Do Now: #8 from the Practice section of the Reducible Functions packet

Sketch the graph and state the domain, range, coordinates of any hole(s), intercepts and the equations of any asymptotes.

8. $y = \dfrac{x-1}{x^2-1}$

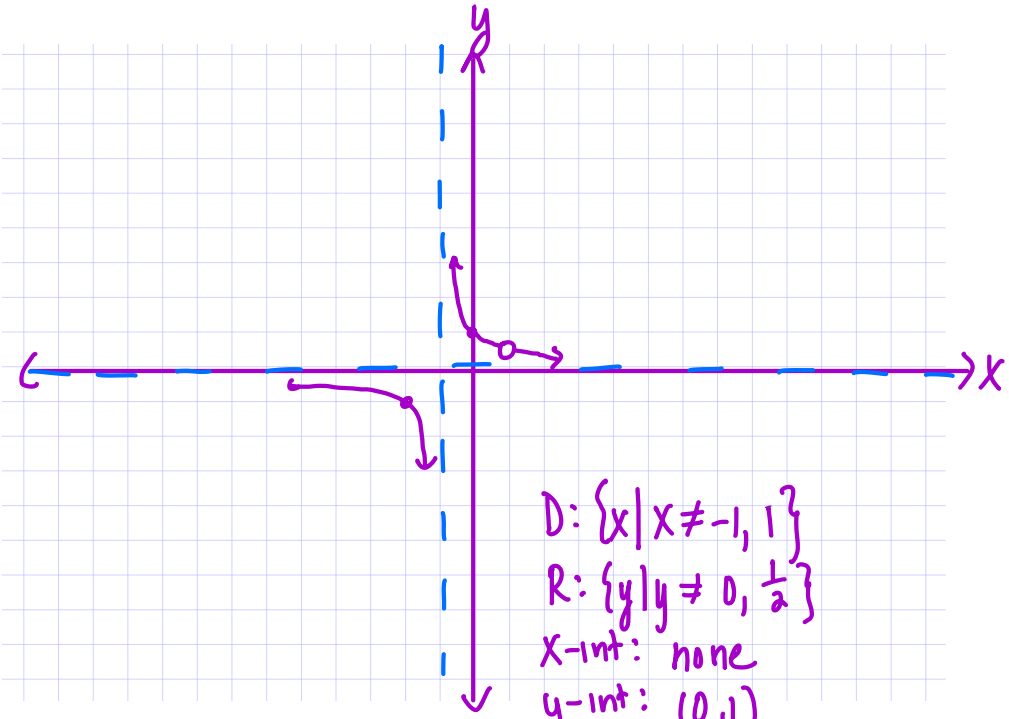
$y = \dfrac{\cancel{x-1}}{(x+1)\cancel{(x-1)}}$

RF: $y = \dfrac{1}{x+1}$

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

hyperbola
left 1

$(-1,-1)$ $(-2,-1)$
$(1,1)$ $(0,1)$



D: $\{x \mid x \neq -1, 1\}$
R: $\{y \mid y \neq 0, \frac{1}{2}\}$
x-int: none
y-int: $(0,1)$
VA: $x = -1$
HA: $y = 0$

Name:_____ Date:_____

PC: Oblique Asymptotes Ms. Loughran

Do Now:

1. Find the vertical asymptote(s) of the function $y = \frac{x+6}{x^2-36}$

$\frac{x+6}{(x+6)(x-6)} = \frac{1}{x-6}$ RF: $y = \frac{1}{x-6}$ $x-6=0$ $x=6$

$x=6$

2. Find the horizontal asymptote of the function $y = \frac{x^2+2x+1}{x+1}$

$\frac{(x+1)(x+1)}{x+1}$ RF: $y = x+1$

none

3. Is there a hole in the graph of $y = \frac{x^2+9}{x+3}$?

no b/c it is not reducible

4. What is the domain of the function $y = \frac{x^2-x-12}{x-4}$?

$y = \frac{(x-4)(x+3)}{x-4} = x+3$ hole $(4, 7)$ $\{x | x \neq 4\}$

5. Are there any x- or y- intercepts for the graph of $y = \frac{3x^2+x-2}{x+1}$? If so, state them.

$3x^2+x-2$

$3x^2-2x+3x-2$

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

$y = \frac{(x+1)(3x-2)}{x+1} = 3x-2$ hole: $(-1, -5)$

x-int: $(\frac{2}{3}, 0)$

$0 = 3x-2$

$2 = 3x$

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

y-int: $(0, -2)$

When the end behavior of a rational function is not horizontal (meaning there is no horizontal asymptote), it is oblique.

Recall: In what situation is there no horizontal asymptote for a rational function?

- if the degree of the numerator > the degree of the denominator.

To find oblique asymptotes:

1. **reduce the function if possible**
2. **divide the numerator by the denominator using long or synthetic division**
3. **the oblique asymptote is y = the quotient** (ignore the remainder)

1. Find the oblique asymptote of $y = \frac{x^2-3x+5}{x+2}$

OA

$$\begin{array}{r|rrr} -2 & 1 & -3 & 5 \\ & & -2 & 10 \\ \hline & 1 & -5 & 15 \end{array}$$ remainder

OA: $y = x-5$

2. Find the oblique asymptote of $y = \frac{x^2}{x+1}$.

-1 | 1 0 0
-1 1
1 -1 (1) remainder

OA: $y = x - 1$

3. Find the oblique asymptote for $y = \frac{x^2 - 4}{x}$

Since you can not ÷ by 0, you have to use LD

x | $x^2 + 0x - 4$
x^2
-4 remainder

OA: $y = x$

4. Find the oblique asymptote of $y = \frac{x^2 - 1}{-x + 3}$

$-x + 3 = 0$
$3 = x$

3 | 1 0 -1
3 9
1 3 (8) remainder
÷ -1

OA: $y = -x - 3$

Name:_____ Date:_____

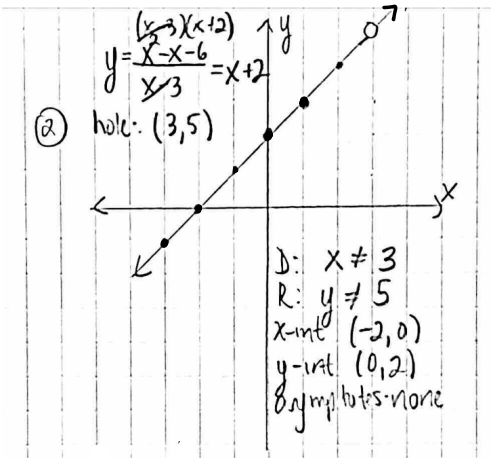
PC: Vertical, Horizontal and Oblique Asymptotes Ms. Loughran

Function	Hole(s)	Vertical Asymptote(s)	Horizontal Asymptote	Oblique Asymptote	x-intercept(s)	y-intercept
① $y=\frac{x+2}{x^2-16}$ $(x+4)(x-4)$	no	$x-4=0$ $x+4=0$ $x=4$ $x=-4$ $x=\pm4$	$y=0$	none	$\frac{x+2}{x^2-16}=0$ $x+2=0$ $x=-2$ $(-2,0)$	$y=\frac{0+2}{0-16}=\frac{2}{-16}$ $(0,-\frac{1}{8})$
② $(x-4)(x+4)$ $y=\frac{x^2-16}{x+2}$	no	$x=-2$	none	$-2\mid 1\ 0\ -16$ $\quad\ -2\ \ 4$ $\quad 1\ -2\ -12$ $y=x-2$	$(x-4)(x+4)=0$ $x=\pm4$ $(\pm4,0)$	$(0,-8)$
③ $y=\frac{2x^2}{x^2+4}$						
④ $x(2x+3)$ $y=\frac{2x^2+3x}{x}$ $y=2x+3$	$(0,3)$	none	none	none	$0=2x+3$ $-3=2x$ $-\frac{3}{2}=x$ $(-\frac{3}{2},0)$	$y=2(0)+3$ $(0,3)$ none b/c of the hole at $(0,3)$
⑤ $y=\frac{3x+21}{9-x}$						
⑥ $y=\frac{1}{(x+6)(x-1)}$						

Homework 01-04

(6) $y=\frac{x-1}{x^2-4}$ $(x-2)(x-2)$	none	$(x-2)(x+2)=0$ $x=\pm 2$	$y=0$	$\frac{x-1}{(x-2)(x+2)}=0$ $0=x-1$ $1=x$ $(1,0)$	$y=\frac{0-1}{(0-2)(0+2)}$ $y=\frac{-1}{-4}$ $(0,\frac{1}{4})$

Function	Hole(s)	Vertical Asymptote(s)	Horizontal Asymptote	x-intercept(s)	y-intercept
(7) $y=\frac{4x}{x-3}$	none	$x=3$	$y=4$	$(0,0)$	$(0,0)$
(8) $y=\frac{5x^2}{3+x}$ $x\neq 3$	none	$x=-3$	none	$(0,0)$	$(0,0)$
(9) $y=\frac{-4x^2}{(x-2)(x+4)}$	none	$x=2,-4$	$y=-4$	$(0,0)$	$(0,0)$
(10) $(x-2)(x+2)$ $y=\frac{-4+x^2}{(x-2)(x+4)}$	$(2,\frac{3}{3})$	$x=-4$	$y=1$	$(-2,0)$	$(0,\frac{1}{2})$
(11) $y=\frac{3x(x-1)}{2x^2-5x+3}$ $(2x-3)(x-1)$	$(1,-3)$	$x=\frac{3}{2}$	$y=\frac{3}{2}$	$(0,0)$	$(0,0)$
(12) $y=\frac{x}{x^4-1}$ $(x^2-1)(x^2+1)$	none	$x=\pm 1$	$y=0$	$(0,0)$	$(0,0)$



hyperbola right 1