Chapter 9 Homework to show for completion marks (5/5)

Due Thursday, April 21st

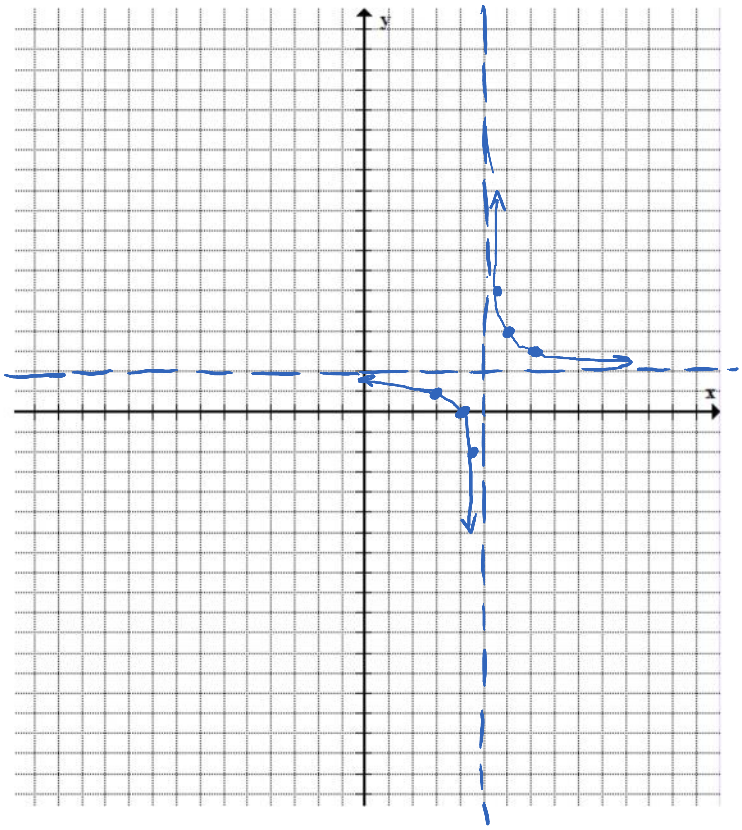
1. Describe the transformations and graph the base function AND the transformed function below – include mapping notation and the completed table of values.

   a. $y = \frac{2}{x-5} + 2$

   Describe the transformations: Vert. stretch by 2, 5 right, 2 up

$y = \frac{1}{x}$

x	y
-2	$-\frac{1}{2}$
-1	-1
$-\frac{1}{2}$	-2
0	∅
$\frac{1}{2}$	2
1	1
2	$\frac{1}{2}$



x	$2y$
-2	-1
-1	-2
$-\frac{1}{2}$	-4
0	∅
$\frac{1}{2}$	4
1	2
2	1

$x+5$	$2y+2$
3	1
4	0
$\frac{9}{2}$	-2
5	∅
$\frac{11}{2}$	6
6	4
7	3

State the domain and range: $\{x \mid x \neq 5, x \in \mathbb{R}\}$ $\{y \mid y \neq 2, y \in \mathbb{R}\}$

State the equation of the asymptote:

