# Math 140 Worksheet 2 — Solution Key
## Week 2 (through Wednesday)

1. For $x \neq 2$, $\dfrac{x^2 - 4}{x - 2} = \dfrac{(x-2)(x+2)}{x-2} = x + 2$, so compute $x + 2$:

   | $x$ | 1.9 | 1.99 | 2.01 | 2.1 | 2.001 |
   |---|---|---|---|---|---|
   | $\frac{x^2-4}{x-2}$ | 3.9 | 3.99 | 4.01 | 4.1 | 4.001 |

   Estimate: the values approach 4, so the limit is 4.

2. Factor:
$$\lim_{x \to 2} \frac{x^2 - 4}{x - 2} = \lim_{x \to 2} \frac{(x-2)(x+2)}{x-2} = \lim_{x \to 2}(x + 2) = 4.$$

3. (a) $\lim\limits_{x \to 1^-} f(x) = \lim\limits_{x \to 1^-}(x + 2) = 3.$
   $\lim\limits_{x \to 1^+} f(x) = \lim\limits_{x \to 1^+}(3 - x) = 2.$

   (b) Since $3 \neq 2$, the two-sided limit $\lim_{x \to 1} f(x)$ does not exist.

4. We need $\lim_{x \to 1} f(x) = 3$ and continuity at $x = 1$. From the left: $\lim_{x \to 1^-}(x^2 + b) = 1^2 + b = 1 + b$. For the limit to equal 3 , we require $b = 2$. From the right: $\lim_{x \to 1^+}(ax + 2) = a + 2$. For the limit to equal 3, we require $a = 1$.