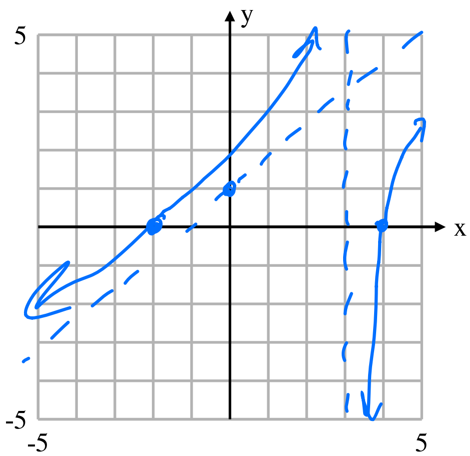
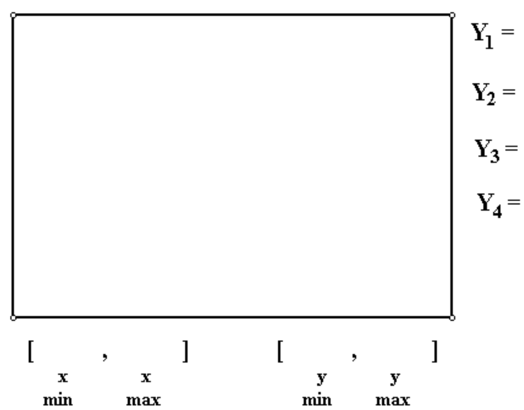
Find the oblique asymptotes of: $y=\dfrac{x^2-2x-8}{x-3}$

$$\begin{array}{r} x+1 \\ x-3\overline{)x^2-2x-8} \\ \underline{x^2-3x} \\ x-8 \\ \underline{x-3} \\ -5 \end{array}$$

$= \underline{x+1} \quad -\dfrac{5}{x-3}$





3. <u>Vertical Asymptotes/Holes</u>. Rational functions whose denominators that have real roots will have either vertical asymptotes or holes. Holes will occur in a graph when a factor in the denominator cancels with a factor in the numerator. Vertical asymptotes will occur when the factor in the denominator doesn't cancel.

Example: Determine if the function has a hole (H) or a vertical asymptote (VA) and state its location (x-coordinate only)

$y=\dfrac{x+2}{x-3}$ V.A. @ x=3	$y=\dfrac{(x+2)(x+3)}{(x-3)(x-1)}$ V.A @ 3, 1
$y=\dfrac{\cancel{(x+2)}(x+3)}{\cancel{(x+2)}}$ hole @ x=-2	$y=\dfrac{(x+2)\cancel{(x+3)}}{(x-1)\cancel{(x+3)}}$ hole @ x=-3 V.A @ x=1
$y=\dfrac{\cancel{(x+2)}\cancel{(x-3)}}{\cancel{(x+2)}\cancel{(x-3)}(x+1)}$ hole @ x=-2, 3 V.A. @ x=-1	$y=\dfrac{x^2+5x+6}{x+2}=\dfrac{\cancel{(x+2)}(x+3)}{\cancel{x+2}}=$ hole @ x=-2

If a function has a vertical asymptote, we take note of it and make a domain statement that doesn't allow this value to be substituted in to the function.

Day 1

If a function has a hole, we take note of it and make a domain statement that doesn't' allow this value to be substituted into the function (but then we go against this statement) and find the *y*-coordinate of the hole.

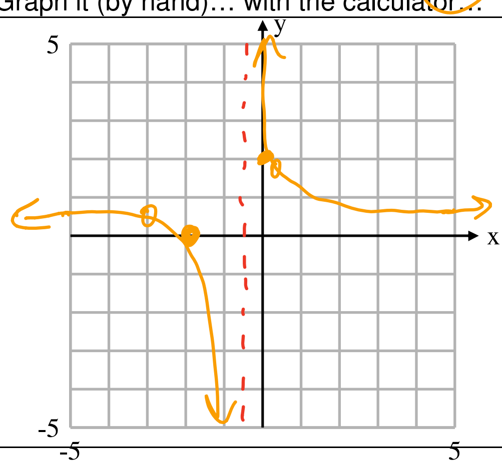
Example: $y = \dfrac{(x+2)(x+3)}{(x-3)(x-1)}$ → V.A @ $x = 3, 1$

So why are we doing all of this? To create most excellent graphs without technology. To understand what the function looks like without graphing it. To understand why the graph looks the way it does. To have a greater appreciation for functions.

So… find everything you know about this function: $y = \dfrac{x^2+5x+6}{2x^2+7x+3}$

1. Find y – intercept $y = \dfrac{0+0+6}{0+0+3}$ $= 2$	2. Find Horizontal/Slant Asymptote num deg = den deg ∴ horizontal asymptote @ $y = \frac{1}{2}$
3. FACTOR → $y = \dfrac{(\cancel{x+3})(x+2)}{(\cancel{x+3})(2x+1)}$ hole @ $x = -3$ V.A @ $x = \frac{-1}{2}$ $2x^2+6x+x+3$ $2x(x+3)+(x+3)$ $(x+3)(2x+1)$	4. Find x-intercept(s) $x = -2$
5. Find Hole(s) (x, y) $f(-3) = \dfrac{-3+2}{2(-3)+1} = \dfrac{-1}{-5}$ $y = \frac{1}{5}$	6. Find Vertical Asympotote(s) V.A @ $-\frac{1}{2}$

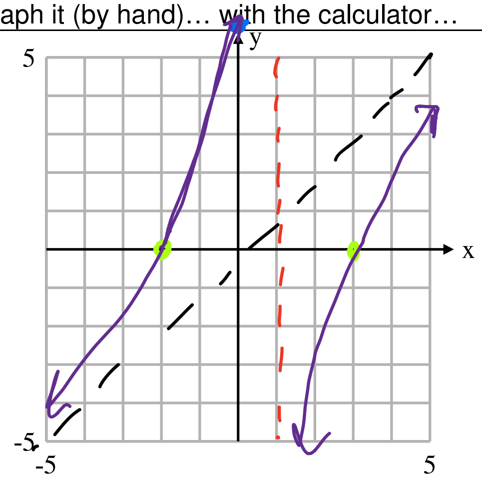
Graph it (by hand)… with the calculator…



So… find everything you know about this function: $y=\dfrac{x^2-x-6}{x-1}$

1. Find y – intercept $y=\dfrac{0-0-6}{0-1}$ $=6$	2. Find Horizontal/Slant Asymptote $x-1\,\overline{)\,x^2-x-6}$, quotient x x^2-x $0\ -6$ $y = x - \dfrac{6}{x-1}$
3. FACTOR $y=\dfrac{(x-3)(x+2)}{x-1}$	4. Find x-intercept(s) $x=3,-2$
5. Find Hole(s) (x, y) NONE	6. Find Vertical Asympotote(s) $x=1$

Graph it (by hand)… with the calculator…



Summary: