

**9.4 Operations with Functions.....page #**

**Objectives**

Add, subtract, multiply, and divide functions.  
Write and evaluate composite functions.

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**Warm Up Simplify.**

Pay attention to what mathematical calculation the question is asking for!

- $(2x + 5) + (x^2 + 3x + 2)$   
 $-x^2 - x + 7$
- $(x - 3)(x + 1)$   
 $x^2 - 2x - 3$
- $\frac{x^2 - x - 6}{x^2 - 4}$   
 $\frac{(x-3)(x+2)}{(x+2)(x-2)}$   
 $\frac{(x-3)}{(x-2)}$   
Factor, then reduce.  
 $x \neq -2$   
 $x \neq 2$

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You can perform operations on functions in much the same way that you perform operations on numbers or expressions. You can add, subtract, multiply, or divide functions by operating on their rules.

Notation for Function Operations	
Operation	Notation
Addition	$(f + g)(x) = f(x) + g(x)$
Subtraction	$(f - g)(x) = f(x) - g(x)$
Multiplication	$(fg)(x) = f(x) \cdot g(x)$
Division	$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}$ , where $g(x) \neq 0$

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- Given  $f(x) = 4x^2 + 3x - 1$  and  $g(x) = 6x + 2$ , find  $(f + g)(x)$ .  
 $(f + g)(x) = f(x) + g(x)$   
 $= (4x^2 + 3x - 1) + (6x + 2)$   
 $4x^2 + 9x + 1$

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- Given  $f(x) = 5x - 6$  and  $g(x) = x^2 - 5x + 6$ , find  $(f - g)(x)$ .  
 $(f - g)(x) = f(x) - g(x)$   
 $5x - 6 + (-x^2 + 5x - 6)$   
 $(f - g)(x) = -x^2 + 10x - 12$

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- Given  $f(x) = 6x^2 - x - 12$  and  $g(x) = 2x - 3$ , find  $(gf)(x)$ .  
 $(fg)(x) = g(x) \cdot f(x)$   
 $(2x - 3)(6x^2 - x - 12)$   
 $12x^3 - 2x^2 - 24x - 18x^2 + 3x + 36$   
 $12x^3 - 20x^2 - 21x + 36$

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4. Given  $f(x) = x + 2$  and  $g(x) = x^2 - 4$ , find  $\left(\frac{g}{f}\right)(x)$

~~$(x+2)(x-2)$~~   
 ~~$x^2 - 4$~~   
 $x + 2$

$x - 2$   
 $x \neq -2$

Factor completely.  
 Note that  $x \neq -2$ .

$$\left(\frac{g}{f}\right)(x) = \frac{g(x)}{f(x)} = \frac{x^2 - 4}{x + 2}$$

$$\left(\frac{g}{f}\right)(x) = x - 2 ; x \neq -2$$

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5. Given  $f(x) = x - 3$  and  $g(x) = x^2 + 5x - 24$ , find

$\left(\frac{g}{f}\right)(x) = \frac{x^2 + 5x - 24}{x - 3}$

$(x+8)(x-3)$   
 $x \neq 3$

$\left(\frac{f}{g}\right)(x) = \frac{x - 3}{x^2 + 5x - 24}$

$(x+8)(x-3)$   
 $\frac{1}{x+8}$   
 $x \neq -8, 3$

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**Lesson Quiz**

Given  $f(x) = 4x^2 - 1$  and  $g(x) = 2x - 1$ , find each function or value.

1.  $(f + g)(x)$   $4x^2 + 2x - 2$

2.  $(fg)(x)$   $8x^3 - 4x^2 - 2x + 1$

3.  $\left(\frac{f}{g}\right)(x)$   $2x + 1; x \neq \frac{1}{2}$

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**Assignment:**  
 pages 686-688

problems 2-7, 15-23, 52

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