You should work on the following problems in groups of 3. Try to get through as many as you can, but you aren't expected to finish everything. Instead, you should make sure everyone in your group knows **how** to solve all the problems, and not just the answers.

1. Decide whether each of the following are polynomials, rational functions, algebraic functions, exponential functions, or none of these.

   (a) $\frac{x^2-1}{x+2}$
   (b) 2^{3x}
   (c) $x^9 - x^2 + 1$
   (d) $\frac{\sqrt{x^2+6x-\sqrt[3]{x}}}{x+\sqrt{x}}$
   (e) $\sqrt{3x^2 - x + 1}$
   (f) $2^x - x^2$

2. Use the given graph of $y = \sqrt{4x^2 - 8x + 4}$ to find an equation for the graph at right

3. The graph of a function $f(x)$ is given at right. Use this to sketch a graph of each of the following functions:

   (a) $f(x-1)$
   (b) $2f(x) + 1$
   (c) $f(2x)$
   (d) $|f(x)|$
   (e) $f(|x|)$

4. The relationship between Farenheit and Celcius is given by the linear function $F = \frac{9}{5}C + 32$

   (a) Sketch the graph of this function
   (b) What is the slope of this graph and what does it represent?
   (c) What is the F-intercept and what does it represent?
   (d) Find an expression for the inverse function. What does it describe?

5. Graph each of the following functions and find their domains and ranges. Note that you do not need calculus to do this:

   (a) $-x^2 + 1$
   (b) $x^2 - 1$
   (c) $(x-1)^2$
   (d) $\sin x - 1$
   (e) $\sin(x-1)$
   (f) $\sqrt{x-3} + 2$

6. Let $f(x) = 1 - 2x, g(x) = \frac{x^2-1}{x}$. Find $f \circ g$ and $g \circ f$ and their domains.

7. Let $f(x) = \sin x, g(x) = x - 1, h(x) = x^2$. Write each of the following functions as a composition of f, g, h. For example, $(x-1)^2$ can be written as $h \circ g$

   (a) $x^2 - 1$
   (b) $\sin(x-1)$
   (c) $\sin^2(x^2 - 1)$
   (d) $\sin((x-1)^2) - 1$
   (e) $x^2 - 2$
   (f) $\sin(x^2 - 2)$

(over)

8. True/False. For those that are true, prove it. For those that are false, explain why or give a counterexample:

   (a) $f(|x|)$ is even for **any** function f

   (b) If $f(x) > 0$ for all x, then f cannot be odd.

   (c) There is a function whose values are all equal to each other

   (d) $\frac{x^2+2x+1}{x+1} = x + 1$

   (e) The domain of $f \circ g$ is the same as the domain of g

   (f) The domain of $f \circ g$ is contained in the domain of g

   (g) The range of $f \circ g$ is the same as the range of f

   (h) The range of $f \circ g$ is contained in the range of f

9. What do you know about the even/oddness $f \circ g$ given the following information about f, g? For those where you know for sure whether it is even or odd, prove it. For those where it could go either way, give examples to demonstrate that fact.

   (a) f is odd, g is even

   (b) f is odd, g is odd

   (c) f is even, g is even

   (d) f is even, g is odd

10. Repeat the above question for the functions $f + g$ and fg

11. Find the flaw in the following "proof" that 0=1:

$$\begin{aligned} x^2 - x^2 &= x^2 - x^2 \\ x(x-x) &= (x+x)(x-x) \\ x &= x + x \\ x &= 2x \\ 0 &= x \end{aligned}$$

    So now we just plug in $x = 1$ to get the desired result.