

Function Composition

1. Take the composition of each of the following pairs of functions (for each, compute $f(g(x))$ and $g(f(x))$, don't simplify).

- (a) $f(x) = 3x^2$, $g(x) = \sin(x)$
- (b) $f(x) = 2^x$, $g(x) = 3x - 5$
- (c) $f(x) = \cos(x)$, $g(x) = 2x + 5$
- (d) $f(x) = \tan(x)$, $g(x) = 2^x$
- (e) $f(x) = 2x^2 - 3x + 5$, $g(x) = 5x - 2$
- (f) $f(x) = \frac{1}{x}$, $g(x) = \sqrt{x - 6}$
- (g) $f(x) = \sqrt{x + 2}$, $g(x) = 8x^2 - 6$
- (h) $f(x) = \sin(x)$, $g(x) = \frac{1}{\sqrt{x}}$
- (i) $f(x) = \frac{\sin(x)}{x}$, $g(x) = \cos(x)$
- (j) $f(x) = \cos(x)$, $g(x) = 3x$

2. Each of the following functions is a composition. Find $f(x)$ and $g(x)$ so that $h(x) = f(g(x))$:

- (a) $h(x) = (8x^2 - 4)^3$
- (b) $h(x) = \sqrt{3x - 5}$
- (c) $h(x) = \frac{(x-2)^2+1}{5-(x-2)^2}$
- (d) $h(x) = \sin(3x - 5)$
- (e) $h(x) = \cos(3x^2 - 5x + 1)$
- (f) $h(x) = \sqrt{x^2 - 5}$
- (g) $h(x) = \frac{1}{\cos(x)}$
- (h) $h(x) = (11x^2 - 6)^{15}$
- (i) $h(x) = (3x + 2)^2 + 3(3x + 2) - 5$
- (j) $h(x) = 4\sin^2(x) - 3\sin(x) + 5$
- (k) $h(x) = e^{-x^2+3x+5}$
- (l) $h(x) = \tan(\sin(x))$

3. Each of the following functions is a composition of three functions. Find $f(x)$, $g(x)$, and $h(x)$ so that $F(x) = f(g(h(x)))$:

- (a) $F(x) = \sin(\sqrt{x - 5})$
- (b) $F(x) = \frac{1}{\sqrt{3x^2 - 7x + 5}}$
- (c) $F(x) = (3(3(3x^2 - 5)^2 - 5)^2 - 5)$
- (d) $F(x) = \frac{3}{\sin(4x^2 - 1)}$
- (e) $F(x) = \sqrt{\sqrt{\sqrt{x}}}$
- (f) $F(x) = \tan(3(x - 2)^2 + 5)$