$x = 5$

$y = 2$

b. $y = \dfrac{1}{\frac{1}{2}(x+3)} - 4$

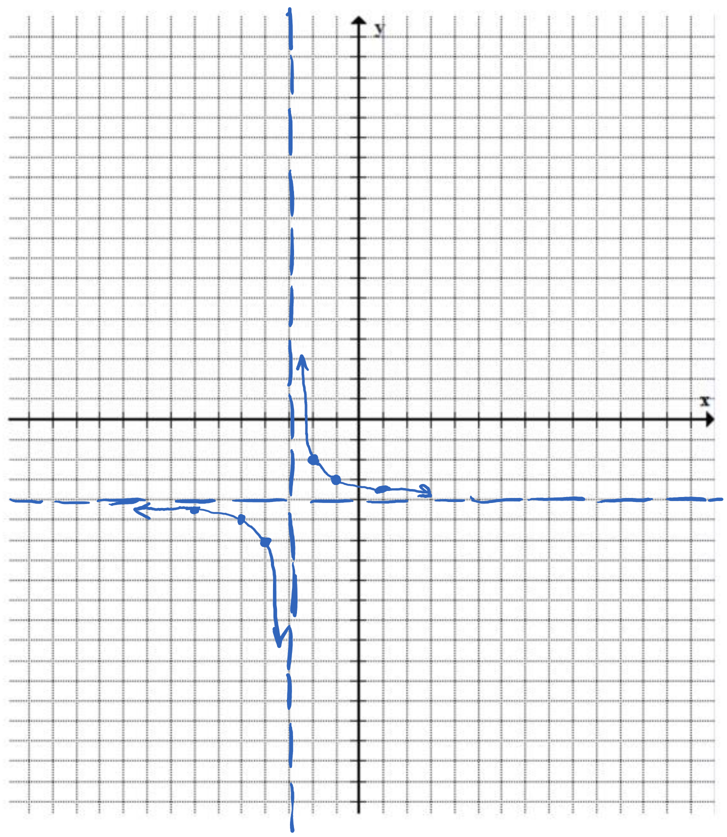
Describe the transformations: horiz. stretch by 2, 3 left, 4 down

$y = \dfrac{1}{x}$

x	y
-2	$-\frac{1}{2}$
-1	-1
$-\frac{1}{2}$	-2
0	$\varnothing$
$\frac{1}{2}$	2
1	1
2	$\frac{1}{2}$

$2x$	y
-4	$-\frac{1}{2}$
-2	-1
-1	-2
0	$\varnothing$
1	2
2	1
4	$\frac{1}{2}$

$2x-3$	$y-4$
-7	$-\frac{9}{2}$
-5	-5
-4	-6
-3	$\varnothing$
-2	-2
-1	-3
1	$-\frac{7}{2}$



State the domain and range: $\{x \mid x \neq -3, x \in \mathbb{R}\}$

$\{y \mid y \neq -4, y \in \mathbb{R}\}$

State the equation of the asymptote:

$x = -3$

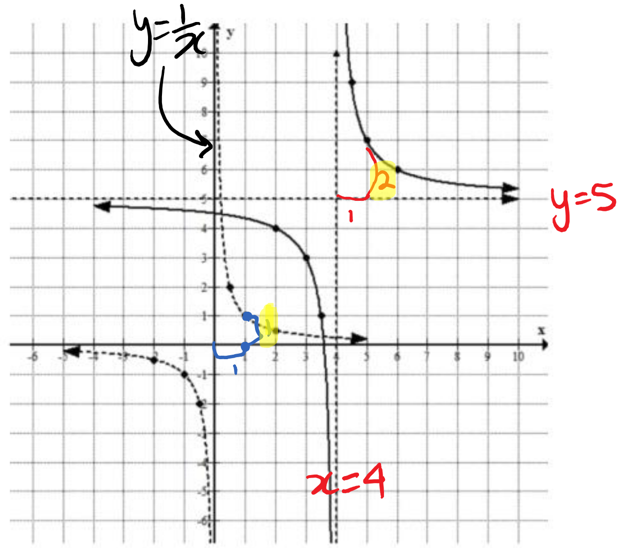
$y = -4$

2. Write an equation for each of the transformed graphs below. The base function is given.

a.

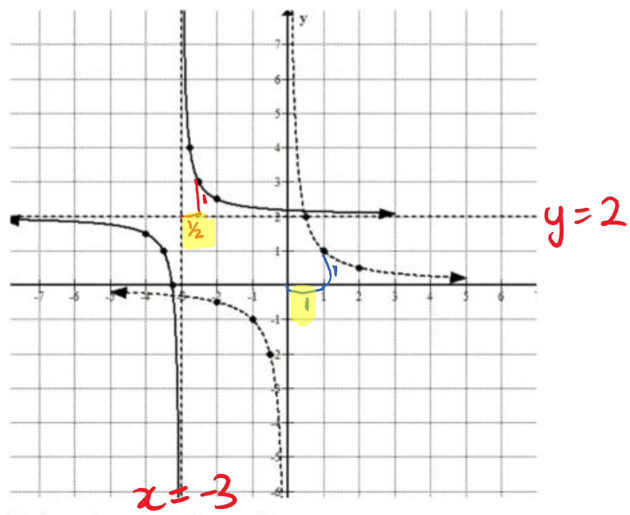
$$y=\frac{a}{b(x-h)}+k$$

$$\boxed{y=\frac{2}{x-4}+5}$$



b.

$$\boxed{y=\frac{1}{2(x+3)}+2}$$



3. Write the equation of each function with the given transformations:

a. $f(x)=\frac{1}{x}$ is stretched vertically by a factor of 2, stretched horizontal by a factor of 2, reflected in the y-axis, and translated 6 right and 3 down.

$$f(x)=\frac{2}{-\frac{1}{2}(x-6)}-3$$

b. $y=\frac{1}{x}$ is stretched horizontally by a factor of ½, reflected in the x-axis, and translated 3 left and 1 down.

$$y=-\frac{1}{2(x+3)}-1$$

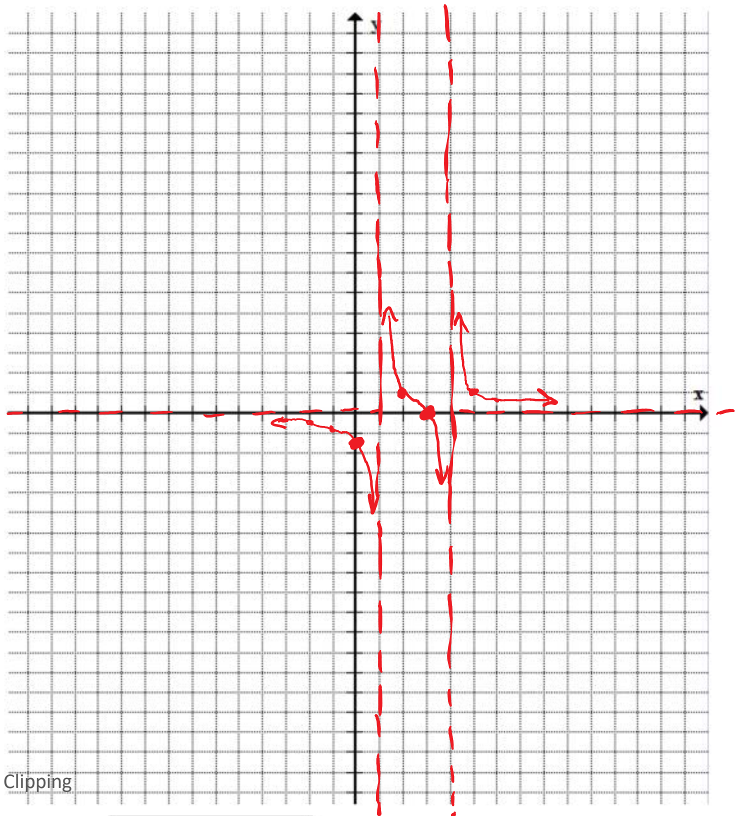
4. For each of the following functions, simplify (if possible), determine all of the characteristics of each and graph each function.

x- intercept
x=3

a. $y = \dfrac{2x-6}{x^2-5x+4}$

$$y = \frac{2(x-3)}{(x-4)(x-1)}$$

vertical asymptotes
$x=4$
$x=1$



X	Y_1
-3	-.4286
-2	-.5556
-1	-.8
0	-1.5
1	ERROR
2	1
3	0

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X	Y_1
3	0
4	ERROR
5	1
6	.6
7	.44444
8	.35714
9	.3

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Characteristic	Answer
Restrictions	$x \neq 4, x \neq 1$ $(y \neq 0)$
Asymptote(s)	$x = 4$, $x = 1$ $(y = 0)$
Point(s) of Discontinuity	none
x-intercept	$(3, 0)$
y-intercept	$(0, -\frac{3}{2})$
Domain	$\{x \mid x \neq 1, x \neq 4, x \in \mathbb{R}\}$
Range	$\{y \mid y \in \mathbb{R}\}$

Show work here:

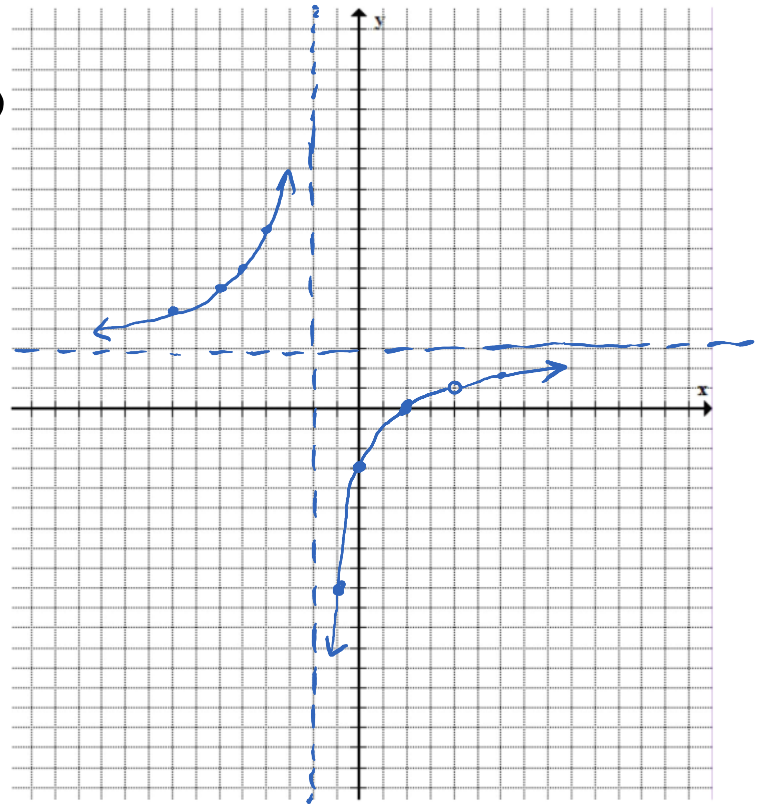
$$y = \frac{2(0)-6}{(0)^2-5(0)+4} = \frac{-6}{4} = -\frac{3}{2}$$

b. $y = \dfrac{3x^2 - 18x + 24}{x^2 - 2x - 8}$

$$y = \frac{3(x^2-6x+8)}{x^2-2x-8}$$

$$y = \frac{3(x-2)\cancel{(x-4)}}{\cancel{(x-4)}(x+2)}$$

$$\boxed{y = \frac{3(x-2)}{x+2}}$$



Characteristic	Answer
Restrictions	$x \neq -2$ $x \neq 4$ $y \neq 3$
Asymptote(s)	$x = -2$ $y = 3$
Point(s) of Discontinuity	$(4, 1)$
x-intercept	$x = 2.$ $(2, 0)$
y-intercept	$y = -3$ $(0, -3)$
Domain	$\{x \mid x \neq -2, x \neq 4, x \in \mathbb{R}\}$
Range	$\{y \mid y \neq 3, y \neq 1, y \in \mathbb{R}\}$

Show work here:

$$y = \frac{3(4-2)}{4+2} = 1$$

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

c. $y = \dfrac{2x^2 - 3x - 5}{2x - 5}$

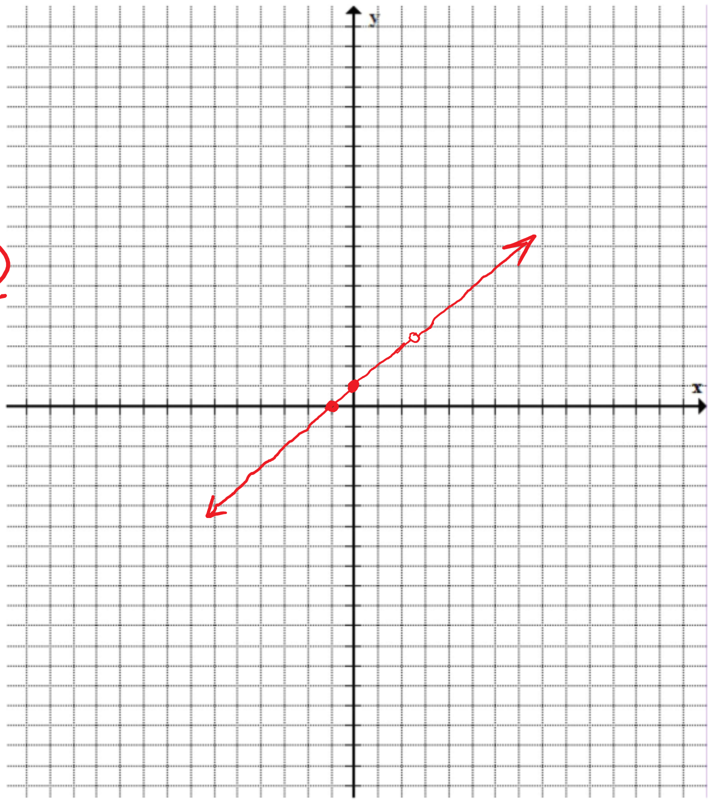
$2x \cdot -5 = -10$

$-5, +2$

$(2x-5)(\cancel{2}x+\cancel{2})$

$(2x-5)(x+1) \rightarrow y = \dfrac{\cancel{(2x-5)}(x+1)}{\cancel{2x-5}}$

$y = x+1$



Characteristic	Answer
Restrictions	$x \neq \frac{5}{2}$
Asymptote(s)	none
Point(s) of Discontinuity	$(\frac{5}{2}, \frac{7}{2})$
x-intercept	$(-1, 0)$
y-intercept	$(0, 1)$
Domain	$\{x \mid x \neq \frac{5}{2}, x \in \mathbb{R}\}$
Range	$\{y \mid y \neq \frac{7}{2}, y \in \mathbb{R}\}$

Show work here:

$2x - 5 \neq 0$

$2x \neq 5$

$x \neq \frac{5}{2}$

$y = \frac{5}{2} + 1$

$= \frac{5}{2} + \frac{2}{2} = \frac{7}{2}$

$y = 0 + 1$

$= 1$

$y=2$ horiz. asymp.

