

5.5 Notes: Function OperationsFunction Addition

$$f(x) = 3x + 4$$

$$g(x) = x^2 - 5x + 2$$

①

Find $f + g$

$$(f+g)(x) = (3x+4) + (x^2-5x+2)$$

$$(f+g)(x) = x^2 - 2x + 6$$

Combine
like
termsDomain of $f(x)$: $x \in \mathbb{R}$ Domain of $g(x)$: $x \in \mathbb{R}$ so Domain of $(f+g)(x)$: $x \in \mathbb{R}$ ② Find $f - g$

$$(f-g)(x) = (3x+4) - (x^2-5x+2)$$

$$(f-g)(x) = -x^2 + 8x + 2$$

Domain of $f(x)$: $x \in \mathbb{R}$ Domain of $g(x)$: $x \in \mathbb{R}$ so Domain of $(f-g)(x)$: $x \in \mathbb{R}$

Multiply Functions

The demand, d , in units sold, for a company's new brand of cell phones at price, x in dollars, is $d(x) = 5000 - 10x$. What is the company's expected revenue?

Price: $p(x) = x$

Domain
 $x \in [0, \infty)$

Demand: $d(x) = 5000 - 10x$

$x \in [0, 500]$

Revenue = $R(x) = p(x) \cdot d(x)$

$x \in [0, 500]$

$$R(x) = x(5000 - 10x)$$

$$R(x) = 5000x - 10x^2$$

Divide Functions

$$f(x) = x - 7$$

$$g(x) = 2x^2 - 13x - 7$$

$$\frac{f}{g}(x) = \frac{f(x)}{g(x)} = \frac{x-7}{2x^2-13x-7}$$

Factor

$$= \frac{x-7}{(2x+1)(x-7)}$$

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

Domain: $x \in \mathbb{R}, x \neq -\frac{1}{2}$

Composite Functions

the result of applying the rule for one function to the rule of another function.

$$(f \circ g)(x) = f(g(x))$$

The domain of the composition is the intersection of the domains of $g(x)$ & $(f \circ g)(x)$ but not $f(x)$.

Composite Functions

$$f(x) = x^2 \quad g(x) = x + 1$$

① $f(g(3))$

$$g(3) = 3 + 1 = 4$$

$$f(4) = 4^2 = 16$$

$$f(g(3)) = 16$$

Start with the inside function & work out

So now find $f(4)$

②

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

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

Substitute $g(x)$ into $f(x)$

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

$$g(x) = 3x$$

$$f(g(2))$$

$$g(2) = 3(2) = 6$$

$$f(6) = 2(6) - 1 = 11$$

$$f(g(2)) = 11$$

$$f(g(x)) = 2(3x) - 1$$

$$f(g(x)) = 6x - 1$$

$$g(f(x)) = 3(2x - 1)$$

$$g(f(x)) = 6x - 3$$

$$f(x) = \sqrt{x+7} \quad g(x) = 2x-5$$

$$\textcircled{1} \quad (f \circ g)(x) = f(g(x)) =$$

$$f(2x-5) = \sqrt{2x-5+7}$$

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

$$g(x) \text{ domain: } x \in \mathbb{R}$$

$$(f \circ g)(x) \text{ domain } x \in [-1, \infty)$$

$$\textcircled{2} \quad (g \circ f)(x)$$

$$g(\sqrt{x+7}) = 2\sqrt{x+7} - 5$$

$$(g \circ f)(x) = 2\sqrt{x+7} - 5$$

$$\text{domain } x \in [-7, \infty)$$

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

$$g(x) = 4 - x$$

$$(f \circ g)(x)$$

$$f(4-x) = (4-x)^2 + (4-x) + 2$$

$$= 16 - 8x + x^2 + 4 - x + 2$$

$$(f \circ g)(x) = x^2 - 9x + 22$$

$$\text{domain } x \in \mathbb{R}$$