Graphing Transformations of 1/x

Asymptote: a line that a curve approaches but never reaches

Parent Function $f(x)=\frac{1}{x}$

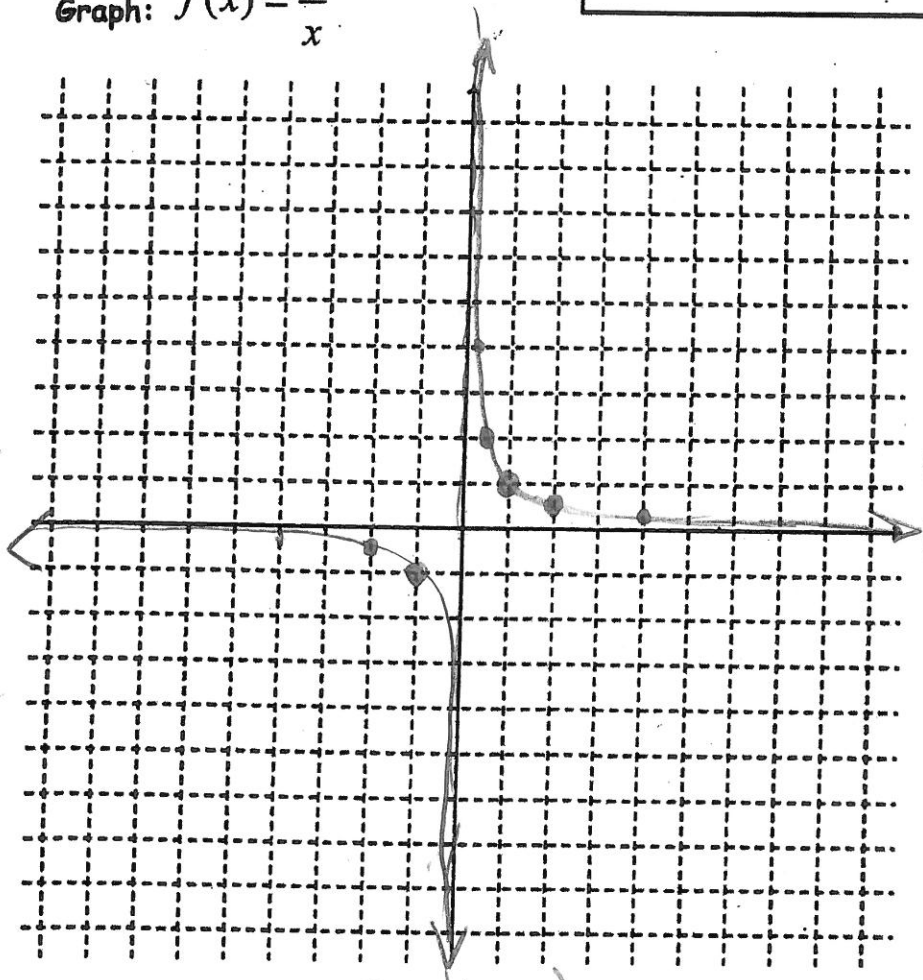
Horizontal Asymptote at y=0

Vertical Asymptote at x=0

General Form: $f(x)=\frac{a}{x-h}+k$

- Horizontal Asymptote at y = k
- Vertical Asymptote at x =h
- (h,k) is the intersection of the asymptote
- "a" vertically stretches of shrinks, if a is negative the graph flips over the x axis

