

## EXPLORE Rational Functions

Given:  $f(x) = \frac{x^2 - 4}{x^2 - x - 6}$

1. What is the domain of  $f(x)$ ?  
All reals except . . . .
2. Graph  $f(x)$  in a friendly viewing rectangle (TI-81:  $[-4.7, 4.8]$  by  $[-5, 5]$ ; TI-82/83:  $[-4.7, 4.7]$  by  $[-5, 5]$ ; TI-85  $[-6.3, 6.3]$  by  $[-5, 5]$ .  
**TRACE** the graph from left to right across the screen. Where is  $f(x)$  undefined?  
Describe what happens to the graph of  $f(x)$  at each  $x$ -value for which  $f(x)$  is undefined.
3. A **vertical asymptote** occurs at a place on a graph where the function is undefined and the graph grows towards positive or negative infinity on each side of the undefined point. Does  $f(x)$  have a vertical asymptote? Where?
4. A **hole** occurs where  $f(x)$  is undefined at a single point, but the graph would be continuous if that single point was not missing. Does  $f(x)$  have a hole in its graph? Where?
5. Write  $f(x)$  in factored form:  $f(x) =$ 
  - (a) How could you use the equation of  $f(x)$  to predict where a vertical asymptote will occur in the graph?
  - (b) How could you use the equation of  $f(x)$  to predict where a hole will occur in the graph?
6. **TRACE** the graph of  $f(x)$  to the right beyond the current viewing rectangle. Continue to trace to the right for awhile. What seems to happen to the  $y$ -coordinates as  $x$  gets large?
7. **TRACE** the graph of  $f(x)$  to the left beyond the current viewing rectangle. Continue to trace to the left for awhile. What seems to happen to the  $y$ -coordinates as  $x$  gets small?
8. What is the end-behavior of the graph of  $f(x)$ ?