

Warm Up

**FCAT:** In a certain state, a license plate consists of 3 digits followed by 2 letters. How many license plates can the state issue if no digit or letter can be repeated on a particular license plate? **FCAT:** A

A. 468,000

B. 676,000

C. 1,404,000

D. 5,311,735

$$\underline{10} \cdot \underline{9} \cdot \underline{8} \cdot \underline{26} \cdot \underline{25}$$

**FCAT:** Hooke's Law states that the distance  $d$  a spring is stretched or compressed varies directly with the force  $f$  on the spring. Which of the following represents this relationship?

A.  $d = k - f$

B.  $d = f - k$

C.  $d = \frac{k}{f}$

D.  $d = kf$

Celebrate Black History

$$43. \quad z = kxy \Rightarrow \boxed{z = 32xy} \checkmark$$

$$8 = k \left( \frac{5}{2} \right) \left( \frac{3}{2} \right)$$

$$8 = \frac{1}{4} \cdot k$$

$$32 = k$$

$$z = 32(-4)(7)$$

$$\boxed{z = -896} \checkmark$$

$$6 = \frac{k}{24}$$

$$6 = \frac{k}{-\frac{2}{3}}$$

$$= k \cdot \left( \frac{-3}{2} \right) \quad \left( \frac{-2}{3} \right) 6 = k \left( \frac{-3}{2} \right) \left( \frac{-2}{3} \right)$$

$$33. \quad y = \frac{k}{x}$$

$$\left( \frac{-2}{3} \right) 6 = \frac{k}{\cancel{\left( \frac{-2}{3} \right)}} \left( \frac{-2}{3} \right)$$

$$-4 = k$$

Warm Up: FCAT:

$$\frac{9 \cdot 8 \cdot 7}{3!} = \frac{504}{6}$$

The board of directors of a company's pension fund has 9 members. In how many ways can they choose a committee of 3 board members to study pension reform?

FCAT: 84 (ways)

FCAT: Which of the following rational functions has the vertical asymptote  $x = 1$  and the horizontal asymptote  $y = 2$ ?

ACE  
AEC  
CAE  
CEA  
EAC  
ECA

F.  $y = \frac{2x - 1}{x + 1}$

G.  $y = \frac{x - 1}{2x + 1}$

H.  $y = \frac{2x + 1}{x - 1}$

I.  $y = \frac{x - 1}{x - 2}$

$$\frac{10 \cdot 9 \cdot 8 \cdot 7}{4 \cdot 3 \cdot 2 \cdot 1}$$

**Black History Month**



$$59. \quad P = \frac{kWD^2}{L}$$

$$a.) \quad P = \frac{k(2W)D^2}{2L} \quad \text{no change}$$

$$b.) \quad P = \frac{k(2W)(2D)^2}{L} = \frac{k(2W)(4D^2)}{L} = \frac{8WD^2k}{L}$$

$$c.) \quad P = \frac{k(2W)(2D)^2}{2L} = \frac{4kWD^2}{L}$$

d.)

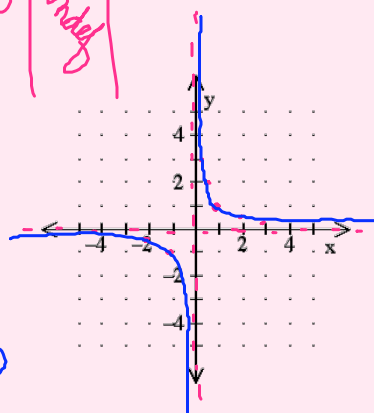
# Rational function

$$y = f(x) = \frac{1}{x} = \frac{p(x)}{q(x)}$$

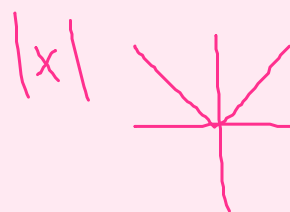
x	1	2	3	100	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{100}$	0
y	1	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{100}$	2	3	100	undef

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

VA  $x=0$     D:  $x \neq 0$   
 HA  $y=0$     R:  $y \neq 0$



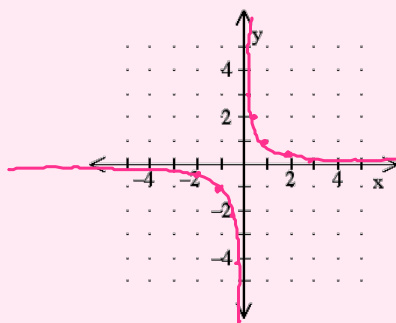
$$f(x) = \frac{3x^2 - 6x + 2}{x^2 - 9}$$



## 9.2 Rational Functions

$$y = f(x) = \frac{1}{x}$$

$$f(x) = \frac{5x^3 - 3x^2 + 2x - 8}{x^2 - 4}$$



x	1	2	3	100	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{100}$
y	1	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{100}$	2	3	100

x	-1	-2	-3	-100	$-\frac{1}{2}$	0
y	-1	$-\frac{1}{2}$	$-\frac{1}{3}$	$-\frac{1}{100}$	-2	undefined

VA  $x=0$     D: all Reals except 0  
 HA  $y=0$     R: " " " "

$x_{int}$  } none  
 $y_{int}$  }

## 9.2 Graphing Simple Rational Functions

pg 543: combine with sec. 9.3

## 9.3 Graphing General Rational Functions

pg 550:

Definition  $f(x) = \frac{p(x)}{q(x)} = \frac{a_m x^m + a_{m-1} x^{m-1} + \dots + a_1 x^1 + a_0 x^0}{b_n x^n + b_{n-1} x^{n-1} + \dots + b_1 x^1 + b_0 x^0}$ ,  $p(x)$  &  $q(x)$  have no common factors

### Characteristics:

1. The x intercepts of  $f(x)$  are the zeros of  $p(x)$
- ✱ 2. The graph of  $f$  has a vertical asymptote at each real zero of  $q(x)$ , *the denominator*
3. The graph of  $f$  has at most one horizontal asymptote

•If degree of  $p(x)$ ,  $m <$  degree of  $q(x)$ ,  $n$ , the horizontal asymptote is \_\_\_\_\_

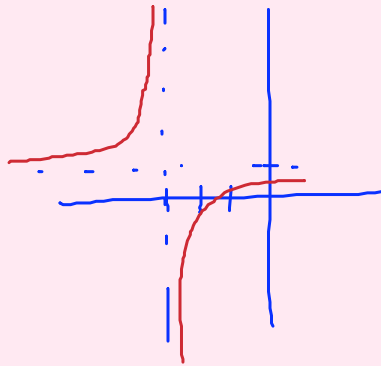
•If degree of  $p(x)$ ,  $m =$  degree of  $q(x)$ ,  $n$ , the horizontal asymptote is \_\_\_\_\_

•If degree of  $p(x)$ ,  $m >$  degree of  $q(x)$ ,  $n$ , the horizontal asymptote is \_\_\_\_\_

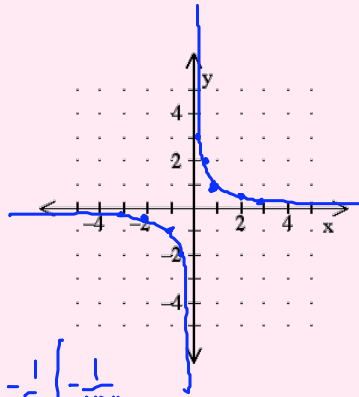
4. Slant ( will be added in Precalculus), occurs if degree of  $p(x)$ ,  $m$  is exactly one degree greater than the degree of  $q(x)$ ,  $n$ .

$$22. \quad y = \frac{x+2}{x+3} = \frac{-1}{x+3} + 1 \quad \begin{array}{l} \text{up} \\ \text{3 left} \end{array}$$

$$\begin{array}{r} 1 + \frac{-1}{x+3} \\ \hline x+3 \overline{) x+2} \\ \underline{-(x+3)} \\ -1 \end{array}$$



$$y = f(x) = \frac{1}{x}$$



VA:  $x=0$

HA:  $y=0$

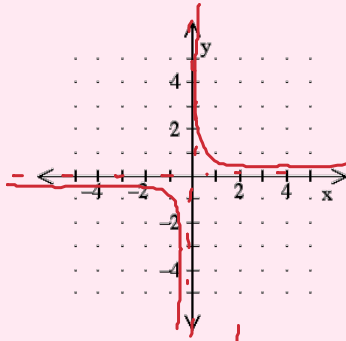
D: all Reals  
except 0

R:  $y \neq 0$

x	1	2	3	100	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{100}$	0	-1	-2	-3	$-\frac{1}{2}$	$-\frac{1}{100}$
	1	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{100}$	2	3	100	undefined	-1	$-\frac{1}{2}$	$-\frac{1}{3}$	-2	