d. $y = \dfrac{2x^2+7x-4}{x^2+x-12}$

$2x \cdot -4 = -8$

$8, -1$

$(\cancel{2}x+\cancel{8})(2x-1)$

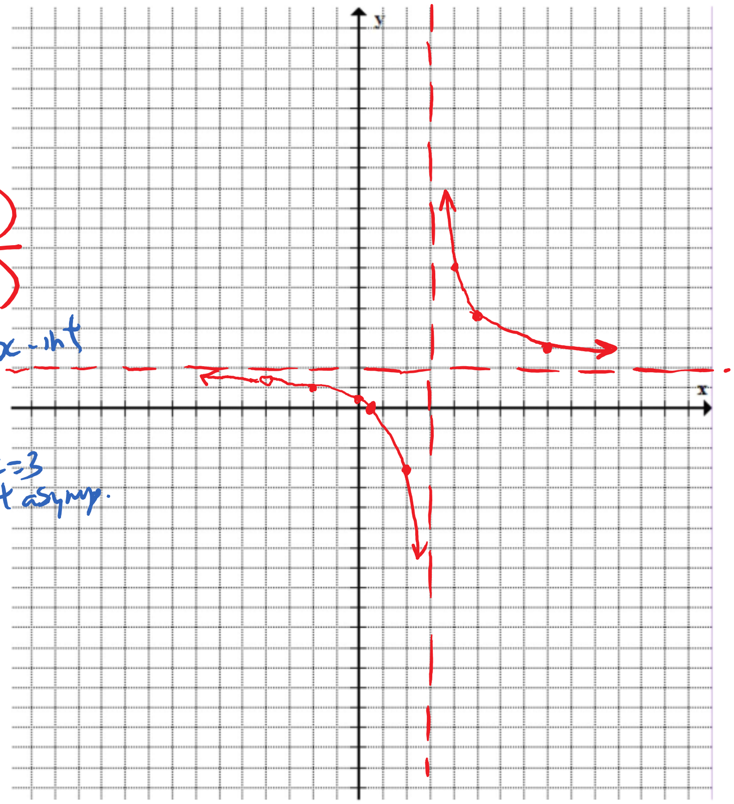
$(x+4)(2x-1) \rightarrow$

$$y = \frac{\cancel{(x+4)}(2x-1)}{\cancel{(x+4)}(x-3)}$$

$$y = \frac{2x-1}{x-3}$$

x-int

$x=3$ vert asymp.



X	Y_1
-4	1.2857
-3	1.1667
-2	1
-1	.75
0	.33333
1	-.5
2	-3

X	Y_1
3	ERROR
4	7
5	4.5
6	3.6667
7	3.25
8	3
9	2.8333

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Characteristic	Answer
Restrictions	$x \neq -4, x \neq 3, y \neq 2$
Asymptote(s)	$x=3 \quad y=2$
Point(s) of Discontinuity	$\left(-4, \frac{9}{7}\right)$
x-intercept	$\left(\frac{1}{2}, 0\right)$
y-intercept	$\left(0, \frac{1}{3}\right)$
Domain	$\{x \mid x \neq -4, x \neq -3, x \in \mathbb{R}\}$
Range	$\{y \mid y \neq 2, y \neq \frac{9}{7}, y \in \mathbb{R}\}$

Show work here:

$$y = \frac{2(-4)-1}{-4-3} = \frac{-9}{-7} = \frac{9}{7}$$

$2x-1=0$

$2x=1$

$x=\frac{1}{2}$

$$y = \frac{2(0)-1}{0-3} = \frac{-1}{-3} = \frac{1}{3}$$

5. Given the following information, determine a possible equation for the rational function: Show the final polynomial form of the rational function.
   a. Vertical asymptotes at $x=-4$ and $x=2$, an x-intercept at $x=5$ and $x=-2$

