

## Exercise 1

Find the derivative of  $f(x) = (1 + 2x^2)(x - x^2)$  in two ways: by using the Product Rule and by performing the multiplication first. Do your answers agree?

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### Solution

Use the product rule to differentiate  $f(x)$ .

$$\begin{aligned} f'(x) &= \frac{d}{dx}[(1 + 2x^2)(x - x^2)] \\ &= \left[ \frac{d}{dx}(1 + 2x^2) \right] (x - x^2) + (1 + 2x^2) \left[ \frac{d}{dx}(x - x^2) \right] \\ &= (4x)(x - x^2) + (1 + 2x^2)(1 - 2x) \\ &= 4x^2 - 4x^3 + 1 - 2x + 2x^2 - 4x^3 \\ &= -8x^3 + 6x^2 - 2x + 1 \end{aligned}$$

Expand the function first

$$f(x) = x - x^2 + 2x^3 - 2x^4$$

and then differentiate it.

$$\begin{aligned} f'(x) &= \frac{d}{dx}(x - x^2 + 2x^3 - 2x^4) \\ &= 1 - 2x + 6x^2 - 8x^3 \end{aligned}$$

Both approaches give the same answer.