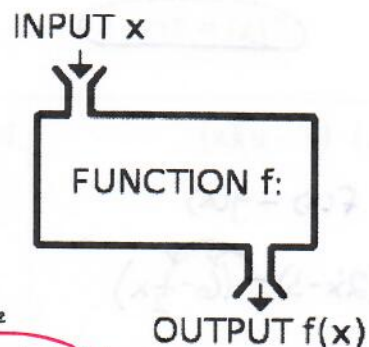


1.6 – Algebraic Operations w/Functions

Evaluating a Function

Is the process of substituting a # or an algebraic expression into a function and then simplifying it. * You are **NOT** solving for a variable! You will **NOT** use set notation ~~{} <math>\{ </math>~~



Example 1: Given the following functions, evaluate completely:

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

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

Piecewise

$$h(x) = \begin{cases} 2x - 5 & \text{if } x < -1 \\ 3 - x & \text{if } x \geq -1 \end{cases}$$

The inequalities tell you which piece to use!

<p>a.) $f(4) + 3g(-2)$ $f(x) = 4x - 2$ $f(4) = 4(4) - 2 \rightarrow f(4) = 14$ <hr/> $g(x) = x^2 - 2x + 4$ $g(-2) = (-2)^2 - 2(-2) + 4$ $g(-2) = 12$ <hr/> $f(4) + 3g(-2)$ \downarrow $14 + 3(12) \rightarrow 50$</p>	<p>b.) $2h(-2) - 3h(4)$ $x < -1$ $x \geq -1$ $h(x) = 2x - 5$ $h(-2) = 2(-2) - 5 \rightarrow h(-2) = -9$ <hr/> $h(x) = 3 - x$ $h(4) = 3 - (4) \rightarrow h(4) = -1$ <hr/> $2h(-2) - 3h(4)$ $2(-9) - 3(-1) \rightarrow -15$</p>	<p>c.) $3g(x-2) + f(3x)$ $g(x) = x^2 - 2x + 4$ $g(x-2) = (x-2)^2 - 2(x-2) + 4$ <u>Box/FOIL</u> $= (x^2 - 4x + 4) - 2x + 4 + 4$ $g(x-2) = x^2 - 6x + 12$ <hr/> $f(x) = 4x - 2$ $f(3x) = 4(3x) - 2 \rightarrow 12x - 2$ <hr/> $3g(x-2) + f(3x)$ $3(x^2 - 6x + 12) + (12x - 2)$ $3x^2 - 18x + 36 + 12x - 2$ $3x^2 - 6x + 34$</p>	<p>d.) $f(x+4) - g(x+1)$ $f(x+4) = 4(x+4) - 2$ $= 4x + 16 - 2 \rightarrow 4x + 14$ <hr/> $g(x+1) = (x+1)^2 - 2(x+1) + 4$ $= (x^2 + 2x + 1) - 2x - 2 + 4$ $= x^2 + 3$ <hr/> $f(x+4) - g(x+1)$ $4x + 14 - (x^2 + 3)$ $4x + 14 - x^2 - 3$ $-x^2 + 4x + 11$</p>
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Operations with Functions

Arithmetic Operations With Functions Chart

Operation	Definition	Examples if $f(x) = x + 2$ and $g(x) = 3x$
Sum	$(f + g)(x) = f(x) + g(x)$	$(f + g)(x) = (x + 2) + (3x) \rightarrow 4x + 2$
Difference	$(f - g)(x) = f(x) - g(x)$	$(f - g)(x) = (x + 2) - (3x) \rightarrow x + 2 - 3x \rightarrow -2x + 2$
Product	$(f \cdot g)(x) = f(x) \cdot g(x)$ <small>↑ multiplication</small>	$(f \cdot g)(x) = (x + 2)(3x) \rightarrow 3x^2 + 6x$
Quotient	$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}; g(x) \neq 0$ <small>* cannot divide by 0*</small>	$\left(\frac{f}{g}\right)(x) = \frac{x + 2}{3x}; x \neq 0$ $\rightarrow 3x = 0 \rightarrow x = 0$ set denominator = 0 solve!
Equation	$(f = g)(x) \rightarrow f(x) = g(x)$ <small>Solve</small>	$(f = g)(x) = (x + 2) = 3x$ $2 = 2x \rightarrow x = 1$ $\{1\}$
Composition	$(f \circ g)(x) =$	

Example 2: Perform the indicated operation(s) with the following functions:

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

$$g(x) = 6 - \frac{1}{2}x$$

$$h(x) = x^2 - 2x - 3$$

$$k(x) = 2x^2 + 5x - 12$$

<p>a.) $(f-g)(x)$</p> $f(x) - g(x)$ $(2x-3) - (6 - \frac{1}{2}x)$ $(2x-3) - 6 + \frac{1}{2}x$ $\frac{5x-9}{2}$ <p>or</p> $2.5x - 9$	<p>b.) $(f \cdot h)(x)$</p> $f(x) \cdot h(x)$ $(2x-3)(x^2-2x-3)$ <table border="1" style="margin-left: 20px;"> <tr> <td></td> <td>x^2</td> <td>$-2x$</td> <td>-3</td> </tr> <tr> <td>$2x$</td> <td>$2x^3$</td> <td>$-4x^2$</td> <td>$-6x$</td> </tr> <tr> <td>-3</td> <td>$-3x^2$</td> <td>$6x$</td> <td>9</td> </tr> </table> $2x^3 - 7x^2 + 9$		x^2	$-2x$	-3	$2x$	$2x^3$	$-4x^2$	$-6x$	-3	$-3x^2$	$6x$	9	<p>c.) $\left(\frac{f}{k}\right)(x)$</p> $\frac{f(x)}{k(x)}; k(x) \neq 0$ $\frac{2x-3}{2x^2+5x-12} \leftarrow \text{Factor}$ $\frac{2x-3}{(2x-3)(x+4)}$ $\frac{1}{x+4}; x \neq -4$ $\begin{aligned} \hookrightarrow x+4 &= 0 \\ x &= -4 \end{aligned}$	<p>d.) $(f=h)(x)$</p> $f(x) = h(x)$ $2x-3 = x^2-2x-3$ $-2x \quad \quad \quad -2x$ $-3 = x^2-4x-3$ $+3 \quad \quad \quad +3$ $0 = x^2-4x \leftarrow \text{Factor}$ $0 = x(x-4)$ <p>zero product property</p> $x=0 \quad x-4=0$ $x=4$ $\{0, 4\}$
	x^2	$-2x$	-3												
$2x$	$2x^3$	$-4x^2$	$-6x$												
-3	$-3x^2$	$6x$	9												
<p>e.) $(f \circ g)(16)$</p>	<p>f.) $(k \circ g \circ f)(-1)$</p>	<p>g.) $(f \circ f)(x)$</p>	<p>h.) $(h \circ f)(x)$</p>												