

## Homework 2-1: Function operations and composition

*Answer on loose leaf paper using proper notation.*

### Function substitution

1. Step by step: Given  $f(x) = 3x + 2$ . What is  $f(2x - 1)$ ?
  - (a) Perform the substitution, putting  $2x - 1$  in parenthesis.
  - (b) Simplify, beginning each line with a leading equals sign if it is equal to the line above.
2. Given  $f(x) = x^2 - 1$ . Simplify  $f(2x - 1)$ ?
3. Given  $f(x) = x^3$ . Simplify  $f(x + 1)$ ?
4. Given  $f(x) = 4 - (2x^2 + x)$ . Simplify  $f(\frac{1}{2}x - 3)$ ?

### Function composition

5. Step by step: Given  $f(x) = x^2 + 2$  and  $g(x) = x^2$  What is  $(f \circ g)(x)$ ?
  - (a) Rewrite  $f \circ g$  and perform the inner substitution (i.e. for  $g$ ):  $f(g(x)) = f(x^2)$
  - (b) Perform the substitution, putting  $x^2$  in parenthesis (and using a leading equals sign).
  - (c) Simplify, beginning each line with a leading equals sign.

In the following exercises, perform the composition  $f \circ g$  and simplify.

6. Given  $f(x) = \frac{1}{2}x^2 + 1$  and  $g(x) = 2x$
7. Given  $f(x) = \sqrt{x - 4}$  and  $g(x) = x^2 + 4$
8. Given  $f(x) = \frac{1 - x}{x^2} + 1$  and  $g(x) = 2x + 3$

### Function operations practice

9. Given  $f(x) = \frac{1}{2}x^2 - 2$  and  $g(x) = x + 2$ 
  - (a) Find  $f + g$
  - (b) Find  $f \times g$
  - (c) Find  $f \div g$

**Homework 2.2: The inverse of a function**

1. Given  $f(x) = 3x + 2$ . What is the inverse of the function  $f^{-1}(x)$ ?

(a) Rewrite the function reversing  $x$  and  $y$ . (assume that  $y$  and  $f(x)$  are interchangeable)

(b) Solve for  $x$ . Finish by putting  $y$  on the left side of the equality.

(c) State the answer as  $f^{-1}(x)$  equals an expression.

Derive the inverse of each function. Simplify the expression.

2.  $f(x) = \frac{1}{2}x + 2$

3.  $f(x) = \frac{2}{3}x^2 - 3$

4.  $f(x) = \sqrt{x-1} + \frac{1}{2}$