

**MAE 301/501 HOMEWORK-2 DUE AT THE BEGINNING OF CLASS ON
THURSDAY, SEPTEMBER 22**

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. Solutions with little or no justification will receive little or no credit.

- (1) Use the Pythagorean theorem to prove the law of cosines.
- (2) Find the perimeter of triangle XYZ from the "median" problem on the Regents exam.
- (3) Give an example of a function $g : \mathbb{Z} \rightarrow \mathbb{Z}$ that is surjective and not injective. Prove that it is surjective and not injective.
- (4) Can the graph of a rational function cross a horizontal asymptote infinitely many times? Either give an example or prove that this is not possible.
- (5) Write an equation for a rational function g , that is not a polynomial, that satisfies all of the following:
 - $\lim_{x \rightarrow -\infty} g(x) = -\infty$.
 - $\lim_{x \rightarrow \infty} g(x) = \infty$.
 - The function g has no asymptotes.
- (6) For each item below, write an equation for a rational function that meets the given criteria. Sketch the graph of each function on labelled coordinate axes.
 - (a) $\lim_{x \rightarrow \infty} f(x) = 0$ and the range of $f(x)$ includes only positive numbers.
 - (b) $\lim_{x \rightarrow 5^+} h(x) = \infty$ and $\lim_{x \rightarrow 5^-} h(x) = \infty$.
 - (c) The graph of the rational function has at least three disjoint components.