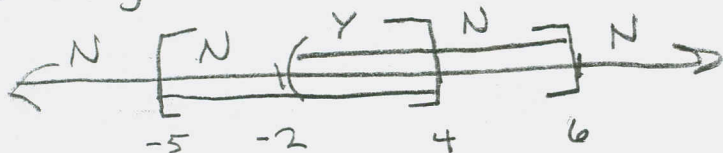


Name KEY

1. (7 pts) If the domain of f is all real numbers in the interval $(-2, 6]$ and the domain of g is all real numbers in the interval $[-5, 4]$, then what is the domain of the function $f+g$?

$$D(f+g) = D(f) \cap D(g) = (-2, 6] \cap [-5, 4] = (-2, 4]$$



2. (5 pts) What is the domain of the function $f(x) = \frac{x+72}{x^2-2x-15}$? Give your answer in set-builder notation (i.e., start with $\{x |$ $\}$).

Need $x^2 - 2x - 15 \neq 0$

Solve $x^2 - 2x - 15 = 0$ & discard solutions.

$$(x-5)(x+3) = 0$$

$$x \in \{-3, 5\}$$

$$D = \mathbb{R} \setminus \{-3, 5\}$$

$$= \{x \mid x \neq -3 \text{ \& } x \neq 5\}$$

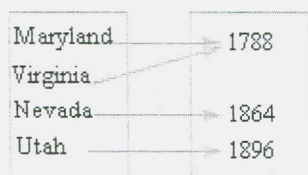
3. (5 pts) Let $f(x) = \frac{x}{x^2+4}$. Find the following values:

a. $f(2) = \frac{2}{2^2+4} = \frac{2}{8} = \frac{1}{4}$

b. $f(-2) = \frac{-2}{(-2)^2+4} = \frac{-2}{4+4} = \frac{-2}{8} = -\frac{1}{4}$

4. Determine whether each of the following relations represents a function. State the domain and range in each case. But if one is *not* a function, explain why.

a. (5 pts)



Yes, Function

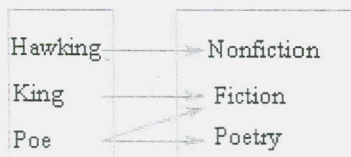
Domain: $\{ \text{Maryland, Virginia, Nevada, Utah} \}$

Range: $\{ 1788, 1864, 1896 \}$

Function? (If not, why not?)

Poe wrote mysteries before Sherlock Holmes.

b. (5 pts)



Domain: $\{ \text{Hawking, King, Poe} \}$

Range: $\{ \text{Nonfiction, Fiction, Poetry} \}$

Function? (If not, why not?) NOT because $x = \text{Poe}$ corresponds to $y = \text{Fiction}$ and $y = \text{Poetry}$.

5. (5 pts) What is the average rate of change of the function $r(x) = 2x^2 - 1$, from $x = 1$ to $x = 2$?

$$\frac{r(2) - r(1)}{2 - 1} = \frac{2(2)^2 - 1 - (2(1)^2 - 1)}{1}$$

$$= \frac{8 - 1 - (2 - 1)}{1} = 7 - 1 = \boxed{6}$$

6. Let $f(x) = \frac{x+5}{x-2}$ and $g(x) = \sqrt{x+5}$.

a. (5 pts) What is the domain of f ? (Set notation or interval notation)

$D(f) = \{x \mid x \neq 2\}$ by inspection

b. (5 pts) What is the domain of g ? (Set notation or interval notation)

Need $x+5 \geq 0$
 $x \geq -5$

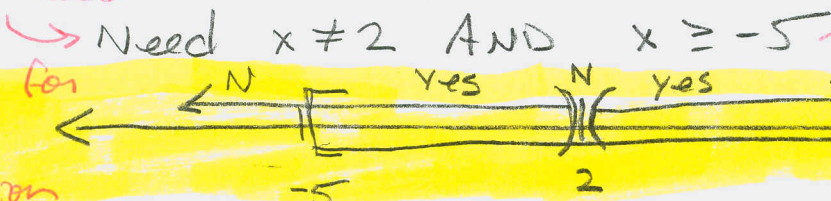
$D(g) = \{x \mid x \geq -5\}$

c. Find the following functions and find the domain of each one. You do not need to simplify the functions.

