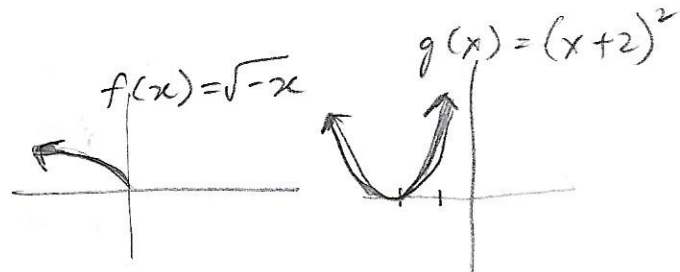## Lesson 2: Combining Functions Algebraically

Example 1: Use $f(x) = \sqrt{x-2}$ and $g(x) = x+1$.
a) State the domain of $f(x)$ and of $g(x)$.
b) Given that $m(x) = f(x) + g(x)$, write an explicit equation for $m(x)$, then determine its domain.
c) Given that $p(x) = f(x) \cdot g(x)$, write an explicit equation for $p(x)$, then determine its domain.
d) **OPTIONAL** Use graphing technology to graph $m(x)$ and $p(x)$, and use the graphs of each function to estimate the range of both functions.

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

Example 2: Use $f(x) = \sqrt{-x}$ and $g(x) = (x+2)^2$.
a) State the domain of $f(x)$ and of $g(x)$.
b) Given that $q(x) = \dfrac{f(x)}{g(x)}$, write an explicit equation for $q(x)$, then determine its domain.
c) **OPTIONAL** Use graphing technology to graph $q(x)$, and use the graph to estimate the range of the function.

a) Domain $f(x)$ $-x \geq 0$

$0 \geq x$

$x \leq 0$ or $(-\infty, 0]$

Domain $g(x)$ $x \in \mathbb{R}$ or $(-\infty, \infty)$

b) $q(x) = \dfrac{\sqrt{-x}}{(x+2)^2}$ npv: $x+2 = 0$

$x = -2$

D: $x \leq 0, \ x \neq -2$ R: $(0, \infty)$

Example #1

$$f(x) = \sqrt{x-2} \quad \text{and} \quad g(x) = x+1$$

a) Domain of $f(x)$

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

This function is defined only when $x-2$ is greater or equal to zero

$$x - 2 \geq 0$$

$$x \geq 2$$

D: $x \geq 2$ or $[2, \infty)$
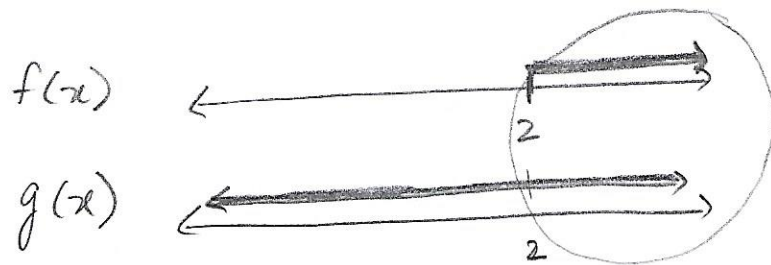
Domain $g(x) = x+1$

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

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

$$m(x) = \sqrt{x-2} + x+1 \quad \Longleftarrow$$

This is the explicit equation for $m(x)$.

Domain of $m(x)$?

$f(x)$

$g(x)$

2

2

Therefore Domain of $m(x)$ $x \geq 2$ or $[2, \infty)$

Ex1 continued.