Graph: $f(x)=\frac{1}{x}$



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

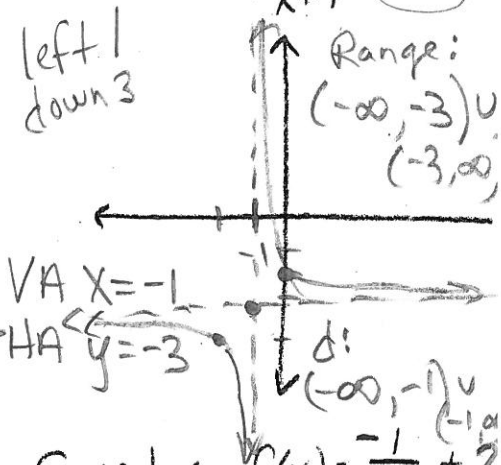
$x\neq 0$

Domain: $(-\infty,0)\cup(0,\infty)$ H.A $y=0$

Range: $(-\infty,0)\cup(0,\infty)$ V.A $x=0$

Graph: $f(x)=\frac{1}{x+1}-3$

left 1
down 3



Range: $(-\infty,-3)\cup(-3,\infty)$

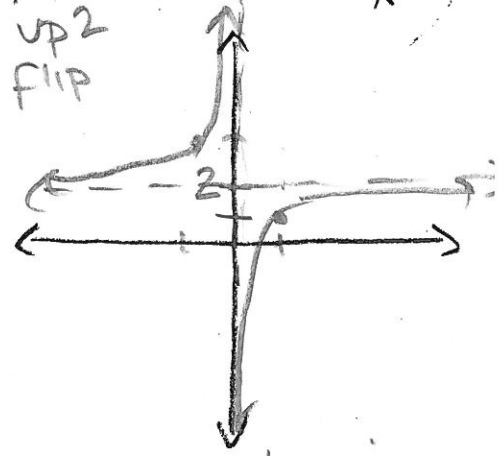
VA $x=-1$

HA $y=-3$

D: $(-\infty,-1)\cup(-1,\infty)$

Graph: $f(x)=\frac{-1}{x}+2$

up 2
flip



VA: $x=0$

HA: $y=2$

domain $(-\infty,0)\cup(0,\infty)$

range: $(-\infty,2)\cup(2,\infty)$

Graphing Transformations of $1/x^2$

Asymptote: a line that a curve approaches but never reaches

Parent Function $f(x)=\frac{1}{x^2}$

Horizontal Asymptote at y=0

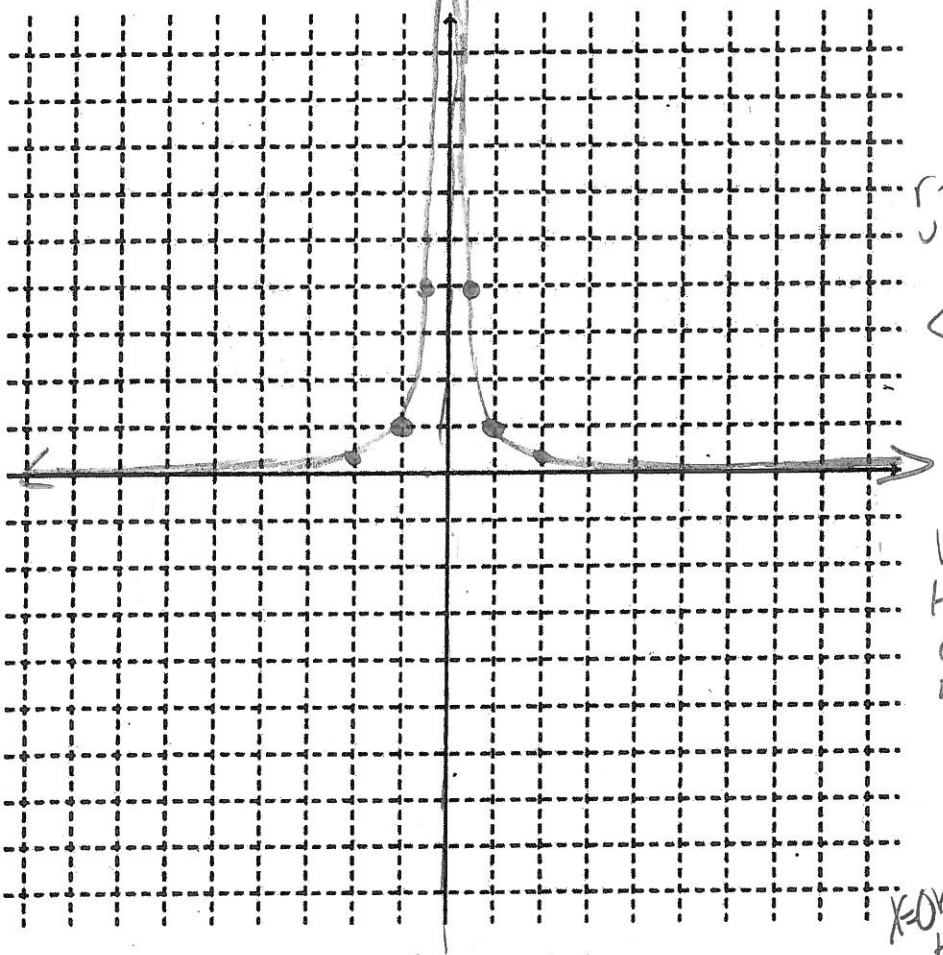
Vertical Asymptote at x=0

General Form: $f(x)=\frac{a}{(x-h)^2}\pm k$

- Horizontal Asymptote at y = k
- Vertical Asymptote at x =h
- (h,k) is the intersection of the asymptote
- "a" vertically stretches of shrinks, if a is negative the graph flips over the x axis

Graph: $f(x)=\frac{1}{x^2}$

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

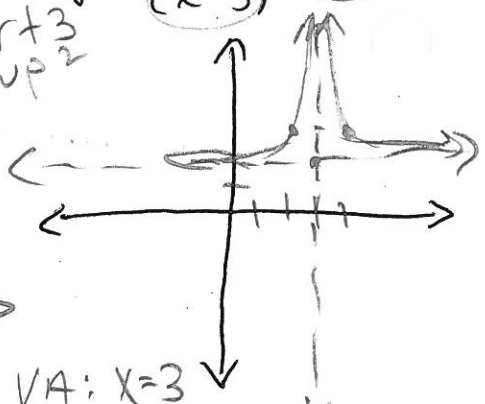


Domain: $(-\infty,0)\cup(0,\infty)$ H.A. $y=0$

Range: $(0,\infty)$ V.A. $x=0$

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

r+3 up 2



VA: x=3

HA: y=2

d: $(-\infty,3)\cup(3,\infty)$

r: $(2,\infty)$

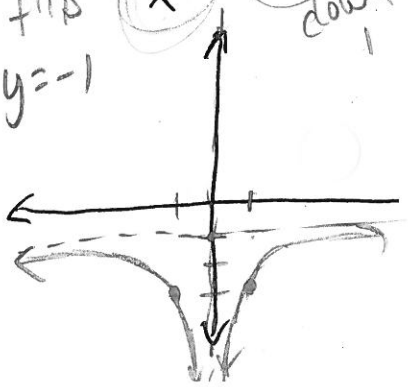
Graph: $y=\frac{-2}{x^2}-1$

flip

x=0 VA

HA: y=-1

down 1



d:

r:

Kuta Software - Infinite Algebra 2 Name_____

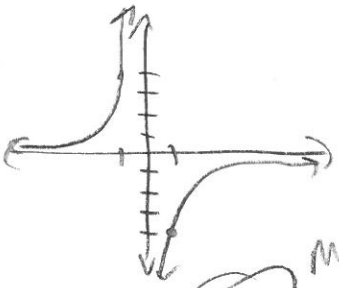
Graphing Simple Rational Functions

Date_____ Period____

Identify the vertical asymptotes, horizontal asymptote, domain, and range of each. Sketch.

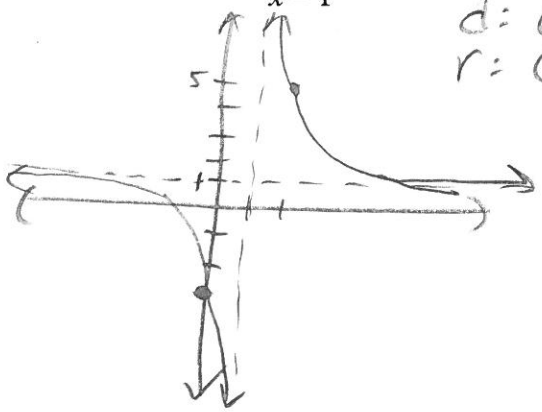
1) $f(x) = -\frac{4}{x}$

VA: $x = 0$
HA: $y = 0$
d: $(-\infty, 0) \cup (0, \infty)$
r: $(-\infty, 0) \cup (0, \infty)$



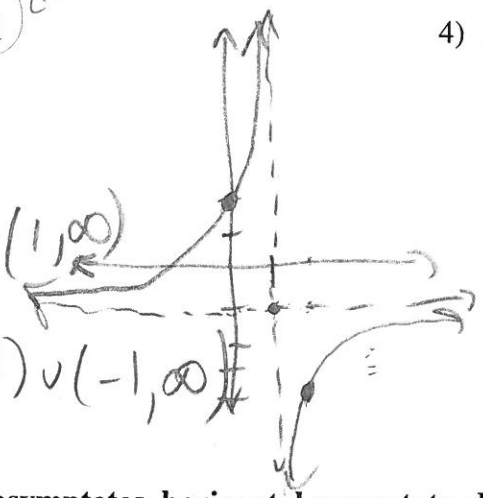
2) $f(x) = \frac{4}{x-1} + 1$

VA: $x = 1$
HA: $y = 1$
d: $(-\infty, 1) \cup (1, \infty)$
r: $(-\infty, 1) \cup (1, \infty)$



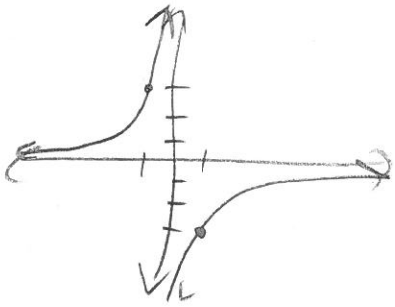
3) $f(x) = -\frac{3}{x-1} - 1$ multiply by 3, down 1

VA: $x = 1$
HA: $y = -1$
dom: $(-\infty, 1) \cup (1, \infty)$
range: $(-\infty, -1) \cup (-1, \infty)$



4) $f(x) = -\frac{3}{x}$

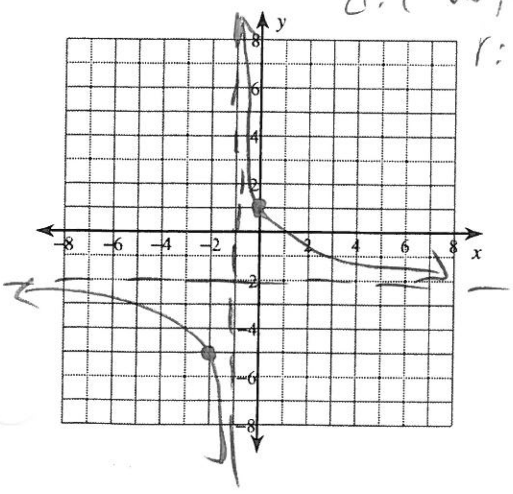
VA: $x = 0$
HA: $y = 0$
d: $(-\infty, 0) \cup (0, \infty)$
r: $(-\infty, 0) \cup (0, \infty)$



Identify the vertical asymptotes, horizontal asymptote, domain, and range of each. Then sketch the graph.

