Work on as many problems as you can together with your group members. Towards the end of lecture your group will be asked to present a problem correctly to receive classwork points.

1. Find all numbers for which the rational expression is undefined. if the rational expression is defined for all real numbers, state this:

   (a) $\dfrac{13}{x+9}$

   (b) $\dfrac{x-3}{x^2+4x-45}$

   (c) $\dfrac{y+1}{y^2-1}$

   (d) $\dfrac{x-1}{x^2+5x+4}$

2. Simplify the rational expressions. Find all numbers that must be excluded from the domain of the simplified rational expression in order for it to be equivalent to the original expression:

   (a) $\dfrac{2x-12}{x^2-12x+36}$

   (b) $\dfrac{y^2+9y+8}{y^2+y-56}$

   (c) $\dfrac{3x-9}{x^2-6x+9}$

   (d) $\dfrac{x^2-14x+49}{x^2-49}$

3. Perform the indicated operation:

   (a) $\dfrac{x^2-9}{x^2-6x+9}\cdot\dfrac{6x-18}{x+3}$

   (b) $\dfrac{x^2-9x+18}{x^2-5x-6}\cdot\dfrac{x^2-1}{x^2-9}$

   (c) $\dfrac{y^2-1}{y}\div\dfrac{y+1}{y-1}$

   (d) $\dfrac{x^2-64}{8x-8}\div\dfrac{x^2+16x+64}{x^2+7x-8}$

4. Perform the indicated operation:

(a) $\dfrac{7x+2}{6x+7} + \dfrac{5x+12}{6x+7}$

(b) $\dfrac{x^2-2x}{x^2+10x} + \dfrac{x^2+x}{x^2+10x}$

(c) $\dfrac{5}{x-2} + \dfrac{7}{x+3}$

(d) $\dfrac{15}{x^2+10x+25} + \dfrac{5}{x+5}$

(e) $\dfrac{4x}{x^2+2x-24} - \dfrac{3x}{x^2+x-20}$

5. Simplify the following complex rational expressions:

(a) $\dfrac{1+\frac{1}{x}}{3-\frac{1}{x}}$

(b) $\dfrac{\frac{x}{2}-1}{x-2}$

(c) $\dfrac{\frac{3}{x-3}-\frac{4}{x+3}}{\frac{11}{x^2-9}}$

(d) $\dfrac{\frac{6}{x^2+2x-15}-\frac{1}{x-3}}{\frac{1}{x+5}+1}$

6. **Challenge:** Perform the indicated operations. Simplify if possible:

(a) $\left(\dfrac{2x+3}{x+1} \cdot \dfrac{x^2+4x-5}{2x^2+x-3}\right) - \dfrac{2}{x+2}$

(b) $\dfrac{1}{x^2-2x-8} \div \left(\dfrac{1}{x-4} - \dfrac{1}{x+2}\right)$

(c) $\left(2 - \dfrac{6}{x+1}\right)\left(1 + \dfrac{3}{x-2}\right)$

(d) $\left(4 - \dfrac{3}{x+2}\right)\left(1 + \dfrac{5}{x-1}\right)$