$ and explain why your answer to part d) is reasonable.