

c. $f(x) = x^4 + 2x^3 - 5x^2 - 14x - 14$, $-1+i$ is a root

d. $f(x) = x^4 - 4x^3 + 10x^2 - 8x + 16$, $2-2i$ is a root

Exercises

11. For each of the following rational functions, find the requested information and sketch. Calculator verify.

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

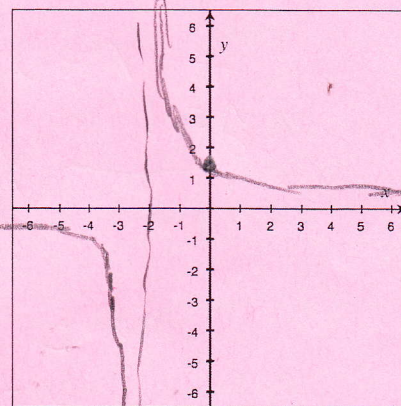
a. domain: $x \neq -2$

b. VA: $x = -2$

c. HA: $y = 0$ Bottom half

d. Zeros none

e. Interval Work



f. y-intercept: $(0, 3/2)$

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

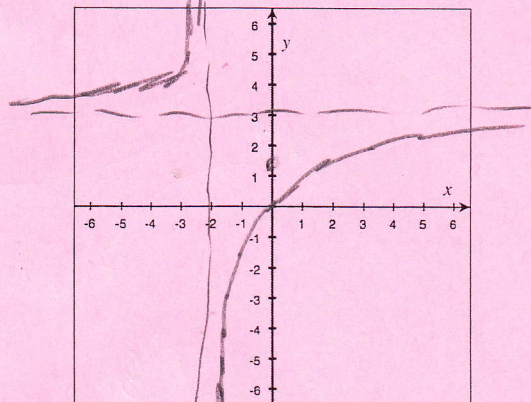
a. domain: $x \neq -2$

b. VA: $x = -2$

c. HA: $y = 3$

d. Zeros $(0, 0)$

e. Interval Work



f. y-intercept: $(0, 0)$

c. $y = \frac{x}{x^2 + 2x - 3}$

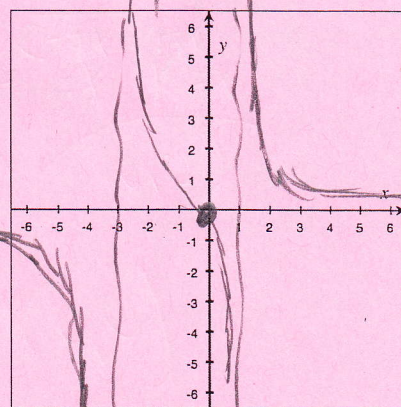
a. domain: $x \neq -3, x \neq 1$ $(x+3)(x-1)$

b. VA: $x = -3, x = 1$

c. HA: $y = 0$ Bottom half

d. Zeros $(0, 0)$ $x = -1, y = \frac{-1}{1-2-3} = \frac{-1}{-4} = \frac{1}{4}$

e. Interval Work



f. y-intercept: $(0, 0)$

d. $y = \frac{x^2}{x^2 - 16}$

a. domain:

b. VA:

c. HA: $y = 1$

d. Zeros

e. Interval Work

f. y-intercept:

$(x+4)(x-4)$
 $x \neq -4 \quad x \neq 4$

$x = -4 \quad x = 4$

$(0,0)$ Double zero

$-4 < x < 4$

$(0,0)$ y is neg.

e. $y = \frac{x^2 - 3x - 4}{x^2}$

a. domain:

b. VA:

c. HA: $y = 1$

d. Zeros

e. Interval Work

f. y-intercept:

none

f. $y = \frac{x^2 - 2x + 1}{x^2 + 2x - 8}$

a. domain:

b. VA:

c. HA: $y = 1$

d. Zeros

e. Interval Work

f. y-intercept:

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

$x \neq -4 \quad x \neq 2$

$x = -4 \quad x = 2$

$(1,0)$ Dbl root

g. $y = \frac{-4x}{x^2 - x - 12}$

a. domain:

b. VA:

c. HA: $y = 0$

d. Zeros

e. Interval Work

f. y-intercept:

