

# Graphing Technology Lab

## Simplifying Rational Expressions

Sharp EL-9900C

When simplifying rational expressions, you can use a Sharp EL-9900C graphing calculator to support your answer. If the graphs of the original expression and the simplified expression overlap, they are equivalent. You can also use the graphs to see excluded values.

### ACTIVITY Simplify a Rational Expression

Simplify  $\frac{x^2 - 16}{x^2 + 8x + 16}$ .

**Step 1** Factor the numerator and denominator.

$$\begin{aligned} \frac{x^2 - 16}{x^2 + 8x + 16} &= \frac{(x - 4)(x + 4)}{(x + 4)(x + 4)} \\ &= \frac{(x - 4)}{(x + 4)} \end{aligned}$$

When  $x = -4$ ,  $x + 4 = 0$ . Therefore,  $x$  cannot equal  $-4$  because you cannot divide by zero.

**Step 2** Graph the original expression.

- Clear the memory.

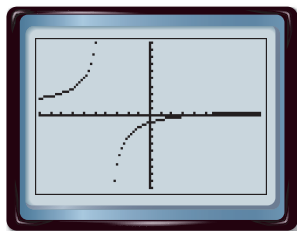
KEYSTROKES:  $\boxed{2\text{ndF}}$   $\boxed{[\text{OPTION}]}$   $\boxed{[\text{ALPHA}]}$   $\boxed{[\text{E}]}$   $\boxed{2}$   
 $\boxed{[\text{CL}]}$   $\boxed{[\text{ENTER}]}$

- Set the calculator to Dot mode.

KEYSTROKES:  $\boxed{2\text{ndF}}$   $\boxed{[\text{DRAW}]}$   $\boxed{[\text{D: LINE}]}$   $\boxed{[\text{ENTER}]}$   $\boxed{[\text{Y1}]}$   
 $\boxed{[\text{▶}]} \boxed{[\text{▶}]} \boxed{[\text{▶}]} \boxed{[\text{ENTER}]}$   $\boxed{[\text{▼}]} \boxed{[\text{ENTER}]}$   $\boxed{2\text{ndF}}$   
 $\boxed{[\text{QUIT}]}$

- Enter  $\frac{x^2 - 16}{x^2 + 8x + 16}$  as Y1 and graph.

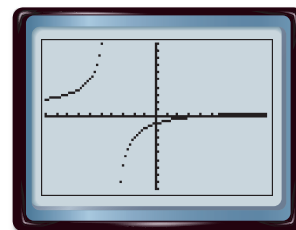
KEYSTROKES:  $\boxed{[\text{Y=}]}$   $\boxed{[( ]}$   $\boxed{[\text{X}/\theta/\tau/n]}$   $\boxed{[x^2]}$   $\boxed{[-]}$   $\boxed{16}$   $\boxed{[ )]}$   
 $\boxed{[\div]}$   $\boxed{[( ]}$   $\boxed{[\text{X}/\theta/\tau/n]}$   $\boxed{[x^2]}$   $\boxed{[+]}$   $\boxed{8}$   
 $\boxed{[\text{X}/\theta/\tau/n]}$   $\boxed{[+]}$   $\boxed{16}$   $\boxed{[ )]}$   $\boxed{[\text{Zoom}]}$   $\boxed{5}$



**Step 3** Graph the simplified expression.

- Enter  $\frac{(x - 4)}{(x + 4)}$  as Y2 and graph.

KEYSTROKES:  $\boxed{[\text{Y=}]}$   $\boxed{[\text{▼}]}$   $\boxed{[( ]}$   $\boxed{[\text{X}/\theta/\tau/n]}$   $\boxed{[-]}$   $\boxed{4}$   $\boxed{[ )]}$   
 $\boxed{[\div]}$   $\boxed{[( ]}$   $\boxed{[\text{X}/\theta/\tau/n]}$   $\boxed{[+]}$   $\boxed{4}$   $\boxed{[ )]}$   
 $\boxed{[\text{GRAPH}]}$



Since the graphs overlap, the two expressions are equivalent.

### Exercises

Simplify each expression. Then verify your answer graphically. Name the excluded values.

1.  $\frac{5x + 15}{x^2 + 10x + 21}$

2.  $\frac{x^2 - 8x + 12}{x^2 + 7x - 18}$

3.  $\frac{2x^2 + 6x + 4}{3x^2 + 9x + 6}$

4. a. Simplify  $\frac{3x - 8}{6x^2 - 16x}$ .

b. How can you use the  $\boxed{[\text{TABLE}]}$  function to verify that the original expression and the simplified expression are equivalent?

c. How does the  $\boxed{[\text{TABLE}]}$  function show you that an  $x$ -value is an excluded value?