c) $p(x) = f(x) \cdot g(x)$

$p(x) = (\sqrt{x-2}) \cdot (x+1)$

Domain of $p(x)$ $x \geq 2$ or $[2, \infty)$

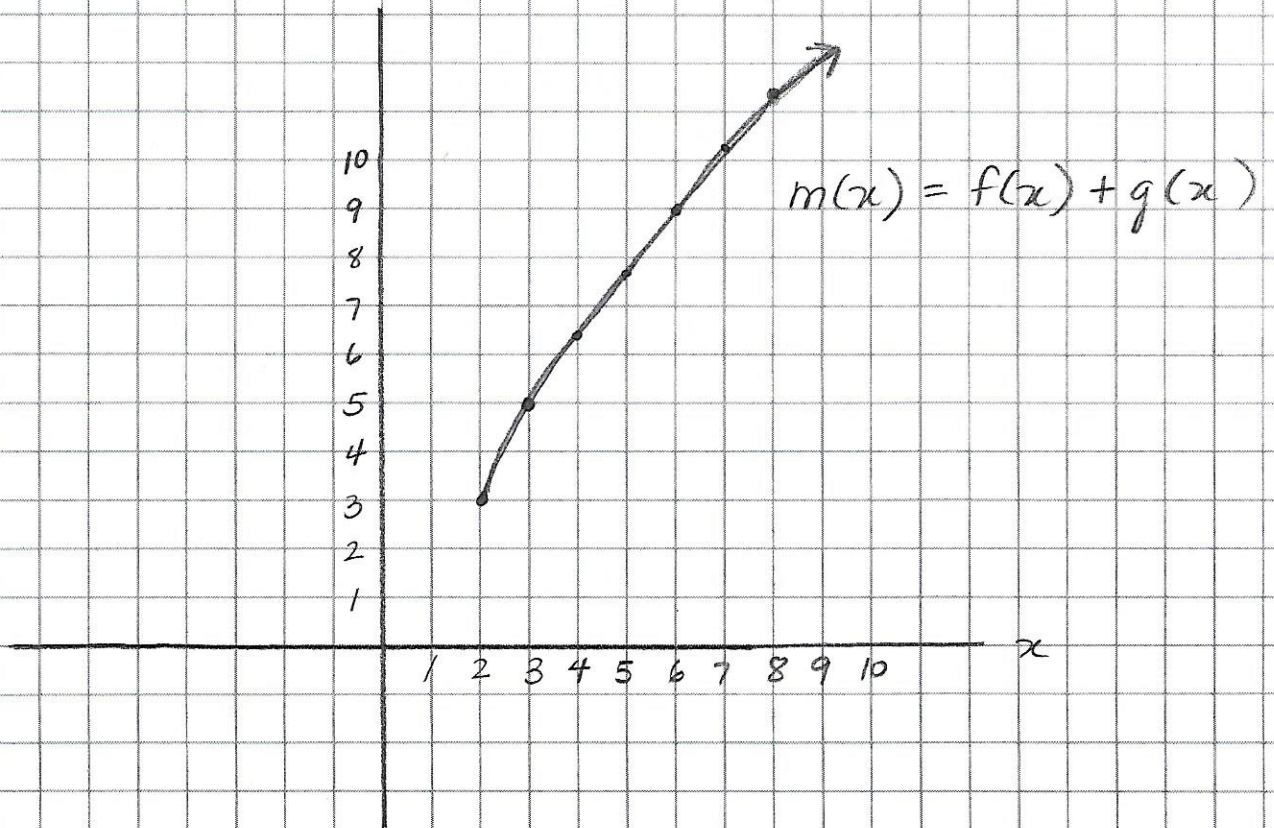d) Graph $m(x)$.

x	$f(x) = \sqrt{x-2}$	$g(x) = x+1$	$m(x) = f(x) + g(x)$
2	0	3	3
3	1	4	5
4	$\sqrt{2} = 1.4$	5	6.4
5	$\sqrt{3} = 1.7$	6	7.7
6	2	7	9
7	$\sqrt{5} = 2.2$	8	10.2
8	$\sqrt{6} = 2.4$	9	11.4

Use these for graphing

Graph $p(x)$

x	$f(x) = \sqrt{x-2}$	$g(x) = x+1$	$p(x) = f(x) \cdot g(x)$
2	0	3	0
3	1	4	4
4	1.4	5	7
5	1.7	6	10.2
6	2	7	14
7	2.2	8	17.6
8	2.4	9	21.6