$$y=\frac{(x-5)(x+2)}{(x+4)(x-2)}$$

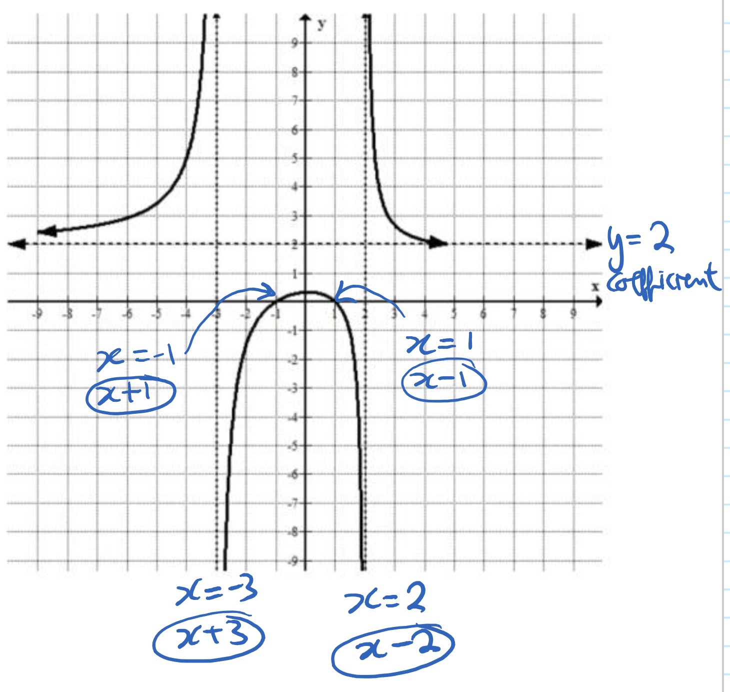
$$\boxed{y=\frac{x^2-3x-10}{x^2+2x-8}}$$

   b. A vertical asymptote at $x=-3$, x-intercept at $x=2$, a horizontal asymptote at $y=-4$, and a point of discontinuity at $x=1$

$$y=\frac{-4(x-2)(x-1)}{(x+3)(x-1)}=\frac{-4(x^2-3x+2)}{(x^2+2x-3)}$$

$$\boxed{y=\frac{-4x^2+12x-8}{x^2+2x-3}}$$

6. Given the graph of the rational function below, determine a possible equation of the function: Show the final polynomial form of the rational function.
   a.



$$y=\frac{2(x+1)(x-1)}{(x+3)(x-2)}$$

$$y=\frac{2(x^2-1)}{x^2+x-6}$$

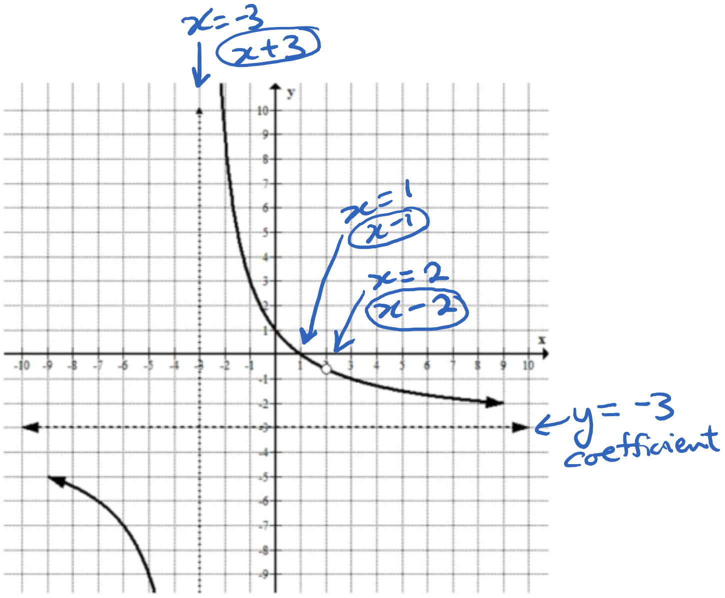
$$\boxed{y=\frac{2x^2-2}{x^2+x-6}}$$

b.

$$y = \frac{-3(x-1)(x-2)}{(x+3)(x-2)}$$

$$y = \frac{-3(x^2-3x+2)}{(x^2+x-6)}$$

$$\boxed{y = \frac{-3x^2+9x-6}{x^2+x-6}}$$



7. Solve the following functions graphically and two different ways of solving graphically:

a. $2x - x^2 = \frac{x-5}{x+9}$

$$\left.\begin{aligned} y_1 &= 2x - x^2 \\ y_2 &= \frac{x-5}{x+9} \end{aligned}\right\} \text{5: intercepts}$$

$x = -0.2661$

$x = 2.1220$

or $\quad y = 2x - x^2 - \frac{x-5}{x+9} \Big\}$ 2: zeros.

b. $x = \frac{x^2}{x^2-9} + 6x$

$$\left.\begin{aligned} y_1 &= x \\ y_2 &= \frac{x^2}{x^2-9} + 6x \end{aligned}\right\} \text{5: intercepts}$$

$x = -3.1017$

$x = 0$

$x = 2.9017$

or $\quad y_1 = \frac{x^2}{x^2-9} + 5x \Big\}$ 2: zeros.

