B.4

6-6 Function Operations

take note

Key Concepts Function Operations

Addition	$(f + g)(x) = f(x) + g(x)$
Subtraction	$(f - g)(x) = f(x) - g(x)$
Multiplication	$(f \cdot g)(x) = f(x) \cdot g(x)$
Division	$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}, g(x) \neq 0$

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Problem 1 Adding and Subtracting Functions

Let $f(x) = 4x + 7$ and $g(x) = \sqrt{x} + x$. What are $f + g$ and $f - g$?

$f + g$

$f(x) + g(x)$

$(4x+7) + (\sqrt{x} + x)$

$5x + \sqrt{x} + 7$

$f - g$

$f(x) - g(x)$

$(4x+7) - (\sqrt{x} + x)$

$3x - \sqrt{x} + 7$

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Problem 2 Multiplying and Dividing Functions

Let $f(x) = x^2 - 9$ and $g(x) = x + 3$. What are $f \cdot g$ and $\frac{f}{g}$

$f(x) \cdot g(x)$

$(x^2-9)(x+3)$

$x^3 + 3x^2 - 9x - 27$

$\frac{f(x)}{g(x)}$

$\frac{(x^2-9)}{(x+3)} \rightsquigarrow \frac{(x+3)(x-3)}{(x+3)}$

$x - 3$

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Composition of Functions

take note

Key Concept Composition of Functions

The composition of function g with function f is written as $g \circ f$ and is defined as $(g \circ f)(x) = g(f(x))$.

$(g \circ f)(x) = g(f(x))$ 1. Evaluate $f(x)$ first.
2. Then use $f(x)$ as the input for g.

Function composition is not commutative since $f(g(x))$ does not always equal $g(f(x))$.

Say it properly: $(g \circ f)(x) = g(f(x))$ reads, "g of f of x"

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Problem 3 Composing Functions

Let $f(x) = x - 5$ and $g(x) = x^2$. What is $(g \circ f)(-3)$?

$(f \circ g)(-5)$?

$(g \circ f)(-3)$

$g(f(-3))$

$(-3)-5$

-8

$g(-8) = (-8)^2 = \boxed{64}$

$(f \circ g)(-5)$

$f(g(-5))$

$(-5)^2 = 25$

$(25)-5 = \boxed{20}$

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

Find (f ∘ g)(x) **and then** (g ∘ f)(x)

$f(g(x))$

$f(x^2+1)$

$3(x^2+1)-2$

$3x^2+3-2$

$\boxed{3x^2+1}$

$g(f(x))$

$g(3x-2)$

$(3x-2)^2+1$

$(3x-2)(3x-2)+1$

$\boxed{9x^2-12x+5}$

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Using Composite Functions

You have a coupon good for $5 off the price of any large pizza. You also get a 10% discount on any pizza if you show your student ID.

a. Create a function each for the coupon *C(x)* and the student ID discount *D(x)*, where *x* is the price of a large pizza.

$C(x) = x - 5$ $D(x) = .90x$

b. Compose the function in both orders. *C(D(x))* and *D(C(x))*. Which order yields the largest price reduction?

$C(D(x))$
$C(.90x)$
$.90x - 5$

$D(C(x))$
$D(x-5)$
$.90(x-5)$
$.90x - 4.5$

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Homework:

p. 401

#'s: 1-6, 9-57 every third, 61, 64, 66,

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