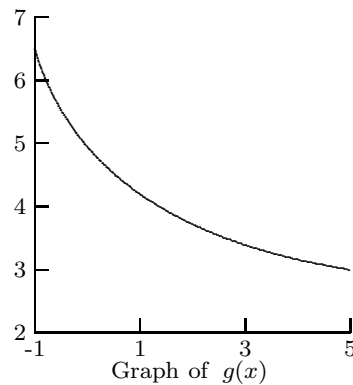
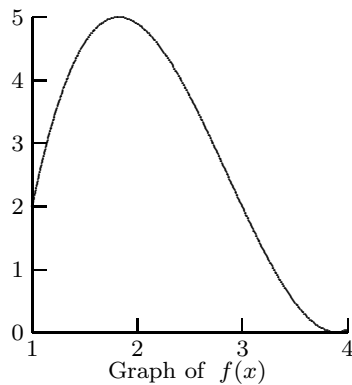


7. Let $f(x) = x^2 + 2$ and $g(x) = 3x - 1$ be functions from the real numbers to the real numbers.

- (a) Find the equation for $f(g(x))$ and $g(f(x))$. You need not simplify your answer.
- (b) Is $f(x)$ onto? Is $f(x)$ one-to-one? Explain your answer.
- (c) Is $g(x)$ onto? Is $g(x)$ one-to-one? Explain your answer.

8. Consider the graphs of the functions $f(x)$ and $g(x)$ below.

- (a) Based on the graphs, what appear to be the domain, codomain, and range of $f(x)$ and $g(x)$.
- (b) Is $f(x)$ onto?, one-to-one?, a correspondence?
- (c) Is $g(x)$ onto?, one-to-one?, a correspondence?



Math 120: Discrete Mathematics
First Hour Exam
23 February 1998

Solve all of the following problems. You must show all your work to receive full credit for your solution. Please be concise in your answers. Write clearly and neatly. NO answers should be written on this question sheet.

- Twelve books are on a shelf in the library.
 - How many different ways can you select three of them to take with you on vacation?
 - How many different ways can you arrange four of the books on one shelf and the remaining eight on another?
- In how many ways can you select a committee of five persons from ten eligible individuals?
 - How does this number change if two of the individuals insist on serving together or not at all?
- If n an integer, explain why n^2 is congruent to either 0 or 1 modulo 4.
- In arithmetic modulo 5, what is $58 \cdot 19$?
 - If $x \equiv 3 \pmod{5}$ and $y \equiv 4 \pmod{5}$, to what are $x + y$ and xy congruent modulo 5?
 - Solve $3x \equiv 4 \pmod{5}$ for x .

5. For the relation

$$x \sim y \text{ if } xy > 0$$

on the set of non-zero integers, determine which of the properties of an equivalence relation hold. If \sim is an equivalence relation, determine the equivalence classes.

6. Show that for the natural number n ,

$$(1 \cdot 2) + (2 \cdot 3) + (3 \cdot 4) + \cdots + n(n + 1) = \frac{n(n + 1)(n + 2)}{3}.$$