Math 173A Discussion 1

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October 2, 2019

1. Let $f : \mathbb{R}^+ \to \mathbb{R}$ be defined by $f(x) = -\sqrt{x}$.

   (a) With the definition, show convexity.

   (b) Refer back to Homework 1, Problem 2c, which gives a concave function. How does this given function relate to the one of Problem 2c?

   (c) State and prove a statement relating the concavity and convexity of a function f with $-f$.
   Hint: It's exactly what you think it should be!

2. Let $S = \{\vec{x} \in \mathbb{R}^3 : max\{x_1, x_2, x_3\} - min\{x_1, x_2, x_3\} \leq 1\}$. Determine whether or not this set is convex, and justify your answer.

   Hint: It might be helpful to prove $max\{x_1 + y_1, x_2 + y_2, x_3 + y_3\} \leq max\{x_1, x_2, x_3\} + max\{y_1, y_2, y_3\}$. State and prove an analogous statement for min, and use these in your proof.