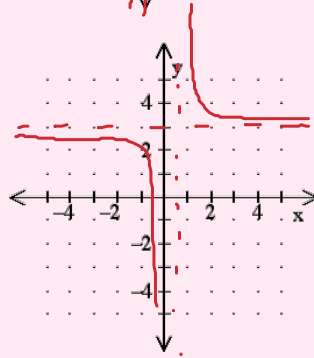
$$y = f(x) = \frac{p(x)}{q(x)} = \frac{3x^4 - 6x^2 + 8x - 2}{5x^2 - 1}$$

$$23. y = \frac{4}{x}$$



$$\text{VA: } x=0$$

$$35. y = \frac{9x+1}{3x-2}$$



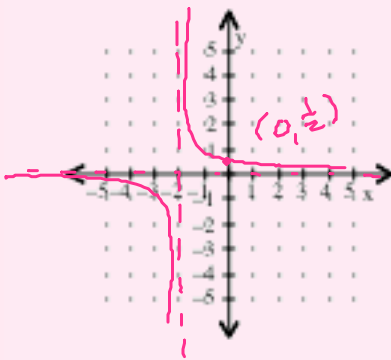
$$\text{VA: } x = \frac{2}{3}$$

$$\text{HA: } y = 3$$

$$\begin{array}{r} 3 + \frac{7}{3x-2} \\ \hline 3x-2 \overline{) 9x+1} \\ \underline{-(9x-6)} \\ 7 \end{array}$$

Graph and label asymptotes, domain and range, and intercepts of:

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



H.A.  $y = 0$

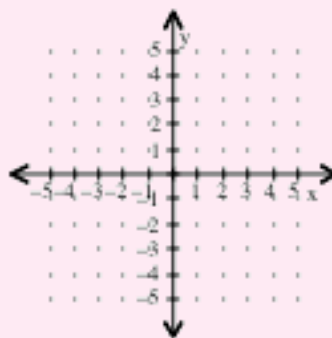
V.A.  $x = -2$

intercepts:  $(0, \frac{1}{2})$ 

D:  $x \neq -2$

R:  $y \neq 0$

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



H.A.

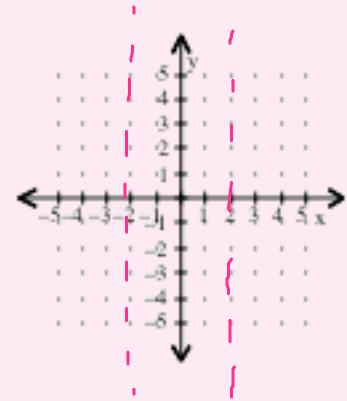
V.A. *none*

intercepts:

D: *all Reals*

R:

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



H.A.

V.A.  $x = 2, x = -2$ 

intercepts:

D:  $x \neq 2, x \neq -2$ 

R:

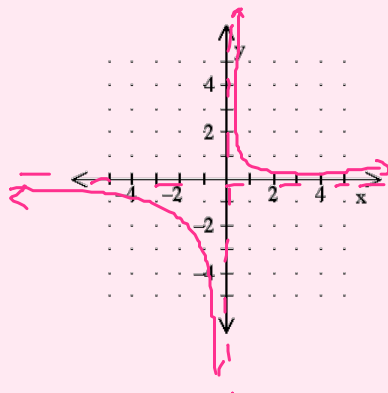
$$22. \quad y = \frac{x+2}{x+3} = \frac{-1}{x+3} + \begin{matrix} \text{up 1} \\ \text{left 3} \end{matrix}$$

$$\text{VA } x = -3$$

$$\begin{array}{r} 1 + \frac{-1}{x+3} \\ \hline x+3 \overline{) x+2} \\ \underline{-(x+3)} \\ -1 \end{array}$$