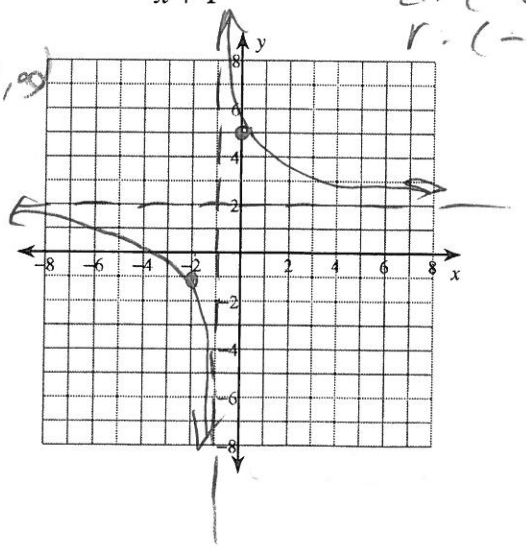
5) $f(x) = \frac{3}{x+1} - 2$

VA: $x = -1$
HA: $y = -2$
d: $(-\infty, -1) \cup (-1, \infty)$
r: $(-\infty, -2) \cup (-2, \infty)$



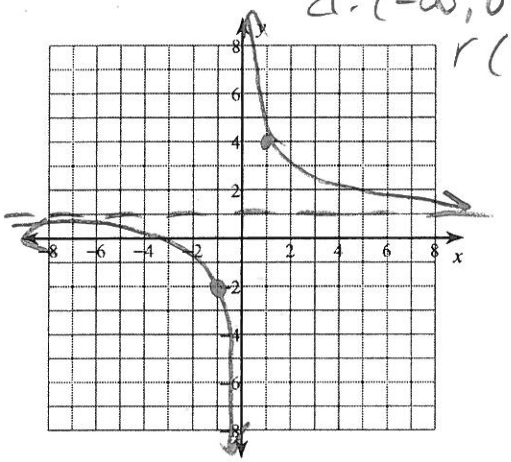
6) $f(x) = \frac{3}{x+1} + 2$

VA $x = -1$
HA $y = 2$
d: $(-\infty, -1) \cup (-1, \infty)$
r: $(-\infty, 2) \cup (2, \infty)$



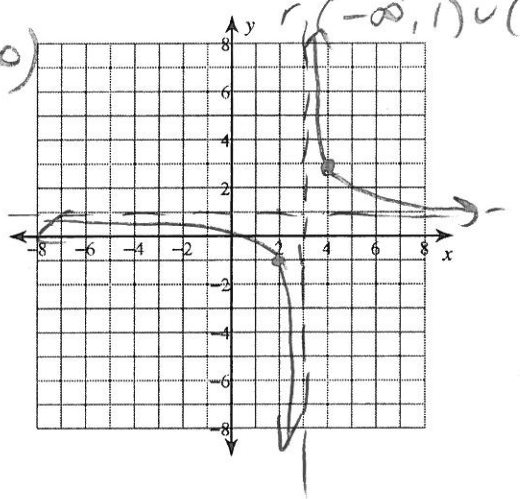
7) $f(x)=\frac{3}{x}+1$

VA $x=0$
HA $y=1$
d: $(-\infty,0)\cup(0,\infty)$
r $(-\infty,1)\cup(1,\infty)$



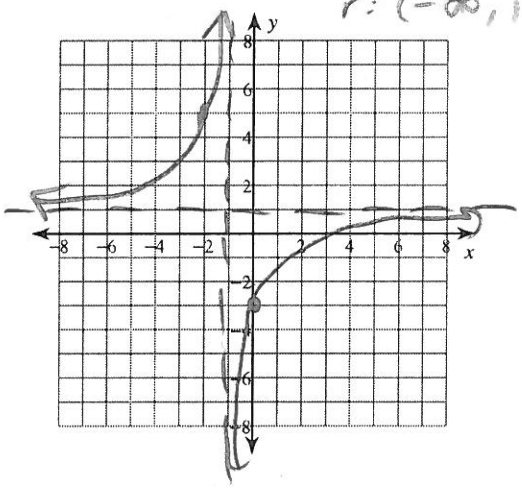
8) $f(x)=\frac{2}{x-3}+1$

VA: $x=3$
HA: $y=1$
d $(-\infty,3)\cup(3,\infty)$
r $(-\infty,1)\cup(1,\infty)$



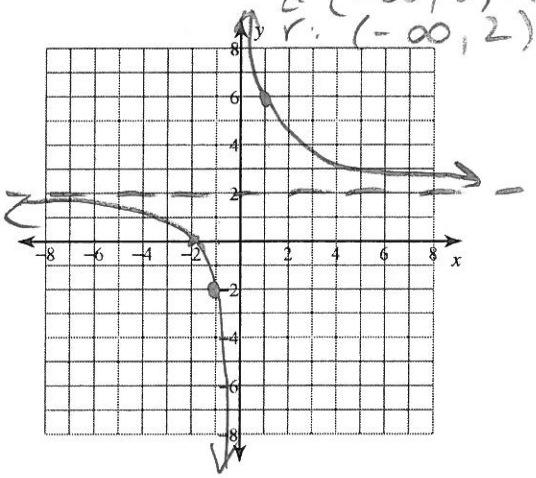
9) $f(x)=-\frac{4}{x+1}+1$

VA: $x=-1$
HA: $y=1$
d: $(-\infty,-1)\cup(-1,\infty)$
r: $(-\infty,1)\cup(1,\infty)$



10) $f(x)=\frac{4}{x}+2$

VA $x=0$
HA $y=2$
d $(-\infty,0)\cup(0,\infty)$
r: $(-\infty,2)\cup(2,\infty)$



Critical thinking question:

11) Write a function of the form $f(x)=\frac{a}{x-h}+k$ with a vertical asymptote at $x=25$, horizontal asymptote at $y=3$ and passing through $(24,5)$

$y=\frac{a}{x-25}+3$

$5=\frac{a}{24-25}+3$ $\quad 2=\frac{a}{-1}$ $\quad a=-2$

$y=\frac{-2}{x-25}+3$

Name Key Date _____ Period _____

Graphing Rational Functions Worksheet 2

Find the VA and HA of the following:

1. $\frac{x^2+4x-5}{x^2+9x+20} = \frac{(x+5)(x-1)}{(x+4)(x+5)}$

VA $x=-4$

HA $y=1$

hole: $(-5,6)$

2. $\frac{x^2-9}{x+3}$ $\frac{(x+3)(x-3)}{x+3}$

VA none

HA none

hole: $(-3,-6)$

3. $\frac{x+6}{2x^2+9x-18}$ $(2x-3)(x+6)$

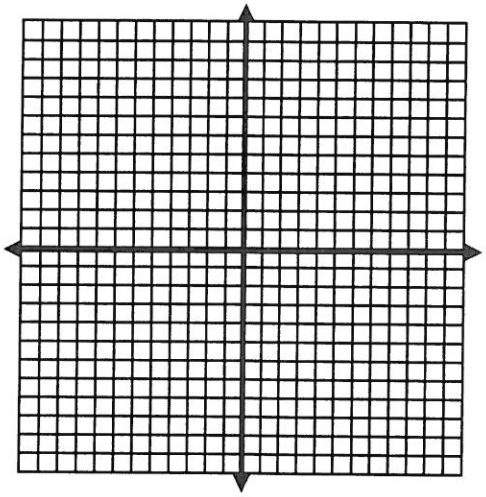
VA $x=3/2$

HA $y=0$

hole: $(-6,-\frac{1}{15})$

Graph each equation and fill in all the blanks.

4. $y=\frac{3}{x+2}$



Domain $(-\infty,-2)\cup(-2,\infty)$

VA $x=-2$

Holes none

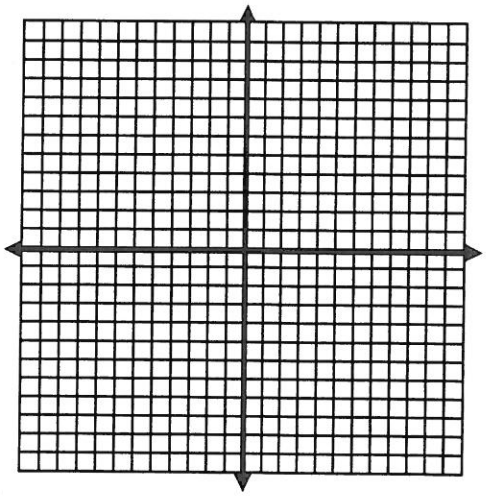
-int none

y-int $(0,3/2)$

HA $y=0$

Continuous/Discontinuous infinite

5. $y=\frac{x^2-9}{x-3} = \frac{(x-3)(x+3)}{x-3}$



Domain $(-\infty,3)\cup(3,\infty)$

VA none

Holes $(3,6)$

x-int $(-3,0)$

y-int $(0,3)$

A none

Continuous/Discontinuous hole (removable)

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

Domain $(-\infty, 2) \cup (2, \infty)$

VA $x = 2$

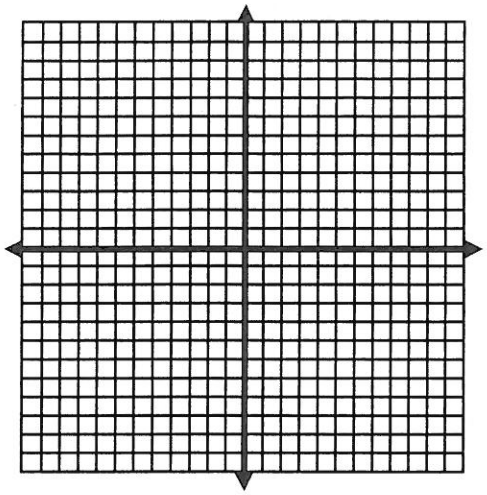
Holes none

x-int $(3, 0)(-1, 0)$

y-int $(0, 3/2)$

HA none

Continuous/Discontinuous infinite



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

Domain $(-\infty, 3) \cup (3, \infty)$

VA $x = 3$

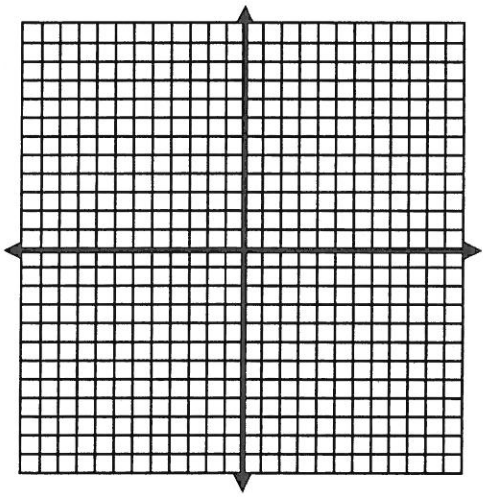
Holes none

x-int $(-1, 0)$

y-int $(0, 1/9)$

HA $y = 0$

Continuous/Discontinuous infinite @ 3



8. $y = \frac{x-4}{-4x-16} = \frac{x-4}{-4(x+4)}$

Domain $(-\infty, -4) \cup (-4, \infty)$

VA $x = -4$

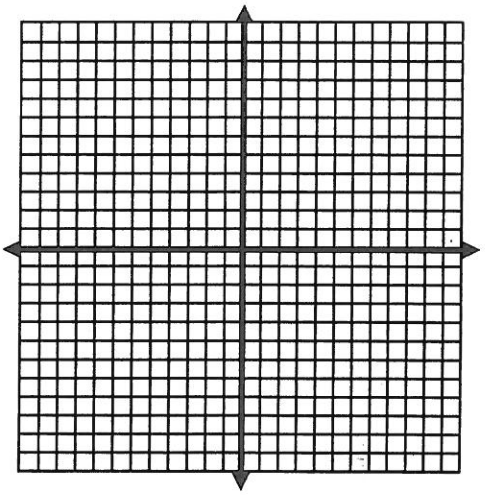
Holes none

x-int $(4, 0)$

y-int $(0, 1/4)$

HA $y = -1/4$

Continuous/Discontinuous infinite



Kuta Software - Infinite Algebra 2 Name Key

Graphing Rational Functions

Date _____ Period ____

Identify the points of discontinuity, holes, vertical asymptotes, x-intercepts, and horizontal asymptote of each.

1) $f(x) = \dfrac{1}{3x^2 + 3x - 18}$

Discontinuities: $-3, 2$
Vertical Asym.: $x = -3$, $x = 2$
Holes: None
Horz. Asym.: $y = 0$
X-intercepts: None

2) $f(x) = \dfrac{x - 2}{x - 4}$

Discontinuities: 4
Vertical Asym.: $x = 4$
Holes: None
Horz. Asym.: $y = 1$
X-intercepts: 2 (2, 0)

3) $f(x) = \dfrac{x^3 - x^2 - 6x}{-3x^2 - 3x + 18}$

Discontinuities: $2, -3$
Vertical Asym.: $x = 2$, $x = -3$
Holes: None
Horz. Asym.: None
X-intercepts: $0, -2, 3$
(0,0) (-2,0) (3,0)

4) $f(x) = \dfrac{x^2 + x - 6}{-4x^2 - 16x - 12}$

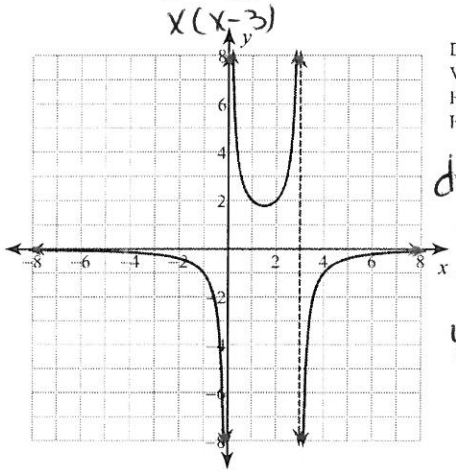
$-4(x^2+4x+3)$
$= \dfrac{(x+3)(x-2)}{-4(x+3)(x+1)}$

Discontinuities: $-1, -3$
Vertical Asym.: $x = -1$
Holes: $x = -3$ $(-3, \frac{5}{8})$
Horz. Asym.: $y = -\dfrac{1}{4}$
$-5/8$
X-intercepts: 2 (2, 0)

Identify the points of discontinuity, holes, vertical asymptotes, and horizontal asymptote of each. Then sketch the graph.