8. Solve the following algebraically and show all restrictions:

a. $3x+2=\dfrac{5x+4}{x+1}$

$$(x+1)(3x+2) = \cancel{(x+1)}\left(\frac{5x+4}{\cancel{x+1}}\right)$$

$(x+1)3x + (x+1)2$

Restrictions

$x+1 \neq 0$

$x \neq -1$

$$3x^2+5x+2 = 5x+4$$

$$3x^2-2=0$$

$$3x^2=2$$

$$x^2=\frac{2}{3}$$

$$\boxed{x = \pm\sqrt{\frac{2}{3}}}$$

b. $\left(\dfrac{3x}{4x+1}\right)-1=\dfrac{x}{2x-1}$

Restrictions

$x \neq -\frac{1}{4}$

$x \neq \frac{1}{2}$

$$\cancel{(4x+1)}(2x-1)\left(\frac{3x}{\cancel{4x+1}}\right) - 1(4x+1)(2x-1) = (4x+1)\cancel{(2x-1)}\left(\frac{x}{\cancel{2x-1}}\right)$$

$$6x^2-3x \quad -8x^2+2x+1 = 4x^2+x$$

$$-(-6x^2-2x+1)=0$$

$$6x^2+2x-1=0$$

$$x=\frac{-2\pm\sqrt{2^2-4(6)(-1)}}{2(6)}$$

$$x=\frac{-2\pm\sqrt{28}}{12} = \frac{-\cancel{2}\pm\cancel{2}\sqrt{7}}{\cancel{12}}$$

$$\boxed{x=\frac{-1\pm\sqrt{7}}{6}}$$

Restrictions

$x \neq 3$
$x \neq -3$

c. $\frac{1}{x^2 - 9} + \frac{1}{x + 3} = 0$

$$\frac{1}{(x+3)(x-3)} + \frac{1}{x+3} = 0$$

$$\cancel{(x+3)}\cancel{(x-3)}\left(\frac{1}{\cancel{(x+3)}\cancel{(x-3)}}\right) + \cancel{(x+3)}(x-3)\left(\frac{1}{\cancel{x+3}}\right) = (\;)(\;)0$$

$$1 + x - 3 = 0$$

$$\boxed{x = 2}$$ valid

Restrictions $x \neq 1$
$x = 3$

d. $\frac{2x}{x-1} - \frac{x}{x^2 - 4x + 3} = \frac{x+1}{x-3} - 2$

$(x-3)(x-1)$

$$(x-3)\cancel{(x-1)}\left(\frac{2x}{\cancel{x-1}}\right) - \cancel{(\;)(\;)}\left(\frac{x}{\cancel{(\;)(\;)}}\right) = \cancel{(x-3)}(x-1)\left(\frac{x+1}{\cancel{x-3}}\right)$$

$$2x(x-3) - x = (x-1)(x+1) \quad -2(x-3)(x-1)$$

$-2(x^2-4x+3)$

$$2x^2 - 6x - x = x^2 - 1 - 2x^2 + 8x - 6$$

$$3x^2 - 15x + 7 = 0$$

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3 , 7

$$x = \frac{-(-15) \pm \sqrt{(-15)^2 - 4(3)(7)}}{2(3)}$$

Restrictions
$x \neq 3, x \neq 1$

$$\boxed{x = \frac{15 \pm \sqrt{141}}{6}}$$

g