i. (5 pts) $(f+g)(x) = \frac{x+5}{x-2} + \sqrt{x+5}$

$D(f+g) =$ Either one.
 $\{x \mid x \geq -5 \text{ AND } x \neq 2\}$

All you need
Scratch for Interval Notation



$= [-5, 2) \cup (2, \infty)$

ii. (5 pts) $\left(\frac{f}{g}\right)(x) = \frac{\frac{x+5}{x-2}}{\sqrt{x+5}} = \frac{x+5}{(x-2)\sqrt{x+5}}$

Same as above, but need $\sqrt{x+5} \neq 0 \Rightarrow x+5 \neq 0$
 $\Rightarrow x \neq -5$, so throw out $x = -5$
 $\{x \mid x > -5 \text{ AND } x \neq 2\}$
Either one
 $= (-5, 2) \cup (2, \infty)$

iii. (5 pts) $(f \circ g)(x)$ (The domain on this one is a little bit tricky.)

$(f \circ g)(x) = \frac{\sqrt{x+5} + 5}{\sqrt{x+5} - 2}$. Start w/ $D(g) = \{x \mid x \geq -5\}$

Also need to keep $g(x) \in D(f)$, which means $x = -1$ throw out

Keeping $g(x) \neq 2$. $g(x) = 2$
 $\sqrt{x+5} = 2$
 $x+5 = 2^2 = 4$

$D(f \circ g) = \{x \mid x \geq -5 \text{ AND } x \neq -1\}$

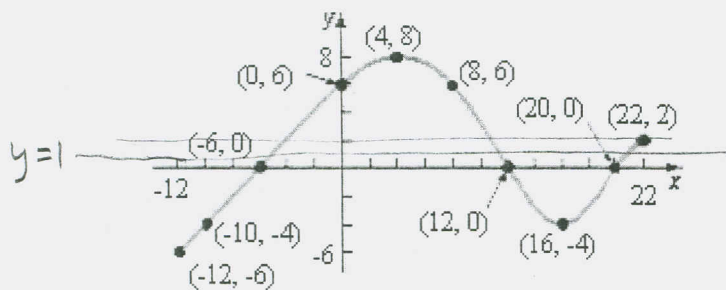
$D(f \circ g) = [-5, -1) \cup (-1, \infty)$
Interval Version

7. (10 pts) Find the difference quotient of f , that is, find $\frac{f(x+h) - f(x)}{h}$, for $f(x) = 2x^2 - 3x$. Simplify your answer.

$$\begin{aligned} \frac{f(x+h) - f(x)}{h} &= \frac{2(x+h)^2 - 3(x+h) - (2x^2 - 3x)}{h} \\ &= \frac{2(x^2 + 2xh + h^2) - 3x - 3h - 2x^2 + 3x}{h} \\ &= \frac{2x^2 + 4xh + 2h^2 - 3x - 3h - 2x^2 + 3x}{h} \\ &= \frac{4xh + 2h^2 - 3h}{h} = \frac{h(4x + 2h - 3)}{h} = \boxed{4x + 2h - 3} \end{aligned}$$

Scratch:
 $(x+h)^2 = x^2 + 2xh + h^2$

8. Use the graph of the function f , below, to answer the following questions.



- a. (2 pts) What is $f(8)$?

$$f(8) = 6$$

- b. (2 pts) Is $f(18)$ positive or negative?

Negative.

- c. (2 pts) How often does the line $y = 1$ intersect the graph of f ?

3 times.

- d. (2 pts) What is the domain of f ?

$$\mathcal{D}(f) = [-12, 22]$$

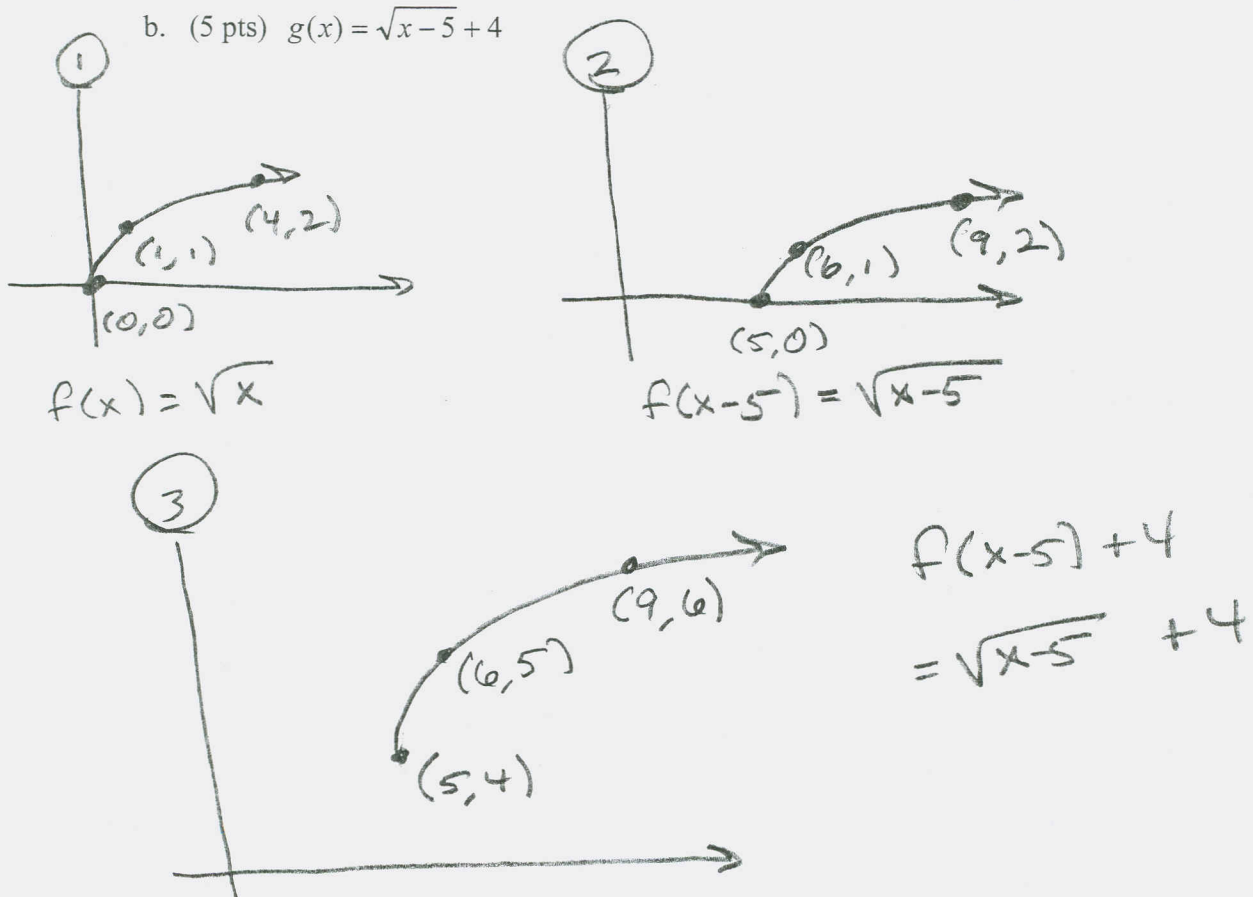
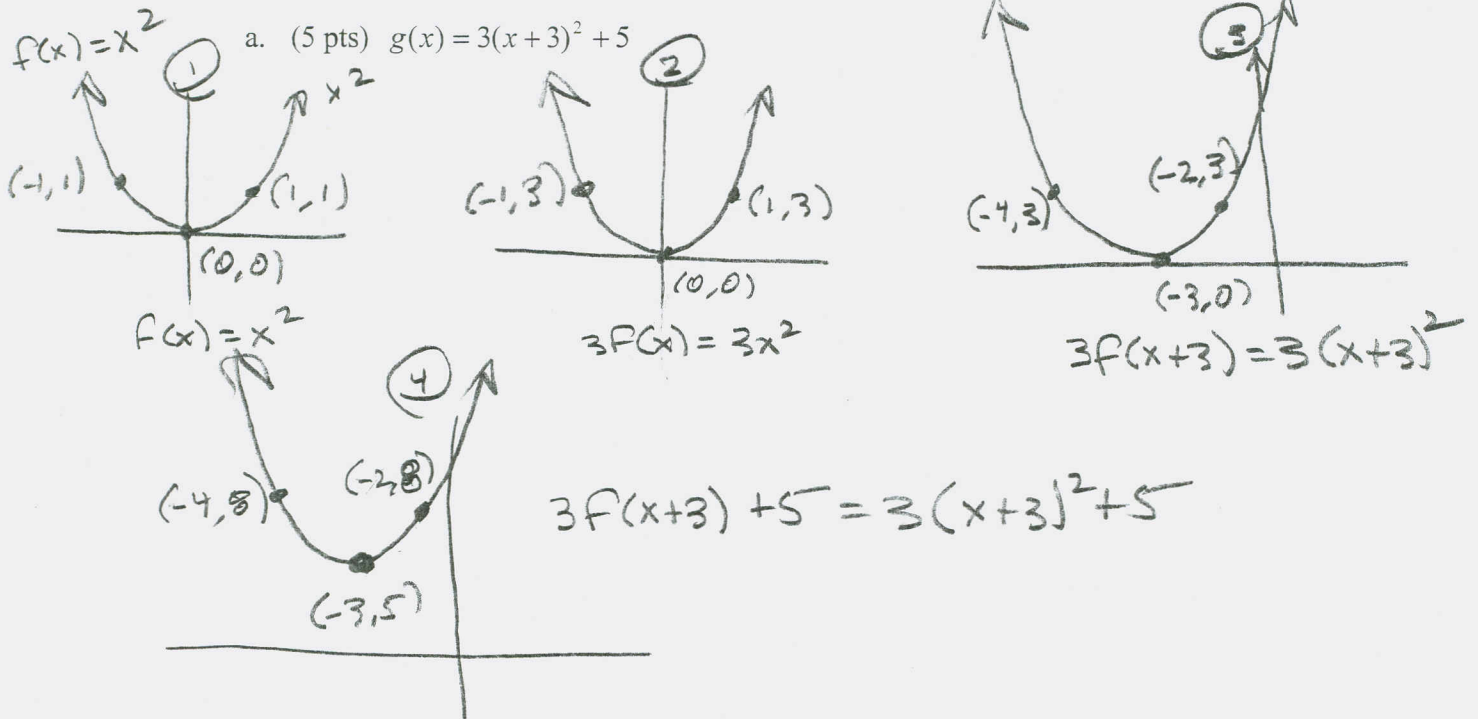
- e. (2 pts) What is the range of f ?