Ex 1) $m(x) = f(x) + g(x)$

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

$p(x) = f(x) \cdot g(x)$

$p(x) = f(x) \cdot g(x)$
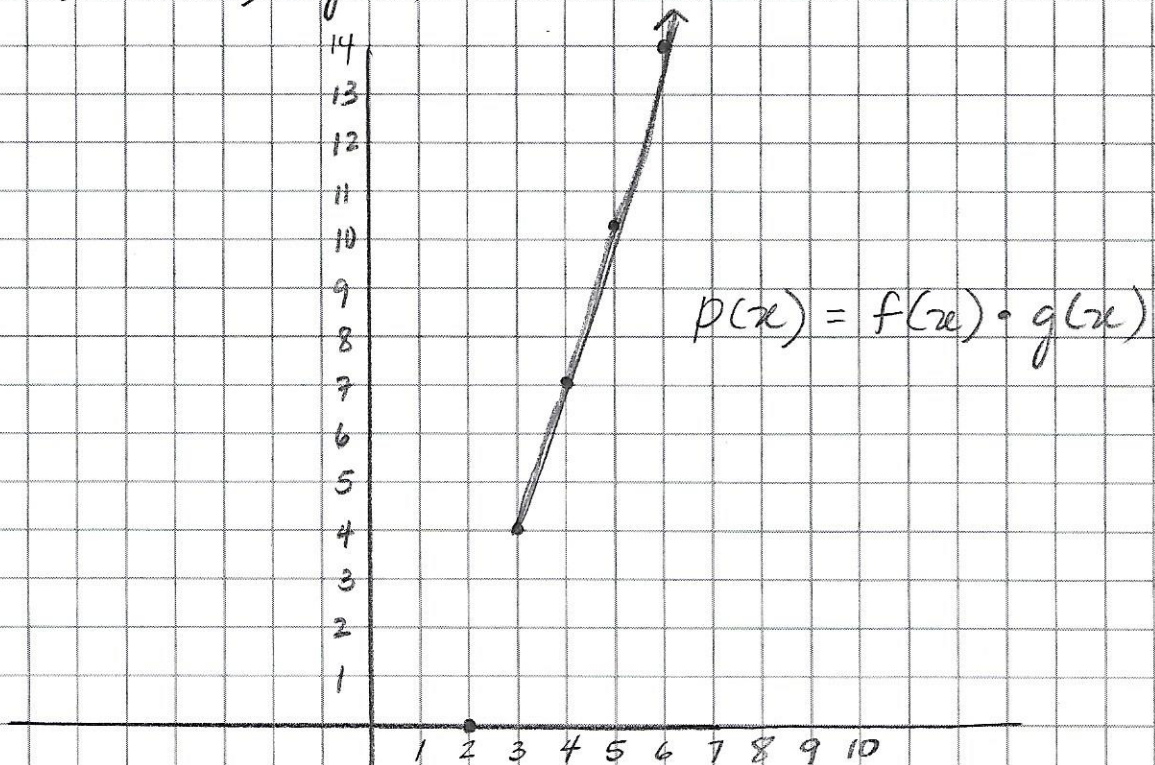
Ex 2) $f(x) = \sqrt{-x}$ $g(x) = (x+2)^2$

x	$f(x) = \sqrt{-x}$	$g(x) = (x+2)^2$	$\frac{f}{g}(x) = \dfrac{\sqrt{-x}}{(x+2)^2}$
0	0	4	0
−1	1	1	1
−2	$\sqrt{2} = 1.4$	0	undefined
−3	$\sqrt{3} = 1.7$	1	1.7
−4	2	4	0.5
−5	$\sqrt{5} = 2.2$	9	0.24
−6	$\sqrt{6} = 2.4$	16	0.15