$(0, -1/3)$

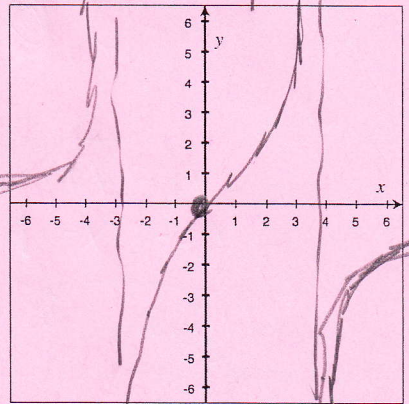
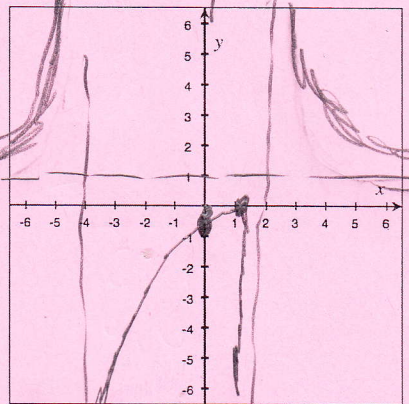
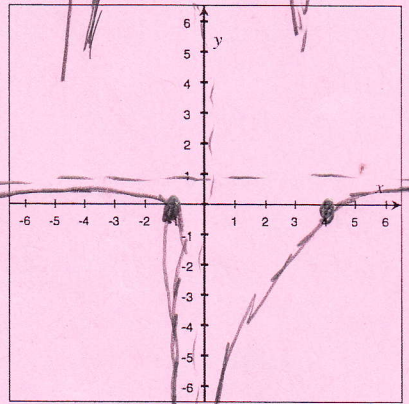
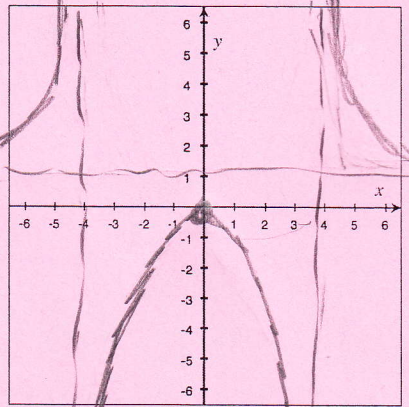
$(x-4)(x+3)$

$x \neq 4 \quad x \neq -3$

$x = 4 \quad x = -3$

$(0,0) \quad y = 0$

$(0,0)$

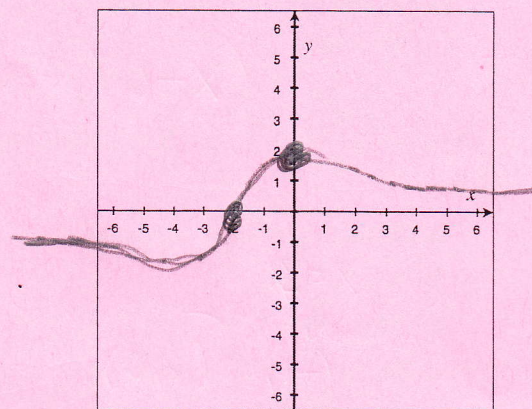


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h. $y = \frac{4x+8}{x^2+4}$

- a. domain: *all reals*
- b. VA: *none*
- c. HA: $y=0$
- d. Zeros $\rightarrow x = (-2, 0)$
- e. Interval Work

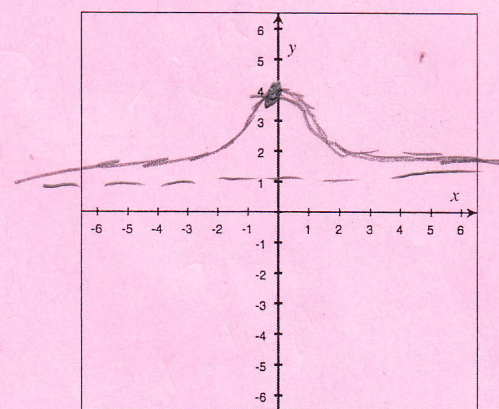
f. y-intercept: ~~$y = (0, 2)$~~



i. $y = \frac{x^2+4}{x^2+1}$

- a. domain: *All reals*
- b. VA: *none*
- c. HA: $y=1$
- d. Zeros *none*
- e. Interval Work