5) $f(x) = -\dfrac{4}{x^2 - 3x}$

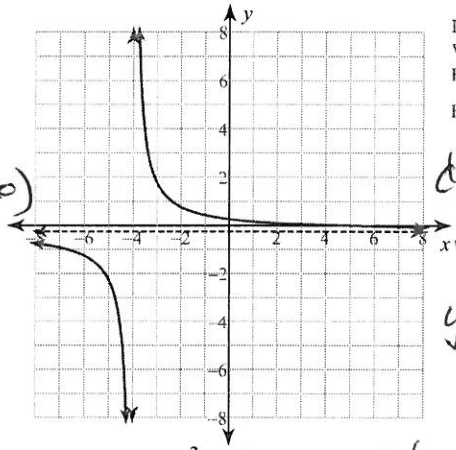
$x(x-3)$



Discontinuities: 0, 3
Vertical Asym.: $x = 0$, $x = 3$
Holes: None
Horz. Asym.: $y = 0$

domain: $(-\infty, 0) \cup (0, 3) \cup (3, \infty)$
x int none
y int none

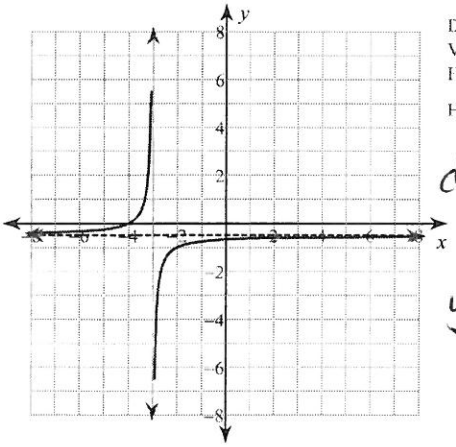
6) $f(x) = \dfrac{x - 4}{-4x - 16}$



Discontinuities: -4
Vertical Asym.: $x = -4$
Holes: None
Horz. Asym.: $y = -\frac{1}{4}$

dom: $(-\infty, -4) \cup (-4, \infty)$
x int: $(4, 0)$
y int: $(0, -1)$

7) $f(x) = \dfrac{x + 4}{-2x - 6}$



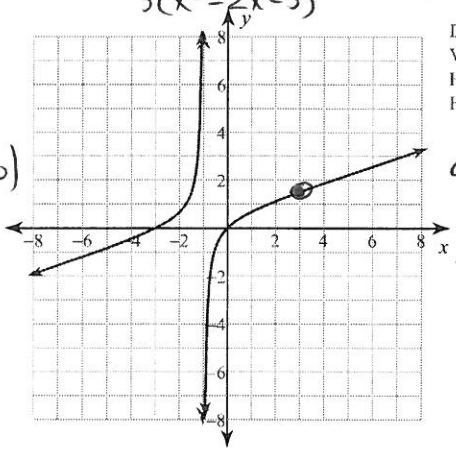
Discontinuities: -3
Vertical Asym.: $x = -3$
Holes: None
Horz. Asym.: $y = -\frac{1}{2}$

dom $(-\infty, -3) \cup (-3, \infty)$
x int $(-4, 0)$
y int $(0, -2/3)$

8) $f(x) = \dfrac{x^3 - 9x}{3x^2 - 6x - 9}$

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

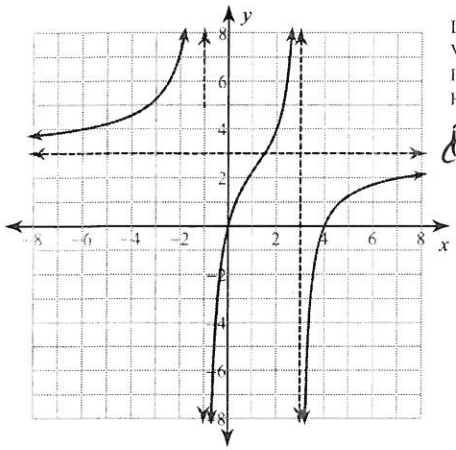
$= \dfrac{x(x-3)(x+3)}{3(x-3)(x+1)}$



Discontinuities: $-1, 3$
Vertical Asym.: $x = -1$
Holes: $x = 3$ $(3, \frac{3}{2})$
Horz. Asym.: None

dom: $(-\infty, -1) \cup (-1, 3) \cup (3, \infty)$
x int & y int $(0, 0)$

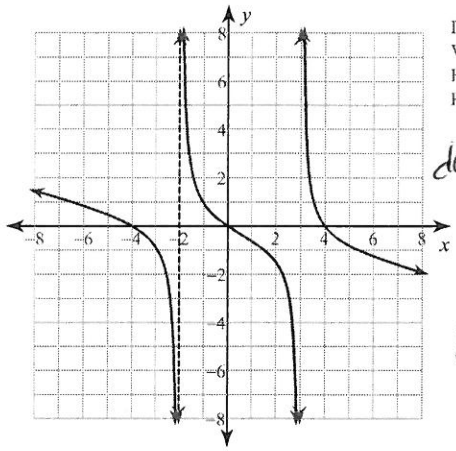
9) $f(x) = \dfrac{3x^2 - 12x}{x^2 - 2x - 3}$



Discontinuities: $-1, 3$
Vertical Asym.: $x = -1, x = 3$
Holes: None
Horz. Asym.: $y = 3$

dom: $(-\infty, -1) \cup (-1, 3) \cup (3, \infty)$
x+y int $(0,0)$
x int: $(4,0)$

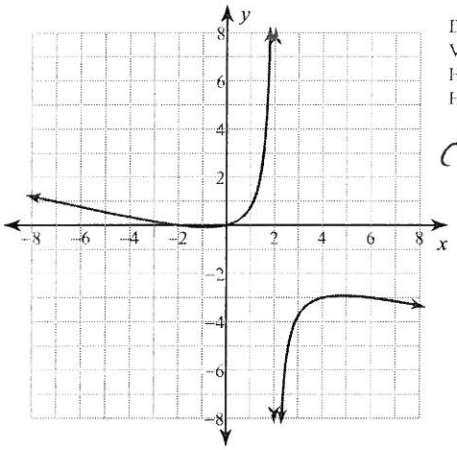
10) $f(x) = \dfrac{x^3 - 16x}{-4x^2 + 4x + 24}$



