1. A **Rational Function** is a function that can be written in the form: $f(x) = \frac{N(x)}{D(x)}$, where N(x) and D(x) are polynomials and $D(x) \neq 0$.

2. Typically, the Domain of a Rational Function is the set of all Real numbers that are not zeros of the Denominator. When the Domain includes all real numbers, the function is continuous.

3. Write the Domain for $f(x) = \frac{3x^2 - 2x + 1}{6x^2 + x - 2}$

   Factor the denominator: $f(x) = \frac{3x^2 - 2x + 1}{(3x + 2)(2x - 1)}$ Therefore $x \neq -\frac{2}{3}$ & $x \neq \frac{1}{2}$

   The Domain is $\left(-\infty, -\frac{2}{3}\right) \cup \left(-\frac{2}{3}, \frac{1}{2}\right) \cup \left(\frac{1}{2}, \infty\right)$

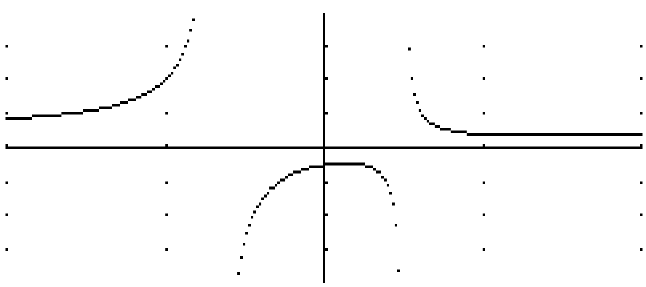
4. We now take a closer look at the activity of the previous function near the excluded values from the domain.

   a. Select MODE on your calculator and switch from "Connected" to "Dot"

   b. Place the function $f(x) = \frac{3x^2 - 2x + 1}{6x^2 + x - 2}$ into Y1 =

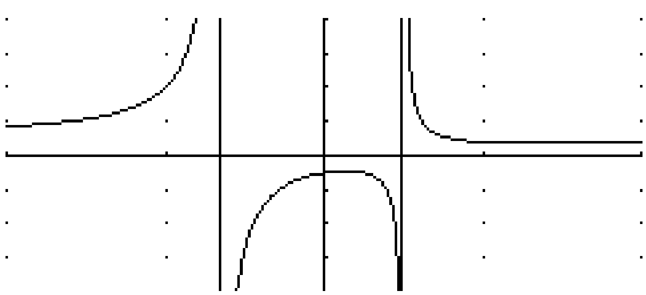
   c. Set the window to $-2 \leq x \leq 2$ and $-4 \leq y \leq 4$

   d. Press Graph



5. Now set the MODE back to "Connected" and prass Graph again.

   It looks as if the calculator understands the concept of **vertical asymptote**. It does not. It simply tries to connect pixels with a segment.



6. These asymptotes will occur at $x = -\frac{2}{3}$ and $x = \frac{1}{2}$ .these values make the denominator zero, but not the numerator.

7. This function, $f(x) = \frac{3x^2 - 2x + 1}{6x^2 + x - 2}$ also has a **horizontal asymptote** of $y = \frac{1}{2}$.

$\lim_{x \to \pm\infty} \frac{3x^2 - 2x + 1}{6x^2 + x - 2}$ can be found by observing only the 2nd degree terms in the numerator and denominator. Therefore $\frac{3x^2}{6x^2} = \frac{1}{2}$

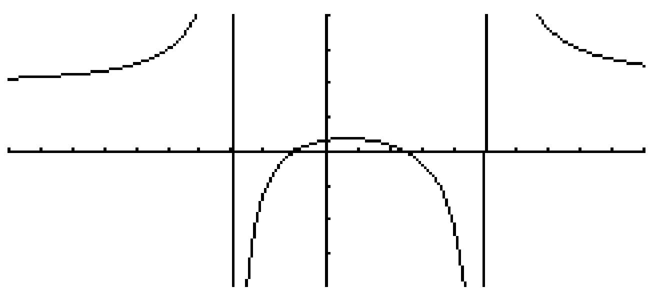
This is a special case that only works when the numerator and denominator have the same degree.

8. Predict the asymptotes: $f(x) = \frac{2x^2 - 3x - 5}{x^2 - 2x - 15} = \frac{(2x-5)(x+1)}{(x-5)(x+3)}$

Vertical Asymptotes: x = 5, x = -3
Horizontal Asymptote: y = 2

9. On Calculator Window: $-10 \le x \le 10$ and $-4 \le y \le 4$

10. Also note that the x-intercepts are at -1 and $\frac{5}{2}$, While the y-intercept is found by letting x = 0, so the y-intercept is $\frac{-5}{-15} = \frac{1}{3}$



11. When the numerator and denominator share equal instances of the same factor, the graph has a hole at the location found by cancelling the common factor.

12. $f(x) = \frac{x^2 + 4x - 5}{x^2 + 5x - 6} = \frac{(x-1)(x+5)}{(x-1)(x+6)} = \frac{x+5}{x+6}$, where $x \neq 1$

There will be a hole at x = 1 at coordinate $\left(1, \frac{6}{7}\right)$

x-int = -5; y-int = 5/6; Vertical Asy x = -6; Horizontal Asy y = 1.

Assignment 122
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