f. y-intercept: $(0, 4)$



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

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

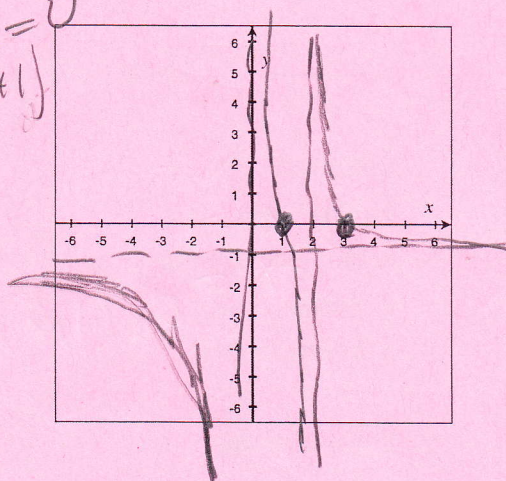
$$\frac{-x^2 + x + 2}{x(x+2)} = 0$$

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

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

- a. domain: $x \neq 1$ $x \neq -2$
- b. VA: $x=0$ $x=-2$
- c. HA: $y=-1$
- d. Zeros $x=2$ $x=-1$
- e. Interval Work

f. y-intercept: *none*



X

12. For each of the following rational functions, find the requested information and sketch. Verify using the calculator.

a. $y = \frac{x^2 - 5x - 6}{x - 3}$ Synthetic/Long Division:

$(x-6)(x+1)$

a. domain:

b. VA: $x = 3$

c. OA: $y = x - 2$

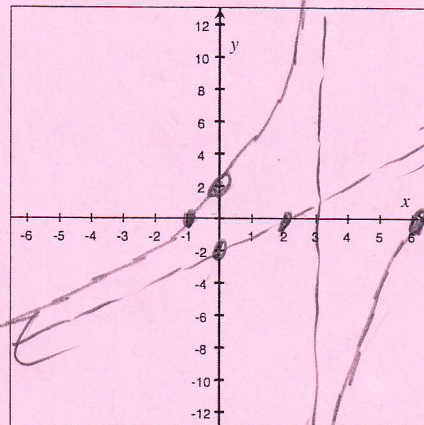
d. Zeros: $(-1, 0)$ $(6, 0)$

e. Interval Work:

f. y-intercept:

$(0, 2)$

$$\begin{array}{r|rrr} 3 & 1 & -5 & -6 \\ & \downarrow & 3 & -6 \\ \hline & & 1 & -2 & -12 \\ & & & & \frac{-12}{x-3} \end{array}$$



b. $y = \frac{x^2 + 2x + 1}{x + 2}$ Synthetic/Long Division:

$-(x+1)^2$

a. domain:

b. VA: $x = -2$

c. OA: $y = x$

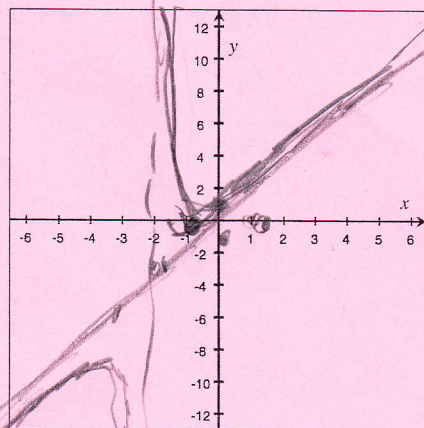
d. Zeros: $x = -1$ DBL $x + \frac{1}{x+2}$

e. Interval Work:

f. y-intercept:

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

$$\begin{array}{r|rrr} -2 & 1 & 2 & 1 \\ & \downarrow & -2 & 0 \\ \hline & & 1 & 0 & 1 \end{array}$$



c. $y = \frac{x - x^2}{x + 1}$ Synthetic/Long Division:

$-x(x-1)$

a. domain: $x \neq -1$

b. VA: $x = -1$

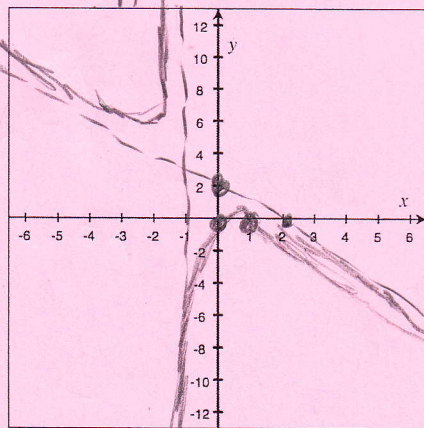
c. OA: $-x + 2$

d. Zeros: $(0, 0)$ $(1, 0)$

e. Interval Work:

f. y-intercept:

$$\begin{array}{r|rrrr} -1 & -1 & 1 & 0 \\ & \downarrow & 1 & -2 \\ \hline & & -1 & 2 & -2 \\ & & & & \frac{-2}{x+1} \end{array}$$