$$\mathcal{R}(f) = [-6, 8]$$

- f. (2 pts) List the interval(s) on which f is decreasing.

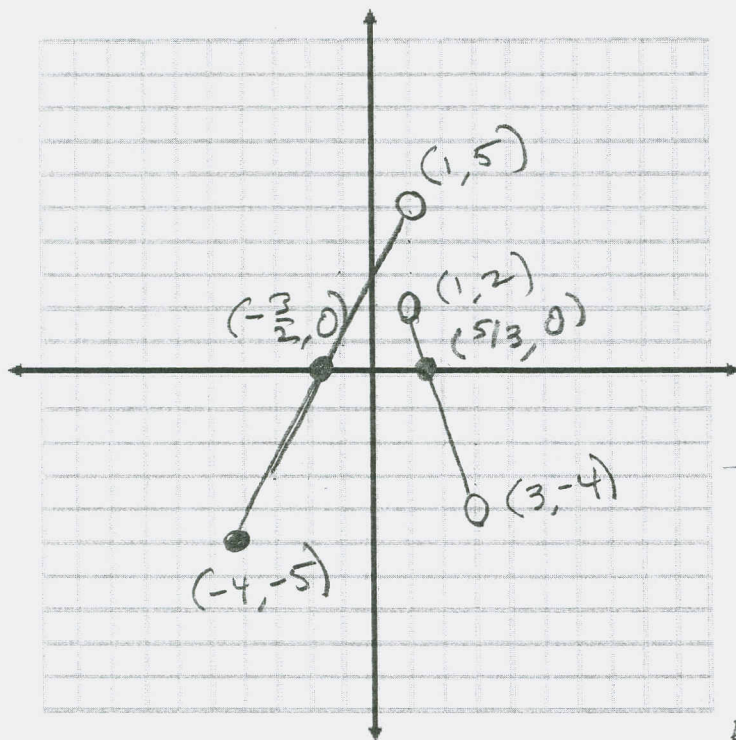
$(4, 16)$

9. Graph each of the following functions using the techniques of shifting, compressing, stretching, and/or reflecting. Start with the graph of the basic function and show all stages.



10. (5 pts) Sketch the graph of $f(x) = \begin{cases} 2x+3 & \text{if } -4 \leq x < 1 \\ -3x+5 & \text{if } 1 < x \leq 3 \end{cases}$. Include all intercepts.

State the domain and range.



x	y	$2x+3=0$
0	3	$2x=-3$
$-\frac{3}{2}$	0	$x=-\frac{3}{2}$

Suture: $2(1)+3=5$ hole
 (1, 5)

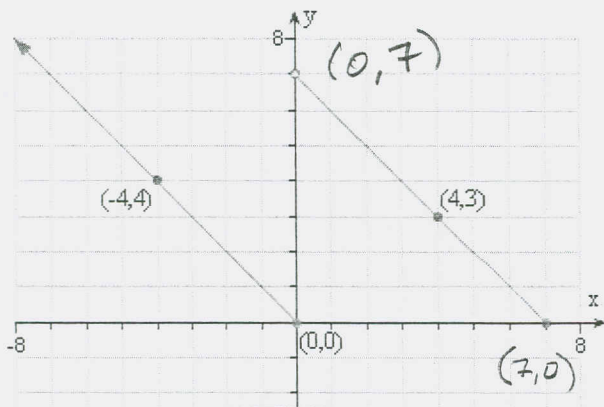
Endpt: $2(-4)+3=-5$
 (-4, -5)
 Dot

x	y	$-3x+5=0$
0	5	$-3x=-5$
$\frac{5}{3}$	0	$x=\frac{5}{3}$ hole

Suture: $-3(1)+5=2$ (1, 2)

Endpt: $-3(3)+5=-4$ (3, -4)
 Dot

11. (5 pts) Determine the piecewise-defined function g from its graph, below.



$x \leq 0$:
 $m = \frac{4-0}{-4-0} = -1$

$y = -1(x-0) + 0$
 $y = -x \quad x \leq 0$

$x > 0$
 $m = \frac{3-7}{4-0} = \frac{-4}{4} = -1$

$y = -1(x-0) + 7$
 $y = -x + 7$

$$f(x) = \begin{cases} -x & \text{if } x \leq 0 \\ -x+7 & \text{if } x > 0 \end{cases}$$