

## 4.24 Composing Functions

Composing functions, or '*function composition*' does not mean making up your own equations of functions! It means when you put one function as the input of another function.

There are several different notations for this, all of which are the same thing, and various different ways of pronouncing it. For example,  $f(g(x))$  is the same as  $f \circ g(x)$ , and is pronounced as 'f o g of x' or 'f after g of x', etc. There's a few other ways of pronouncing it.

The following example quickly and simply illustrates the whole concept.

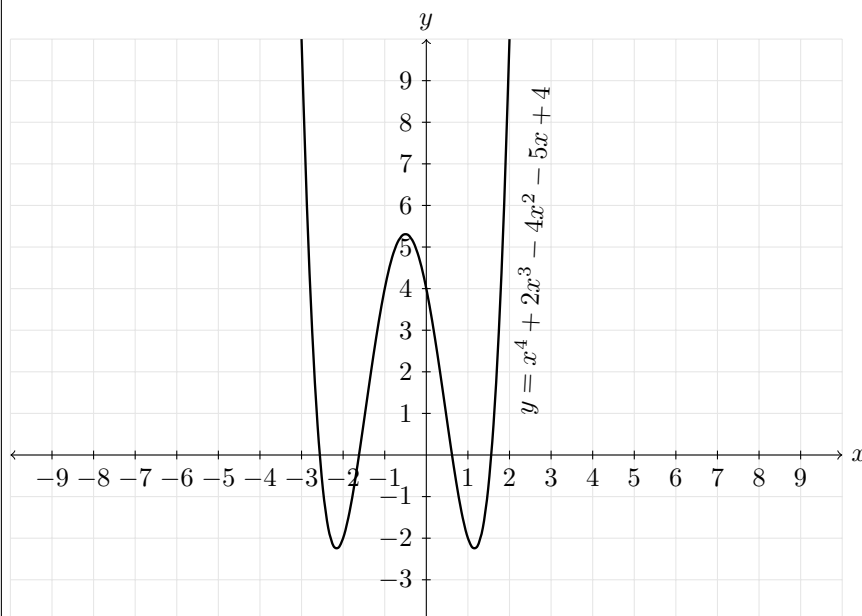
EXAMPLE: Graph the composed function  $g(f(x))$  if  $f(x) = -x^2 - x + 2$  and  $g(x) = x^2 + x - 2$ . (You can see both of these functions graphed together, earlier on in this handout!)

$$g(x) = x^2 + x - 2$$

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

$$\begin{aligned}\Rightarrow g(f(x)) &= (-x^2 - x + 2)^2 + (-x^2 - x + 2) - 2 \\ &= (-x^2 - x + 2)(-x^2 - x + 2) + (-x^2 - x + 2) - 2 \\ &= x^4 + x^3 - 2x^2 + x^3 + x^2 - 2x - 2x^2 - 2x + 4 + (-x^2 - x + 2) - 2 \\ &= x^4 + x^3 + x^3 - 2x^2 + x^2 - x^2 - 2x^2 - 2x - 2x - x + 4 + 2 - 2 \\ &= x^4 + 2x^3 - 4x^2 - 5x + 4\end{aligned}$$

So because of the multiplication of  $x^2$  terms by  $x^2$  terms our composed function is quartic! So it has four roots. Graphing:



Normally you'd set up a table to graph this function!

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