Discontinuities: $3, -2$
Vertical Asym.: $x = 3, x = -2$
Holes: None
Horz. Asym.: None

dom $(-\infty, -2) \cup (-2, 3) \cup (3, \infty)$
x int: $(0,0)$ $(4,0)$ $(-4,0)$
y int $(0,0)$

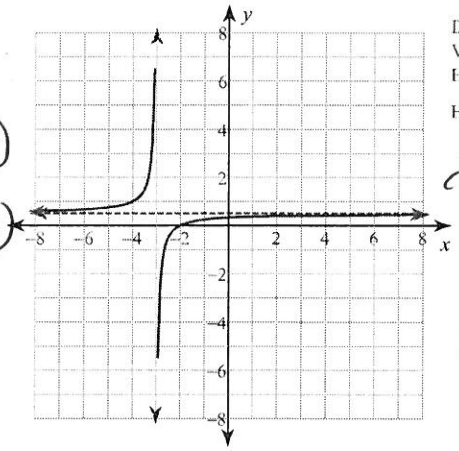
11) $f(x) = \dfrac{x^2 + 2x}{-4x + 8} = \dfrac{x(x+2)}{-4(x-2)}$



Discontinuities: 2
Vertical Asym.: $x = 2$
Holes: None
Horz. Asym.: None

dom: $(-\infty, 2) \cup (2, \infty)$
x int: $(0,0)$ $(-2,0)$
y int $(0,0)$

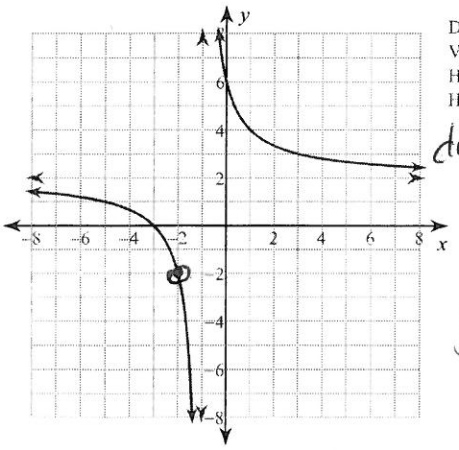
12) $f(x) = \dfrac{x + 2}{2x + 6}$



Discontinuities: -3
Vertical Asym.: $x = -3$
Holes: None
Horz. Asym.: $y = \frac{1}{2}$

dom $(-\infty, -3) \cup (-3, \infty)$
x int $(-2,0)$
y int $(0, 1/3)$

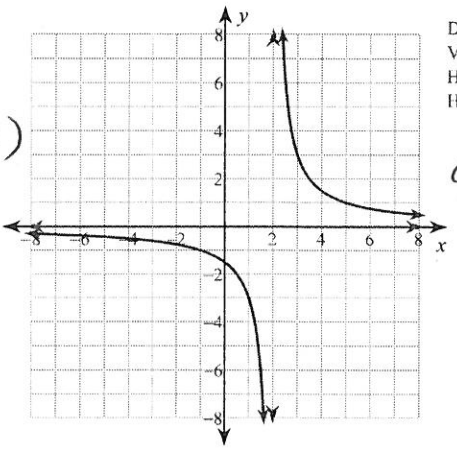
13) $f(x) = \dfrac{2x^2 + 10x + 12}{x^2 + 3x + 2} = \dfrac{2(x^2+5x+6)}{2(x+3)(x+2)} = \dfrac{2(x+3)(x+2)}{(x+2)(x+1)}$



Discontinuities: $-1, -2$
Vertical Asym.: $x = -1$
Holes: $x = -2$ $(-2, -2)$
Horz. Asym.: $y = 2$

dom $(-\infty, -2) \cup (-2, -1) \cup (-1, \infty)$
x int: $(-3, 0)$
y int $(0, 6)$

14) $f(x) = \dfrac{3}{x - 2}$



Discontinuities: 2
Vertical Asym.: $x = 2$
Holes: None
Horz. Asym.: $y = 0$

dom: $(-\infty, 2) \cup (2, \infty)$
x int none
y int $(0, -\frac{3}{2})$

Precalculus Honors B

Name Key

Worksheet 4.2 day 1: Graphing Rational Functions

Find and ~~graph~~ classify all asymptotes and discontinuities.