$$23. \quad y = \frac{4}{x}$$

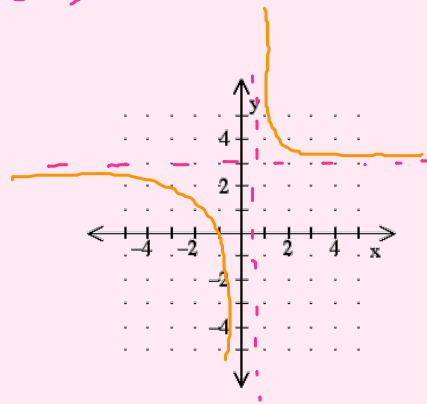
$$\text{VA } x = 0$$



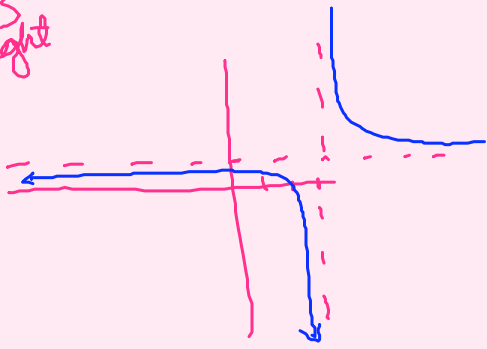
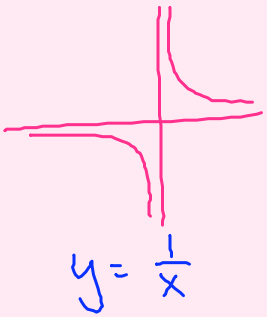
$$y = \frac{9x+1}{3x-2} = \frac{7}{3x-2} + 3$$

VA  $x = \frac{2}{3}$       HA  $y = 3$

$$\begin{array}{r} 3 + \frac{7}{3x-2} \\ 3x-2 \overline{) 9x+1} \\ \underline{-(9x-6)} \\ 7 \end{array}$$



24.  $y = \frac{3}{x-3} + 1$  one up  
3 right

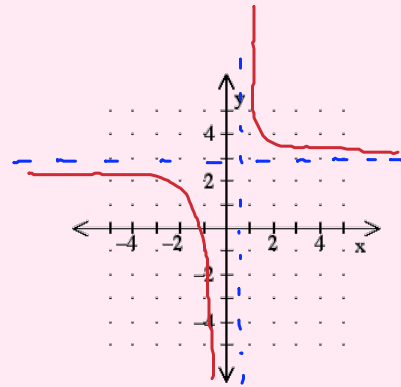


$$35. y = \frac{9x+1}{3x-2} = \frac{7}{3x-2} + 3$$

$$\text{V.A. } x = \frac{2}{3}$$

$$\begin{array}{r} 3 + \frac{7}{3x-2} \\ \hline 3x-2 \overline{) 9x+1} \\ \underline{-(9x-6)} \\ 7 \end{array}$$

$$\text{H.A. } y = 3$$



$$22. \quad y = \frac{x+2}{x+3} = \frac{-1}{x+3} + 1$$

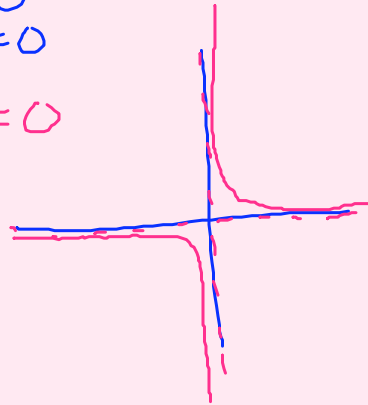
↙ vertical ref.
↑ 1 up
3 left

$$\begin{array}{r} 1 + \frac{-1}{x+3} \\ \hline x+3 \overline{) x+2} \\ \underline{-(x+3)} \\ -1 \end{array}$$

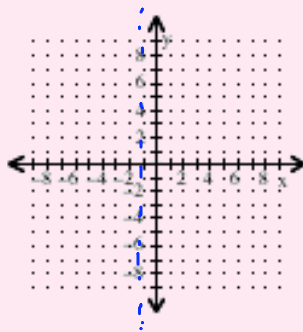
$$23. \quad f(x) = \frac{4}{x}$$

$$\text{VA: } x=0$$

$$\text{HA: } y=0$$



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



H.A.

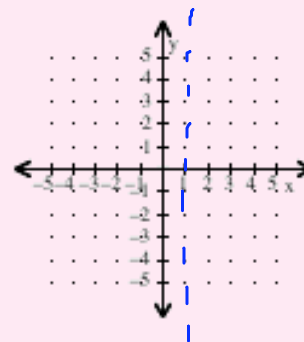
V.A.  $x = -1$

intercepts:

D:

R:

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



H.A.

V.A.  $x = 1$

intercepts:

D:

R:

Homework: 9.2-9.3A pg 543: 20-23, 35  
pg 550: 20, 21

9.2-9.3B pg 550: 22, 23 - 25, 27, 29, 47