Learn

The process of finding a function's derivative is known as **differentiation**. Instead of selecting a specific x value, we'll leave x where it is and expand the equation to solve for the derivative. Since $f(x) = -(x)^2 + 3x - 1$, this works out to:

$$\lim_{h \to 0} \frac{(-(x+h)^2+3(x+h)-1)-(-(x)^2+3x-1)}{h}$$

If we continue expanding the equation to individual terms only, we get:

$$\lim_{h \to 0} \frac{-x^2-2xh-h^2+3x+3h-1+x^2-3x+1}{h}$$

After cancelling out opposing terms, we get the following equation:

$$\lim_{h \to 0} \frac{-2xh-h^2+3h}{h}$$

Once we factor out the h that all of the terms in the numerator share, we get:

$$\lim_{h \to 0} \frac{h(-2x-h+3)}{h}$$

Once we cancel the h on both the numerator and the denominator, we finally get a defined limit.

$$\lim_{h \to 0} -2x - h + 3$$

We're going to ask you to solve the final step using direct substitution, which we discussed in the last mission. Note that the result of this limit won't be a single value, but instead a new function.