

**MAE 501 HOMEWORK-4 DUE AT THE BEGINNING OF CLASS ON THURSDAY,
SEPTEMBER 29**

One goal for this course is for you to develop your skill in effectively communicating mathematics. With this in mind, you should clearly write up your solutions.

- (1) (a) For each statement below, determine whether it is true or false for all $x \in \mathbb{R}$
(b) Explain your responses.
 - (i) $\sin^{-1}(\sin x) = x$.
 - (ii) $\sin(\sin^{-1}(x)) = x$.
- (2) There was a problem on the Regents exam asking you to sketch the graph of a cosine function satisfying several properties.
 - (a) Sketch one period of this cosine function, with clearly labeled axes.
 - (b) Write an equation for this cosine function.
- (3) Let $f : A \rightarrow B$ and $g : B \rightarrow C$ denote bijective functions. Either prove that $g \circ f$ is bijective or give a counterexample.
- (4) Find an example of functions $f : A \rightarrow B$ and $g : B \rightarrow C$ for which both f and $g \circ f$ are injective, but for which g is not injective.
- (5) We talked in class about trigonometric functions and inverse trigonometric functions and about a logarithmic function and an exponential function. Think more about the high school curriculum. Discuss some other context in which injectivity or inverse functions arise in the high school curriculum. What mathematical challenges come up in your context?
- (6) Write a problem or question, involving injectivity or invertibility, using high school mathematical ideas, that you think might be challenging for your peers to solve or to answer.