Quiz 2 Solution

Recall that the *difference quotient* for a function f is given as follows:

$$\frac{f(x+h) - f(x)}{h}$$

Compute the difference quotient for the function $f(x) = x^2 + x$. Your answer should be an expression of x and h.

$$
\begin{aligned}
\frac{f(x+h) - f(x)}{h} &= \frac{((x+h)^2 + (x+h)) - (x^2 + x)}{h} \\
&= \frac{(x^2 + 2hx + h^2 + x + h) - (x^2 + x)}{h} \\
&= \frac{2hx + h + h^2}{h} \\
&= 2x + 1 + h \text{ (when } h \neq 0)
\end{aligned}
$$

The first line is just applying the definition of f to the inputs $(x+h)$ and x. The second line is expanding out $(x+h)^2$, the third line is obtained by canceling $x^2 + x$, and only in the last step do we use the denominator—being careful about the fact that the difference quotient should only be defined when $h \neq 0$.