

1.5 Combinations of Functions Day 2

I. Find  $f \cdot g$  and  $g \cdot f$ . Are they equal?

Ex 1)  $f(x) = 2x + 3$  and  $g(x) = \frac{1}{2}(x - 3)$

$$f(g(x)) = 2\left(\frac{1}{2}(x-3)\right) + 3$$

$$= x - 3 + 3$$

$$= x$$

$$g(f(x)) = \frac{1}{2}((2x+3)-3)$$

$$= \frac{1}{2}(2x)$$

$$= x$$

II. Find two functions  $f$  and  $g$  such that  $(f \cdot g)(x) = h(x)$

Ex 2)  $h(x) = (3x - 5)^3 = f(g(x))$

$$f(x) = x^3$$

$$g(x) = 3x - 5$$

III. Determine the domain of  $f$ ,  $g$ , and  $f \cdot g$ .

Ex 3)  $f(x) = x^2 - 9$  and  $g(x) = \sqrt{9 - x^2}$

D:  $f(x)$ : all reals

D:  $g(x)$ :

$$9 - x^2 \geq 0$$

$$-x^2 \geq -9$$

$$x^2 \leq 9$$

$$x \leq 3$$

$$x \geq -3$$

$-3 \leq x \leq 3$

Ex 4)  $f(x) = x + 2$   $g(x) = \frac{1}{x^2 - 4}$

D:  $f(x)$ : all reals

D:  $g(x)$ : all reals

$$x^2 - 4 = 0 \text{ except } x \neq \pm 2$$

$$x^2 = 4$$

$$x = \pm 2$$

$$f(g(x)) = (\sqrt{9-x^2})^2 - 9$$

$$= 9 - x^2 - 9$$

$$= -x^2$$

D:  $f(g(x))$ : all reals

D:  $-3 \leq x \leq 3$

or  $[-3, 3]$

$$f(g(x)) = \frac{1}{x^2 - 4} + 2$$

D: all reals except  $x \neq \pm 2$

D: All reals except  $x \neq \pm 2$