DISCRETE MATH
QUIZ 10

Name:_____

You have 10 minutes for this exam. If you have a question, raise your hand and remain seated. In order to receive full credit your answer must be **complete**, **legible** and **correct**.

1. Give two functions $f, g\colon \mathbb{R} \to \mathbb{R}$ such that $\operatorname{im}(f) = \operatorname{im}(g)$ and $\ker(f) = \ker(g)$, but $f \neq g$.

Some correct answers are:

(1) $f(x) = x$, $g(x) = -x$,
(2) $f(x) = x$, $g(x) = x + 1$,
(3) $f(x) = |x|$, $g(x) = x^2$, or
(4) $f(x) = x^2$, $g(x) = x^4$.

2. Without using a calculator, show that $33333^2+33334^2+33335^2+33336^2+33337^2$ is divisible by 3.

A number x is divisible by 3 iff $x \equiv 0 \pmod 3$, so we calculate

$$\begin{aligned} 33333^2 + 33334^2 + 33335^2 + 33336^2 + 33337^2 &\equiv 0^2 + 1^2 + 2^2 + 0^2 + 1^2 && \pmod 3 \\ &\equiv 0 + 1 + 1 + 0 + 1 && \pmod 3 \\ &\equiv 3 && \pmod 3 \\ &\equiv 0 && \pmod 3 \end{aligned}$$