Math 30-1
Relation and Functions: Operations on Functions

Name: _____

Addition: $f(x)+g(x)=(f+g)(x)$

Subtraction: $f(x)-g(x)=(f-g)(x)$

Multiplication: $f(x)g(x)=f(x)\times g(x)=(f\bullet g)(x)$ ← multiply y-values at each x

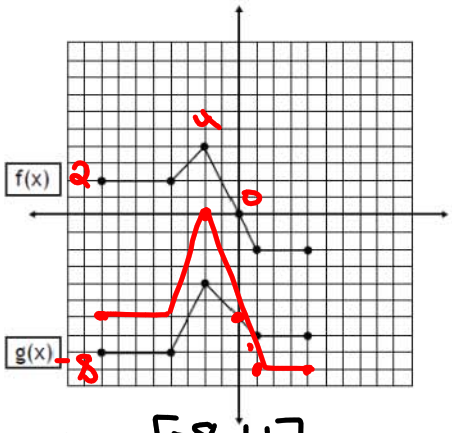
Division: $\frac{f(x)}{g(x)}=f(x)\div g(x)=\left(\frac{f}{g}\right)(x)$

There are 3 ways to determine operations on functions

1. Graphically
2. Numerically
3. Algebraically → new equation

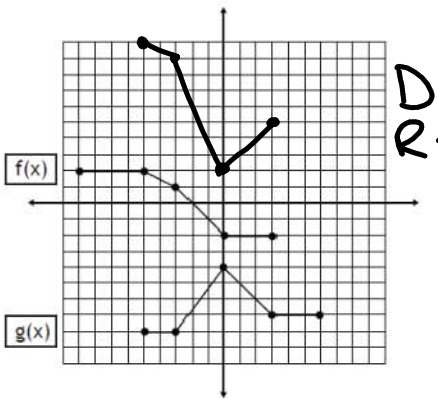
Graphically: Draw the new function and state the domain and range.

a) h(x) = (f + g)(x) *same as f(x) + g(x)*



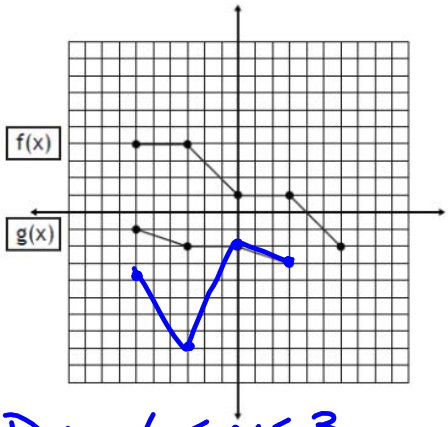
Domain: [-8, 4]
Range: [-9, 0]

b) h(x) = (f - g)(x) *same as f(x) - g(x)*



D: [-5, 3]
R: [2, 10]

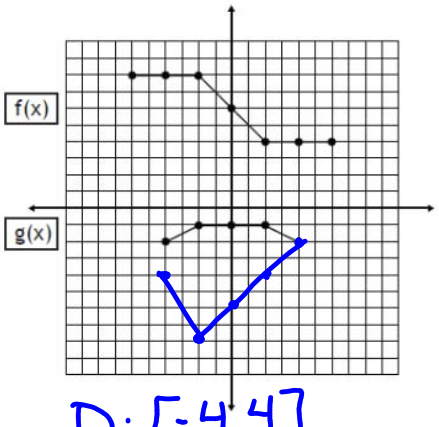
c) $h(x) = (f \cdot g)(x)$ *same as* $f(x) \cdot g(x)$



