

1. Use the *definition of derivative* to find the derivative of the function $f(x) = 4 + 3x - x^2$.

$$\begin{aligned} f'(x) &= \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \\ &= \lim_{h \rightarrow 0} \frac{(4 + 3(x+h) - (x+h)^2) - (4 + 3x - x^2)}{h} \\ &= \lim_{h \rightarrow 0} \frac{(4 + 3x + 3h - (x^2 + 2xh + h^2)) - 4 - 3x + x^2}{h} \\ &= \lim_{h \rightarrow 0} \frac{4 + 3x + 3h - x^2 - 2xh - h^2 - 4 - 3x + x^2}{h} \\ &= \lim_{h \rightarrow 0} \frac{3h - 2xh - h^2}{h} = \lim_{h \rightarrow 0} (3 - 2x - h) = 3 - 2x - 0 = 3 - 2x \end{aligned}$$

2. Use the result of (1) to find $f'(-2)$: $f'(-2) = 3 - 2(-2) = 7$
3. Find the equation of the tangent line to the graph of f at the point with x -coordinate, -2 .

$$f(-2) = 4 + 3(-2) - (-2)^2 = -6 \text{ so the tangent line is } y - (-6) = 7(x - (-2)) \text{ or } y + 6 = 7(x + 2)$$