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d. $y = \frac{x^3}{x-1}$

Synthetic/Long Division:

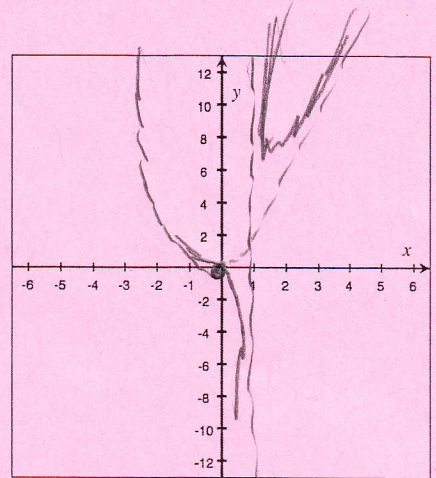
$$\begin{array}{r|rrrr} 1 & 1 & 0 & 0 & 0 \\ & \downarrow & 1 & 1 & 1 \\ \hline & & 1 & 1 & 1 \end{array}$$

$$x^2 + x + 1 + \frac{1}{x-1}$$

- a. domain: $x \neq 1$
- b. VA: $x = 1$
- c. OA: $x^2 + x + 1$
- d. Zeros: 0 triple
- e. Interval Work:

f. y-intercept:

$(0, 0)$



e. $y = \frac{x^3 - 2x^2 - 4x + 8}{x-1}$

Synthetic/Long Division:

$$\begin{array}{r|rrrr} 1 & 1 & -2 & -4 & 8 \\ & \downarrow & 1 & -1 & -5 \\ \hline & & 1 & -1 & -5 \end{array}$$

$$x^2 - x - 5 + \frac{3}{x-1}$$

a. domain:

b. VA: $x = 1$

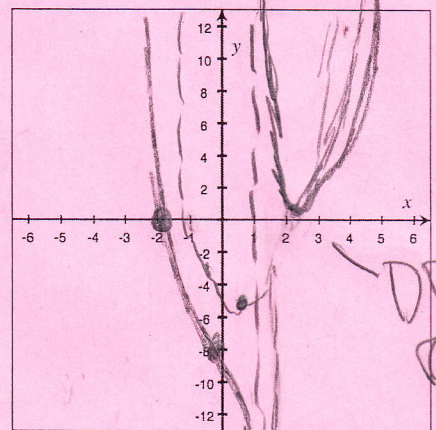
c. OA:

d. Zeros: $(-2, 0)$ $(2, 0)$ DBL

e. Interval Work:

f. y-intercept:

$(0, -8)$



f. $y = \frac{x^3 - 3x + 2}{x^2 - 2x}$

Synthetic/Long Division:

$(x-2)(x-1)$

$$\begin{array}{r} x+2 \\ x^2-2x \overline{) x^3+0x^2-3x+2} \\ \underline{-x^3+2x^2} \\ 2x^2-3x+2 \\ \underline{-2x^2+4x} \\ x+2 \end{array}$$

a. domain: $x \neq 0, x \neq 2$

b. VA: $x = 0, 2$

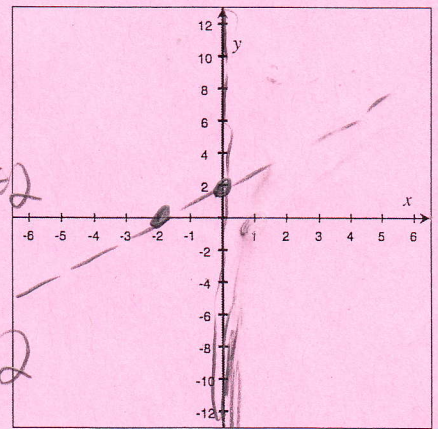
c. OA: $y = x + 2$

d. Zeros: $x = 1$

e. Interval Work:

f. y-intercept: no y-int

hole @ $x = 2$



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