Name: _____

Entry number: _____

There are 2 questions for a total of 10 points.

1. (5 points) <u>Prove or disprove</u>: Let $f : \mathbb{Z}^+ \to \mathbb{R}^+$ and $g : \mathbb{Z}^+ \to \mathbb{R}^+$ be any functions such that:

   1. $f(n)$ is $O(g(n))$, and
   2. p and q are functions mapping $\mathbb{Z}^+$ to $\mathbb{R}^+$ where $p(n) = \log f(n)$ and $q(n) = \log g(n)$.

   Then $p(n)$ is $O(q(n))$.

2. (5 points) Consider the following problem:

> SAME-BEHAVIOUR: Given descriptions $\langle A \rangle, \langle B \rangle$ of algorithms A and B respectively, determine if the behaviour of algorithms A and B are the same on all inputs.

(*Algorithms A and B are said to have the same behaviour on input x, if either they both halt (exclusive-)or both do not halt.*)

An algorithm P is said to solve the above problem if $P(\langle A \rangle, \langle B \rangle)$ halts and outputs 1 when A and B have the same behaviour on all inputs, and it halts and outputs 0 otherwise.

<u>Prove</u>: There does not exist an algorithm P that solves the problem SAME-BEHAVIOUR.