Exercise 1   Differentiate and simplify.

(a) $J(v) = (v^3 - 2v)(v^{-4} + v^{-2})$

(b) $G(x) = \dfrac{x^2 - 2}{2x + 1}$

Exercise 2   The curve
$$y = \frac{x}{1 + x^2}$$
is called a **serpentine**.

(a)   At what point does the curve have the horizontal tangent line?

(b)   Find the equation of the tangent line to this curve at the point $(0, 0)$.

Exercise 3   Suppose that $f(5) = 1$, $f'(5) = 6$, $g(5) = -3$, and $g'(5) = 2$. Find $h'(4)$.

(a) $h(x) = 3f(x) + 8g(x)$

(b) $h(x) = f(x)g(x)$

(c) $h(x) = \dfrac{f(x)}{g(x)}$

(d) $h(x) = \dfrac{g(x)}{f(x) + g(x)}$

Exercise 4   Let $F(x) = f(x)g(x)$ be the product of two functions f and g that have derivatives of all orders.

(a) Show that $F'' = f''g + 2f'g' + fg''$.

(b) Find similar formulas for F''' and $F^{(4)}$.

(c) Guess a formula for $F^{(n)}$.