- Work on these problems in your assigned group, but each person will turn in their own solutions.

- These problems are meant to promote **active learning.** Some of the material has been covered in class, while some will help you learn new material.

- Margaret and I will be available to help you with the problems. You should also ask your group members questions, and share your ideas with each other.

- Focus on **understanding** the solution each problem, and on being able to **explain** them to each other.

1. Let $g(x) = \dfrac{\dfrac{x}{x-1} - \dfrac{x+2}{x}}{x-2}$. Simplify $g(x)$.

2. Given two functions f and g. The **composition** of f and g is defined by

$$f \circ g(x) = f(g(x))$$

   (a) Discuss what the domain of $f \circ g$ is.

   (b) Take $f(x) = \sqrt{x+4}$ and $g(x) = x+2$. Compute **and** graph both $f \circ g$ and $g \circ f$. Discuss whether or not $f \circ g$ equals $g \circ f$. (Hint: what does it mean for two functions to be equal?)

3. Let $f(x) = \dfrac{x+1}{x-1}$. Compute $f(f(2))$. Compute and simplify $f(f(x))$. Hint: first find a large formula for $f(f(x))$. Then simplify by finding common denominators.

4. Let $f(x) = \dfrac{1}{x+1}$. Compute and simplify $\dfrac{f(x+h) - f(x)}{h}$.
   Warning: $f(x+h) \neq f(x) + h$; **be careful!**

5. Let $f(x) = \dfrac{x-7}{x+3}$. Compute and simplify $\dfrac{f(x+h) - f(x)}{h}$.

6. Simplify each of the following expressions.

   (a) $\dfrac{x^2 + 6x + 8}{x^2 - 4}$

   (b) $\dfrac{x^2 + 6x + 8}{x^2 - 5x - 14}$

   (c) $\dfrac{x^2 - 6x + 8}{x^2 - x - 2}$

(d) $\dfrac{1}{t\sqrt{1+t}} - \dfrac{1}{t}$

(e) $\dfrac{t-1}{g(t^2)-3}$, where $g(t) = 2t + 1$

(f) $\dfrac{x^2 - 13x + 42}{x^2 - 4x + 12}$

(g) $\dfrac{1}{x} - \dfrac{1}{|x|}$ Hint: you might need two cases here. Write out the definition of $|x|$.

(h) $\dfrac{|x+4|}{x+4}$ Hint: you might need two cases here. Write out the definition of $|x+4|$.

(i) Let $f(x) = \dfrac{1}{x}$.   Compute and simplify $\dfrac{f(t-1) - 2f(t)}{t^2 - 4}$

7. Find two functions $f(x)$ and $g(x)$ such that

$$f(g(x)) = \frac{x^3 + 1}{x^3 + 2}.$$

For these two functions, what is $g(f(x))$?

8. Some algebra practice with positive numbers x, y, z:

   (a) Which equation is correct:

   $$\frac{xy + x}{xz} = \frac{y+1}{z} \quad \text{or} \quad \frac{xy + y^2}{xz} = \frac{y + y^2}{z}?$$

   For the one that is correct, explain your reasoning, and for the one that is wrong, explain the error that was made.

   (b) Which equation is correct:

   $$\sqrt{x^2 y^4} = xy^2 \quad \text{or} \quad \sqrt{x^2 + y^4} = x + y^2?$$

   For the one that is correct, explain your reasoning, and for the one that is wrong, explain the error that was made.