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

VA: $x = 1$

HA: none

hole: $(2, 3)$ $\dfrac{(3)(1)}{1}$

2. $y = \dfrac{3x^2+3x}{x^2-9}$ $3x(x+1)$ $(x-3)(x+3)$

VA: $x = 3$ $x = -3$

HA: $y = 3$

hole: none

3. $y = \dfrac{2x+1}{6x^2-x-2} = \dfrac{2x+1}{(2x+1)(3x-2)}$

VA: $x = 2/3$

HA: $y = 0$

hole: $(-1/2, -\frac{2}{5})$

4. $y = \dfrac{3(x-2)}{(x-3)(x-2)}$

VA: $x = 3$

HA: $y = 0$

hole: $(2, -3)$

5. $y = \dfrac{x^2-9x-12}{x-1} = \dfrac{(x\ \ )(\ \ )}{x-1}$

VA: $x = 1$

HA: none

hole: none

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

VA: $x = 1$ $x = -1$

HA: $y = 0$

hole: none

7. $y = \frac{x^2 - 6x + 9}{x^2 - x - 6} = \frac{(x-3)(x-3)}{(x-3)(x+2)}$

VA $x = -2$

HA $y = 1$

hole $(3, 0)$

8. $y = \frac{x-1}{2x^2 - 9x - 5}$

$(2x+1)(x-5)$

VA $x = -1/2$ $x = 5$

HA $y = 0$

hole: none

9. $y = \frac{x^2 - 4}{x - 2} = \frac{(x-2)(x+2)}{x-2}$

VA: none

HA none

hole $(2, 4)$

10. $y = \frac{x+2}{x^2 - 4} = \frac{x+2}{(x-2)(x+2)}$

VA: $x = 2$

HA: $y = 0$

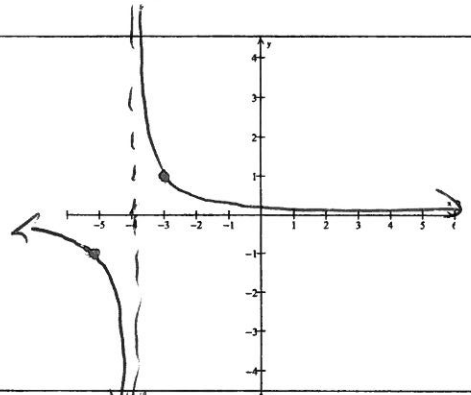
hole: $(-2, -\frac{1}{4})$

1) $f(x)=\frac{1}{x+4}$

Hole(s): None

Vertical Asymptote(s): $x=-4$

Horizontal Asymptote: $y=0$

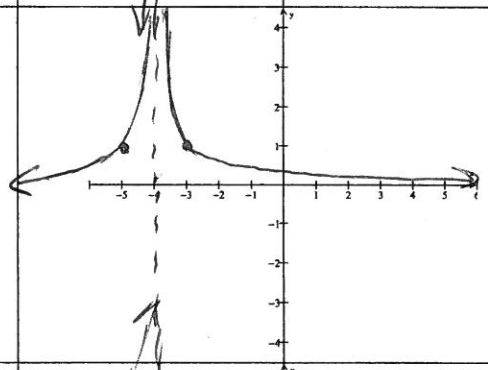


2) $f(x)=\frac{1}{(x+4)^2}$

Hole(s): None

Vertical Asymptote(s): $x=-4$

Horizontal Asymptote: $y=0$

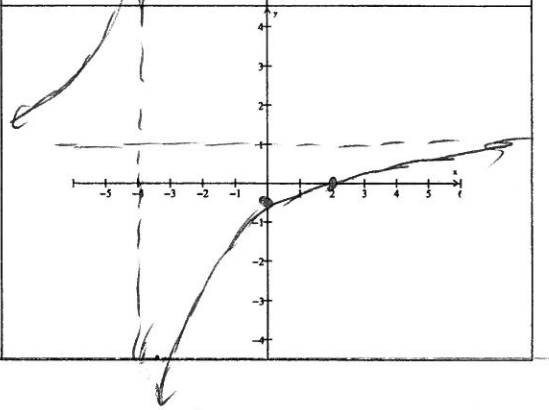


3) $f(x)=\frac{x-2}{x+4}$

Hole(s): None

Vertical Asymptote(s): $x=-4$

Horizontal Asymptote: $y=1$

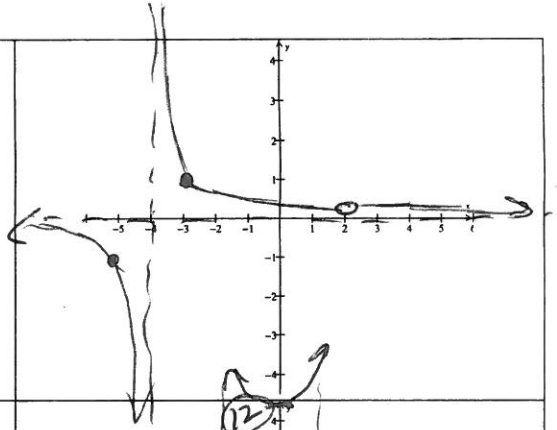


4) $f(x)=\frac{x-2}{(x+4)(x-2)}=\frac{1}{x+4}$

Hole(s): $(2,\frac{1}{6})$

Vertical Asymptote(s): $x=-4$

Horizontal Asymptote: $y=0$

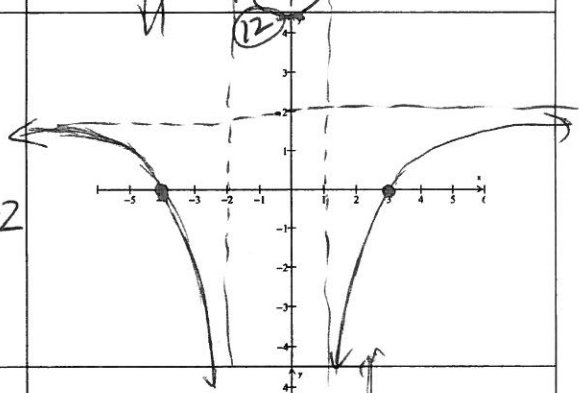


5) $f(x)=\frac{(2x-6)(x+4)}{(x-1)(x+2)}$

Hole(s): None

Vertical Asymptote(s): $x=1$ & $x=-2$

Horizontal Asymptote:: $y=2$

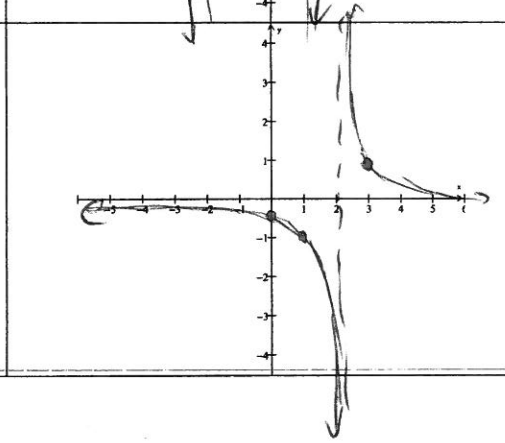


6) $f(x)=\frac{1}{x-2}$

Hole(s): None

Vertical Asymptote(s): $x=2$

Horizontal Asymptote: $y=0$



9) $f(x) = \dfrac{3x^2 - 12x}{x^2 - 2x - 3}$

10) $f(x) = \dfrac{x^3 - 16x}{-4x^2 + 4x + 24}$

11) $f(x) = \dfrac{x^2 + 2x}{-4x + 8}$

