

hw solutions
section 2.2

20. $f(x) = \sqrt{x-1}$, $g(x) = x^3 + 1$

$$(f+g)(x) = x^3 + 1 + \sqrt{x-1}$$

$$(f-g)(x) = \sqrt{x-1} - x^3 - 1$$

$$(fg)(x) = (x^3 + 1)\sqrt{x-1}$$

$$(f/g)(x) = \frac{\sqrt{x-1}}{x^3 + 1}$$

29. $f(x) = \frac{x}{x^2 + 1}$, $g(x) = \frac{1}{x}$

$$(f \circ g)(x) = f(g(x)) = \frac{\frac{1}{x}}{(\frac{1}{x})^2 + 1} = \frac{\frac{1}{x}}{\frac{1}{x^2} + 1} \cdot \frac{x^2}{x^2}$$

simplifying

$$= \frac{x}{1 + x^2}$$

$$(g \circ f)(x) = g(f(x)) = \frac{1}{(\frac{x}{x^2 + 1})} = \frac{x^2 + 1}{x} \stackrel{\text{OR}}{=} x + \frac{1}{x}$$

33. Find $h(2)$, where $h(x) = (g \circ f)(x)$

$$f(x) = \frac{1}{2x+1}, \quad g(x) = \sqrt{x}$$

$$h(2) = g(f(2)) = g\left[\frac{1}{2 \cdot 2 + 1}\right] = g\left(\frac{1}{5}\right) = \sqrt{\frac{1}{5}} = \frac{1}{\sqrt{5}}$$

42. Find f & g where $h = g \circ f$

$$\text{if } h(x) = \frac{1}{\sqrt{2x+1}} + \sqrt{2x+1}$$

way 1:

$$f(x) = 2x+1$$

$$g(x) = \frac{1}{\sqrt{x}} + \sqrt{x}$$

way 2:

$$f(x) = \sqrt{2x+1}$$

$$g(x) = \frac{1}{x} + x$$

48. find & simplify $\frac{f(a+h) - f(a)}{h}$, $h \neq 0$

$$f(x) = 2x^2 - x + 1$$

$$\begin{aligned} \frac{f(a+h) - f(a)}{h} &= \frac{[2(a+h)^2 - (a+h) + 1] - [2a^2 - a + 1]}{h} \\ &= \frac{2(a^2 + 2ah + h^2) - a - h + 1 - 2a^2 + a - 1}{h} \\ &= \frac{2a^2 + 4ah + 2h^2 - h - 2a^2}{h} \\ &= \frac{4ah + 2h^2 - h}{h} \\ &= \frac{h(4a + 2h - 1)}{h} \\ &= 4a + 2h - 1 \end{aligned}$$