Ex 2 $g(x) = \dfrac{f(x)}{g(x)}$

vertical asymptote
$x = -2$

6
5
4
3
2
1

Horizontal asymptote
$y = 0$

-6 -5 -4 -3 -2 -1
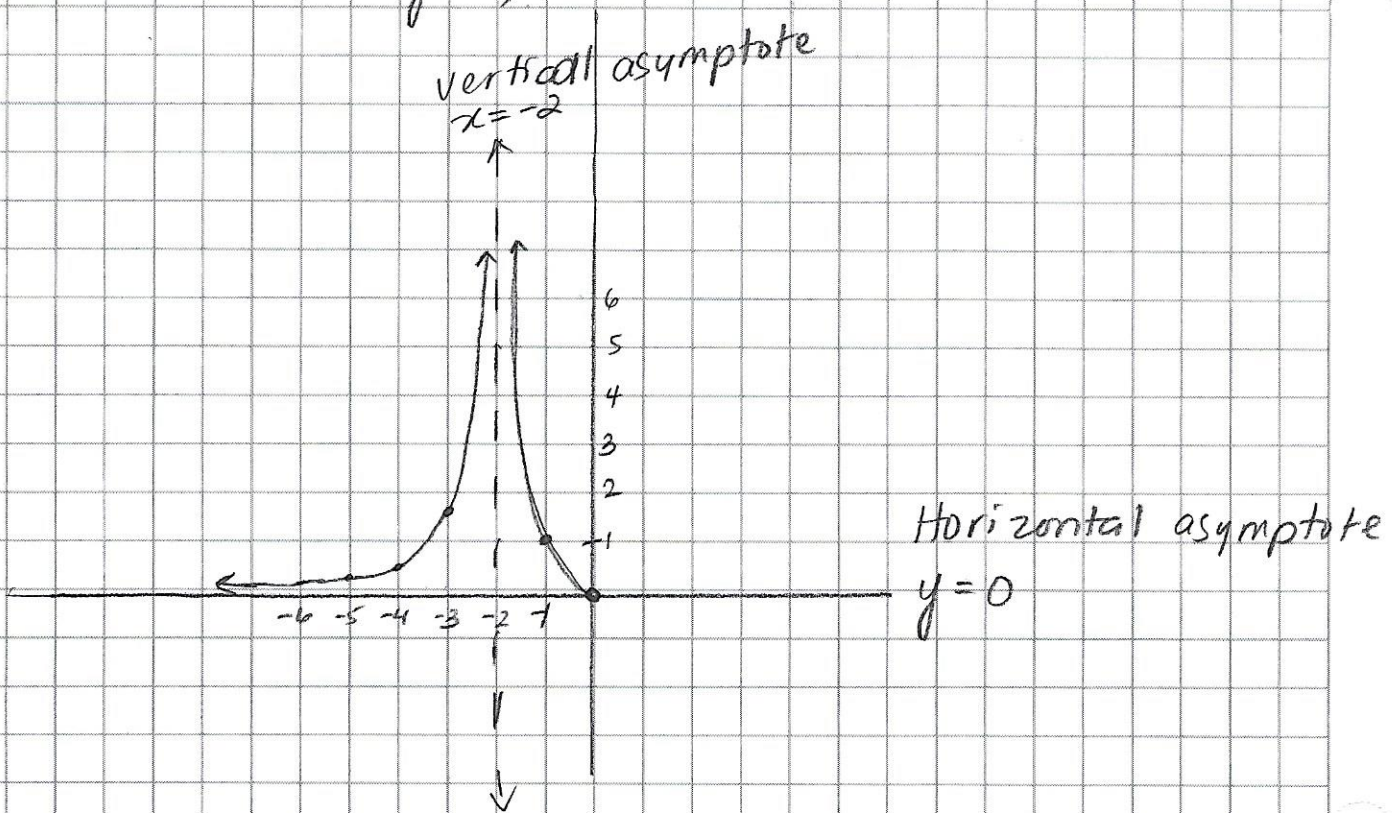
Example 3: Consider the function: $m(x) = 2x^2 + 3x - 7$.
a) Write explicit equations for three functions $f(x)$, $g(x)$, and $n(x)$ so that
$m(x) = f(x) + g(x) + n(x)$.
b) Write explicit equations for two functions $f(x)$ and $g(x)$ so that $m(x) = f(x) - g(x)$.

a) $m(x) = 2x^2 + 3x - 7$

$f(x) = 2x^2$

$g(x) = 3x$

$n(x) = -7$

b) $m(x) = f(x) - g(x)$

$2x^2 + 3x - 7 = f(x) - g(x)$

$= (2x^2 + 3x) - (7)$

$f(x) = 2x^2 + 3x$

$g(x) = 7$

There are many possible solution.

Example 4: Consider the function: $p(x) = x^2 - 2x - 15$.
a) Write explicit equations for two functions $f(x)$, $g(x)$, so that $p(x) = f(x) \cdot g(x)$.
b) Given that $q(x) = x + 3$, write explicit equations for two functions $f(x)$ and $g(x)$ so
that $q(x) = \dfrac{f(x)}{g(x)}$.

a) $p(x) = f(x) \cdot g(x)$

$x^2 - 2x - 15 = (x - 5)(x + 3)$

$f(x) = x - 5$

$g(x) = x + 3$

b) $q(x) = \dfrac{f(x)}{g(x)}$

$x + 3 = \dfrac{(x+3)(x+4)}{(x+4)}$

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

$g(x) = x+4$

Assignment Time! Work on p.278- 3 – 11 (not 5b), MC 1&2