4.1) Combining Functions.
- Use the most restrictive domain (smallest interval)
- Use key points to graph, if not enough kp, then use a table of values.
- Different key points for add, sub, mult, div.
  Look in notes, but easy to reason out.

4.2) Alternatively, algebraically combine them, then use a table of values. Make sure you use brackets when subtracting/dividing/multiplying functions. Always use brackets when substituting to evaluate.

Find combining functions:
- Find easy, but not trivial ones such as \( f(x) = 0 \).
- For multiply, you should factor
- For divide, be careful about domains: i.e. NPV's.
  \( g(x) \) divide by \( g(x) \):
  \[
  \text{if } g(x) = x^2 - 4, \text{ NPV's} \\
  g(x) = x^2 + 4, \text{ no NPV's.}
  \]

4.3) Compositions:
- Generally: \( f(g(x)) \neq g(f(x)) \)
- Another way to determine if functions are inverses of each other: \( f(g(x)) = x \)
  Always use brackets when substituting.

4.4) There are different ways to find composing fns. but questions should be answered by "completing the square".
- \( f(x) = \sqrt{x^2 + 6x + 20} \)
- \( g(x) = \sqrt{x} \)
- \( h(x) = x + 11 \)
- \( j(x) = x^2 \)

\[
\begin{align*}
\text{eq)} & \quad \sqrt{x^2 + 6x + 20} \\
& \quad = \sqrt{(x^2 + 6x + 9) - 9 + 20} \\
& \quad = \sqrt{(x + 3)^2 + 11}
\end{align*}
\]
The other way is to look for patterns of $x$.

\[ g(x) = 2x - 3 \]
\[ f(x) = x^2 + 4x + 3 \]

Determining Domain of Compositing Fns.
- Difficult.
- Working outwards, domains only get smaller, never larger.
- Range of inner becomes domain of outer.
- More reliable way: expand composition, then determine the domain.

\[ f(x) = \sqrt{x - 8} \]
\[ g(x) = x^2 + 4 \]
\[ h(x) = x - 3 \]

\[
f(g(h(x))) = \sqrt{(x-3)^2 + 4 - 8} = \sqrt{(x-3)^2 - 4}
\]

\[
\begin{align*}
(x-3)^2 - 4 & \geq 0 \\
(x-3)^2 & \geq 4 \\
|x-3| & \geq 2 \\
x-3 & \geq 2 \\
x & \geq 5 \\
-x+3 & \geq 2 \\
x & \leq 1
\end{align*}
\]