D: $-6 \le x \le 3$

R: $-8 \le x \le -2$

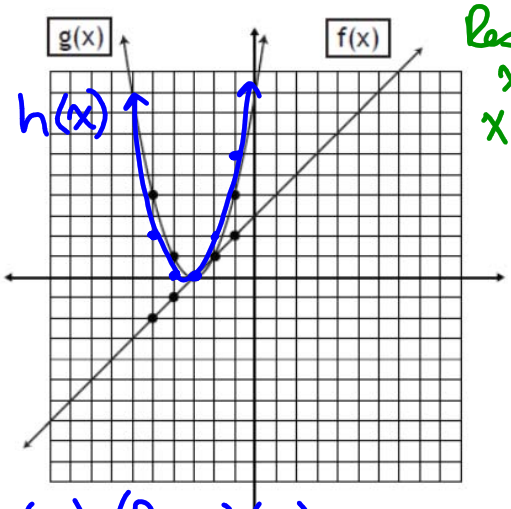
d) $h(x) = \left(\frac{f}{g}\right)(x)$ *same as* $f(x) \div g(x)$



D: $[-4, 4]$

R: $[-8, -2]$

c) $f(x) = x + 3$ and $g(x) = x^2 + 6x + 9$



$h(x) = (f+g)(x)$

$= f(x) + g(x)$

D: $x \in \mathbb{R}$ $(-\infty, \infty)$

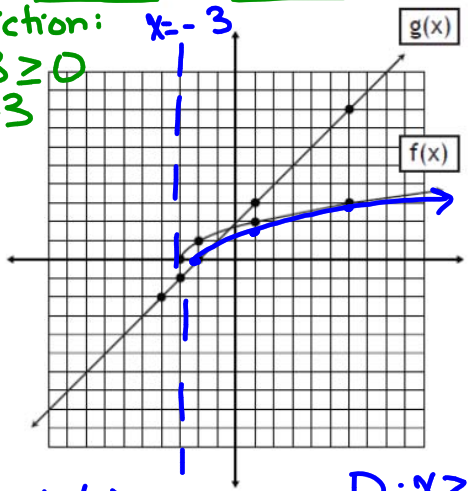
R: $y \ge 0$ $[0, \infty)$

d) $f(x) = \sqrt{x+3}$ and $g(x) = x + 2$

Restriction: $x \ge -3$

$x + 3 \ge 0$

$x \ge -3$



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

D: $x > -3$

R: $y \ge 0$

Numerically: Substitute the value in and perform the operation

Given: $f(x) = 3 + x$ $g(x) = x^2 + 5x + 6$ $h(x) = 7x - 1$

Determine:

1. $f(3) + g(3)$

$= (3+3) + ((3)^2 + 5(3) + 6)$

$= 6 + 30 = \boxed{36}$

(3, 36)

2. $(f \bullet g)(-5)$

$= f(-5) \cdot g(-5)$

$= (3 + (-5)) \cdot ((-5)^2 + 5(-5) + 6) = -2 \cdot 6 = \boxed{-12}$

3. $\frac{g(1)}{f(1)} = \frac{(1)^2 + 5(1) + 6}{3+1} = \frac{12}{4} = \boxed{3}$

4. $h(-1) - f(-1) + g(-1)$

$= (7(-1) - 1) - (3 + -1) + ((-1)^2 + 5(-1) + 6)$

$= -8 - 2 + 2$

$= \boxed{-8}$

Algebraically: Simplify the expressions.

Given: $f(x) = 3 + x$ $g(x) = x^2 + 5x + 6$ $h(x) = 7x - 1$

1. $(f + g)(x)$

$= f(x) + g(x)$

$= (3 + x) + (x^2 + 5x + 6) = \boxed{x^2 + 6x + 9} = m(x)$

2. $f(x) - h(x)$

$= (3 + x) - (7x - 1)$

$= 3 + x - 7x + 1 = \boxed{-6x + 4}$

3. $\left(\frac{g}{f}\right)(x) = \frac{x^2 + 5x + 6}{3 + x} = \frac{(x+2)(x+3)}{(x+3)} = \boxed{x + 2}$, $x \neq -3$

4. $h(x) \cdot g(x)$

$= (7x - 1)(x^2 + 5x + 6)$

$= 7x^3 + 35x^2 + 42x - x^2 - 5x - 6$

$= \boxed{7x^3 + 34x^2 + 37x - 6}$

Pg. 483 # 3, 6, 9.

Pg. 496 # 1, 2, 4, 10.