12) $f(x) = \dfrac{x + 2}{2x + 6}$

13) $f(x) = \dfrac{2x^2 + 10x + 12}{x^2 + 3x + 2}$

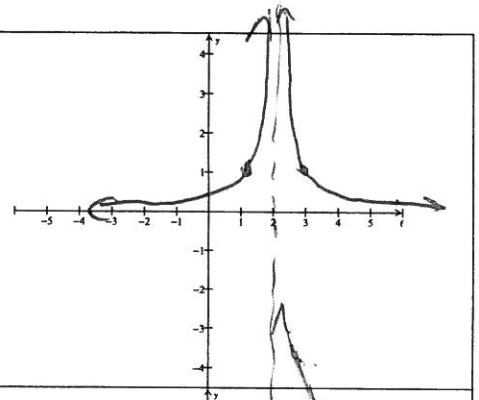
14) $f(x) = \dfrac{3}{x - 2}$

7) $f(x)=\frac{1}{(x-2)^2}$

Hole(s): None

Vertical Asymptote(s): $x=2$

Horizontal Asymptote: $y=0$

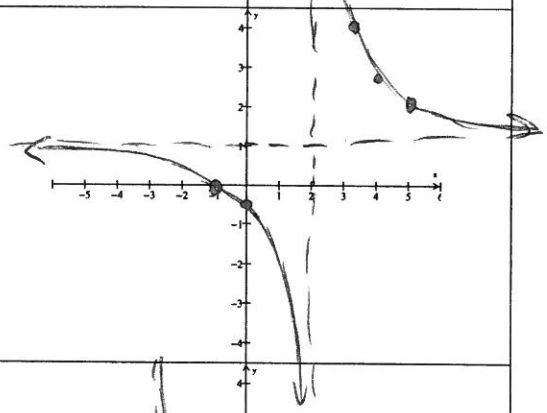


8) $f(x)=\frac{x+1}{x-2}$

Hole(s): None

Vertical Asymptote(s): $x=2$

Horizontal Asymptote: $y=1$

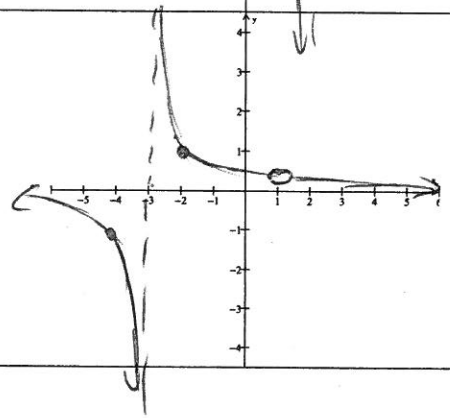


9) $f(x)=\frac{x-1}{(x+3)(x-1)}=\frac{1}{x+3}$

Hole(s): $(1,\frac{1}{4})$

Vertical Asymptote(s): $x=-3$

Horizontal Asymptote: $y=0$

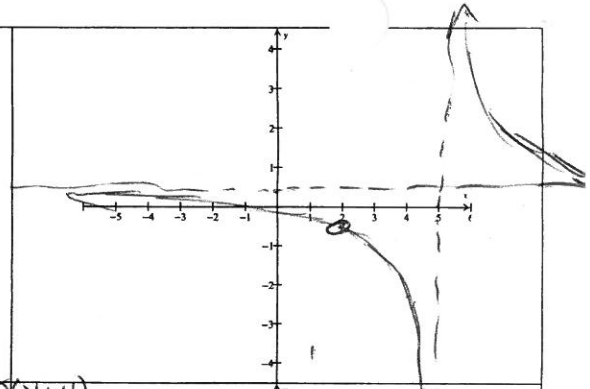


10) $f(x)=\frac{(x+1)(x-2)}{(3x-6)(x-5)}$ $3(x-2)$

Hole(s): $(2,-\frac{1}{3})$

Vertical Asymptote(s): $x=5$

Horizontal Asymptote: $y=\frac{1}{3}$



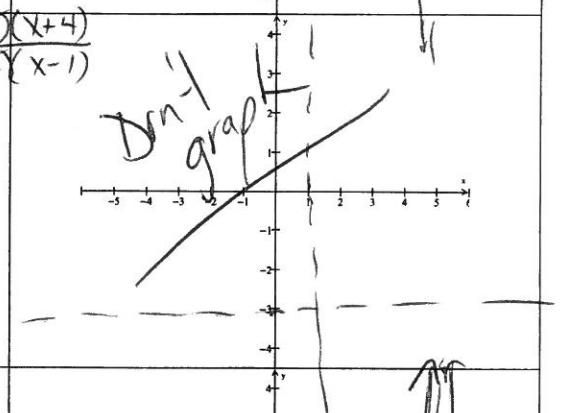
11) $f(x)=\frac{(-3x+6)(x+4)}{(x-2)(x-1)}=\frac{-3(x-2)(x+4)}{(x-2)(x-1)}$

Hole(s): $(2,-18)$

Vertical Asymptote(s): $x=1$

Horizontal Asymptote: $y=-3$

Dn't graph

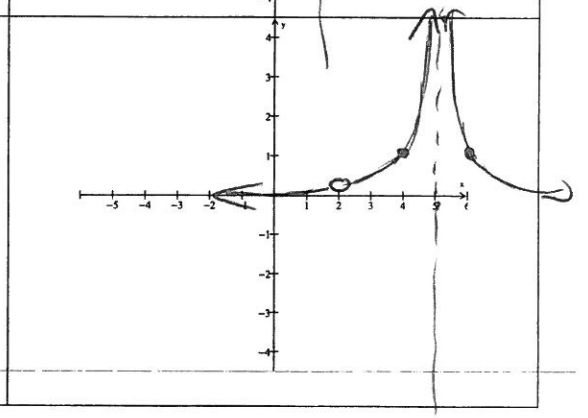


12) $f(x=\frac{(x-2)}{(x-2)(x-5)^2}$

Hole(s): $(2,\frac{1}{9})$

Vertical Asymptote(s): $x=5$

Horizontal Asymptote: $y=0$



Based on the asymptotes, match each equation with its graph. (Don't use a calculator!)

F 13. $f(x)=\frac{1}{x-1}$

C 14. $f(x)=\frac{5x}{x-1}$

H 15. $f(x)=\frac{3x^2}{x^2-1}$

VA $x=1, x=-1$
HA $y=3$

G 16. $f(x)=\frac{4x}{x^2-1}$

A 17. $f(x)=-\frac{x+2}{x+4}$

HA $y=-1$

K 18. $f(x)=\frac{x-1}{x-4}$

B 19. $f(x)=\frac{x+1}{x-3}$

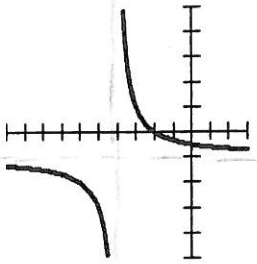
J 20. $f(x)=\frac{2x}{x-3}$

E 21. $f(x)=\frac{1-x^2}{x}$

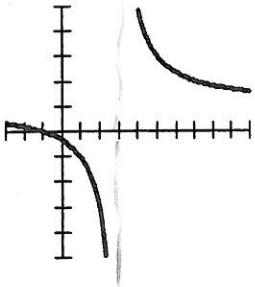
I 22. $f(x)=\frac{x^2-3x+2}{x}$

D 23. $f(x)=\frac{1+3x^2-x^3}{x^2}$

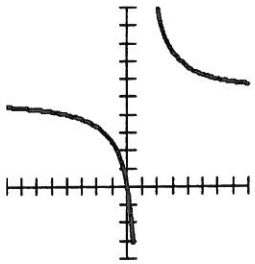
A)



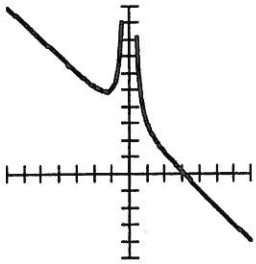
B)



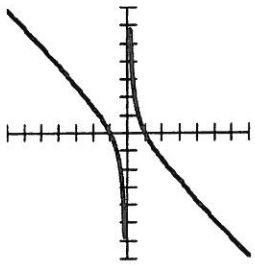
C)



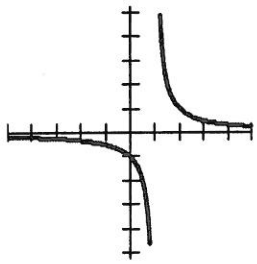
D)



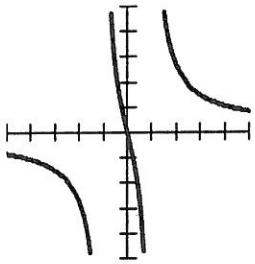
E)



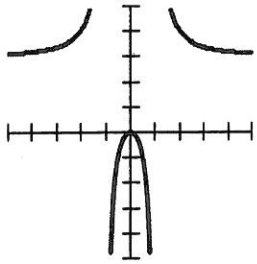
F)



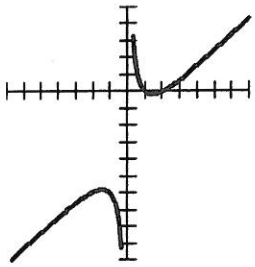
G)



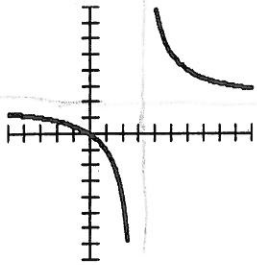
H)



I)



J)



K)