

Composition of Functions

In these exercises, we will practice composing two functions together, and also see how this is useful in some contexts.

1. Let $f(x) = 5x^2$ and $g(x) = x - 3$.

a) Find and simplify $f(g(x))$.

b) Find and simplify $g(f(2))$.

c) Find and simplify $(f \circ g)(x)$.

d) Find and simplify $g(g(x))$.

e) Find and simplify $(f \circ f)(1)$.

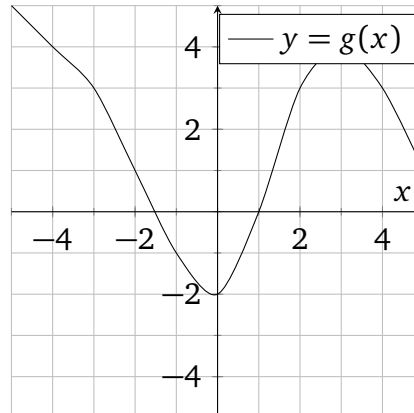
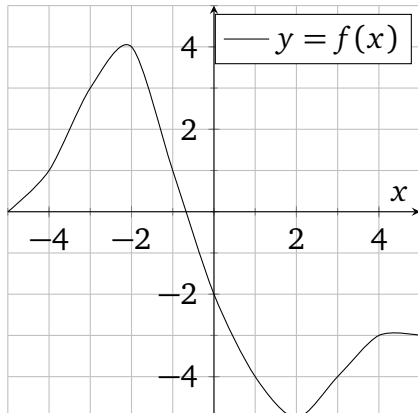
f) Find and simplify $f(g(7))$.

2. Suppose that $\ell = g(t)$, where ℓ is the length (in centimeters) of a plant leaf at time t (in days) after the leaf sprouted. Also, let $s = f(\ell)$, where s is the amount of sugar per day (in grams/day) that a leaf produces when it is ℓ cm long.

(a) What is the *meaning* of $f(g(t))$? That is, give an *English sentence* that provides context for $f(g(t))$; something like “ $f(g(t))$ is the _____ after _____.”

(b) What units does $f(g(t))$ have?

3. Let f and g be defined by the graphs below.



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| a) Find $f(g(1))$. | b) Find $(f \circ g)(-3)$. |
| c) Find $(g \circ f)(0)$. | d) Find $g(f(4))$. |
| e) Find $f(f(f(2)))$. | f) Find $(g \circ g \circ g \circ g \circ g \circ g)(-1)$. |

4. The kinetic energy in a certain moving ball is given by $E = f(v)$, where v is the speed of the ball in $\frac{\text{m}}{\text{s}}$ and the energy is measured in Joules. The formula for f is $f(v) = \frac{1}{2}v^2$. If a ball has been falling for t seconds, its speed is given by $v = g(t)$. The formula for g is $g(t) = 16t$.

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| a) What are the units on $f(g(1))$? | b) What is $f(g(1))$? |
| c) Write an English sentence that says everything you could say about the ball after 1 s has passed. | |
| d) Why does $f \circ g$ make sense, but $g \circ f$ does not? | |