1. Piecewise Defined Functions

2. You should be familiar with the graphs of some common functions, like lines and parabolas. In this lesson, we will graph functions defined piecewise.

3. (a) Here is an example of a piecewise defined function. It actually looks like three separate functions, but each function is defined only for certain values of x. These pieces are then joined together to form the entire function.
   (b) In this example, part of the function is formed by the line $y = 3 - 2x$,
   (c) part of the function is formed by the parabola $y = x^2$,
   (d) and part of the function is formed by the line $y = 8 - 2x$.
   (e) .
   (f) The line $y = 3 - 2x$ forms the part of the function when the x-values are less than 1, so we don't use the entire line, we only use that portion which lies to the left of 1.
   (g) When x is between 1 and 2, the function $f(x)$ is defined by the parabola $y = x^2$, so in the middle section, we graph the parabola.
   (h) To the right of 2, the function is defined by the line $y = 8 - 2x$.
   (i) We then combine the three pieces to get the entire function.

4. (a) Another example is the absolute value function, which is defined piecewise as follows: If x is positive, then don't do anything, the output is the same positive number as the input. If x is negative, then take the opposite of x, changing the output to a positive number. Let's take a closer look at that last statement, isn't $-x$ a negative number? After all, it has a negative sign. Recall that $x < 0$, in other words x itself is negative. The negative sign is a negative on a negative, a double negative. The double negative makes the entire output positive.
   (b) Let's look at the graph, piecing together parts of two lines.
   (c) If x is negative, we graph the line $y = -x$
   (d) If x is positive, then we graph the line $y = x$.
   (e) These two pieces form the entire function.

5. (a) It is not necessary for the pieces to connect. Here the end of the line is at a y-value of -2,
   (b) but the parabola begins at a y-value of 4.
   (c) .

6. (a) This is not a function. For each value of x, it must be clear which piece should be evaluated, the blue piece or the green piece.
   (b) The domains that determine which function to use should not overlap.

7. To recap: When a function is defined in pieces over distinct domains, graph each piece separately, including only the portion corresponding to the appropriate x-values.