i) Compute the derivatives of the following functions (using the appropriate rules). Here you do not need to simplify your answer.

(a) $f(t) = \cos(t^2)$

(b) $g(x) = \sqrt{2x^3 + 4x + 2}$

(c) $h(z) = 2e^{z^2+4z} + 5z + 3$

(d) $k(x) = \sin(x) \cdot (x^2 + 5x)^{100}$

(e) $f(x) = \sin^2(x) \cdot (x^2 + 5x)^{100}$

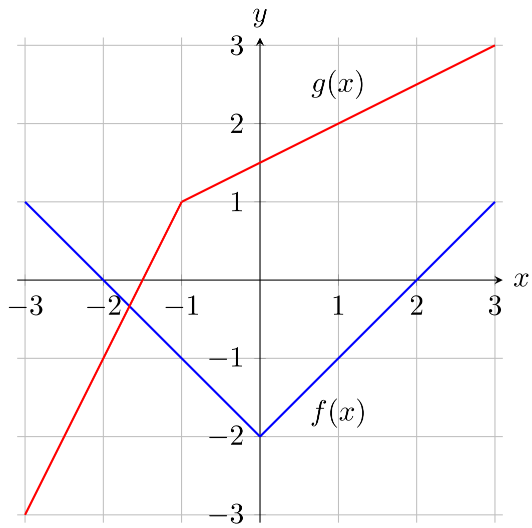
(f) $g(t) = \dfrac{e^t + 1}{\sin(t^4)}$

(g) $h(t) = \dfrac{e^{t^3+t} + 1}{\sin(t^4)}$

(h) $k(z) = e^{\cos(z^2)}$

(i) $f(x) = \tan^3\left(\sqrt{x^5 + 2}\right)$

ii) Consider the two functions $f(x)$ and $g(x)$ below.



(a) Let $h(x) = f(g(x))$. Find: $h'(-2)$, $h'(0)$ and $h'(1)$.

(b) Let $h(x) = g(f(x))$. Find: $h'(-2)$, $h'(0)$ and $h'(1)$.

(c) Let $h(x) = f(f(x))$. Find: $h'(-2)$, $h'(0)$ and $h'(1)$.

(d) Let $h(x) = (f(x))^2$. Find: $h'(-2)$, $h'(0)$ and $h'(1)$.

iii) While revising your course with a friend, this one claims "The chain actually applies all the time!". What do you think of this claim? To what extent is it correct, or incorrect?

Challenge exercises

A. Use the chain rule to find the derivative of $\dfrac{1}{g(x)}$.

B. Use part A., the chain rule and the product rule to prove the quotient rule.