



**UNDERSTAND**

8. **Reason** Explain why  $\frac{4x^2 - 7}{4x^2 - 7} = 1$  is a valid identity under the domain of all real numbers except  $\pm \frac{\sqrt{7}}{2}$ .
9. **Error Analysis** Describe the error a student made in multiplying and simplifying  $\frac{x+2}{x-2} \cdot \frac{x^2-4}{x^2+x-2}$ .

$$\begin{aligned} & \frac{x+2}{x-2} \cdot \frac{x^2-4}{x^2+x-2} \\ &= \frac{x+2}{\cancel{x-2}} \cdot \frac{\cancel{(x+2)}(x-2)}{\cancel{(x+2)}(x-1)} \\ &= \frac{2}{-1} \end{aligned}$$

10. **Higher Order Thinking** Explain why the process of dividing by a rational number is the same as multiplying by its reciprocal.
11. **Use Appropriate Tools** Explain how you can use your graphing calculator to show that the rational expressions  $\frac{-6x^2 + 21x}{3x}$  and  $-2x + 7$  are equivalent under a given domain. What is true about the graph at  $x = 0$  and why?
12. **Generalize** Explain the similarities between rational numbers and rational expressions.
13. **Use Structure** Determine whether  $\frac{5x+11}{6x+11} = \frac{5}{6}$  is *sometimes*, *always*, or *never* true. Justify your reasoning.
14. **Construct Arguments** Explain how you can tell whether a rational expression is in simplest form.
15. **Communicate Precisely** When multiplying  $\frac{15}{x} \cdot \frac{x}{3} = 5$ , is it necessary to make the restriction  $x \neq 0$ ? Why or why not?
16. **Reason** If the denominator of a rational expression is  $x^3 + 3x^2 - 10x$ , what value(s) must be restricted from the domain for  $x$ ?

**PRACTICE**

Write an equivalent expression. State the domain. SEE EXAMPLE 1

17.  $\frac{x^3 + 4x^2 - 12x}{x^2 + x - 30}$
18.  $\frac{3x^2 + 15x}{x^2 + 3x - 10}$

What is the simplified form of each rational expression? What is the domain? SEE EXAMPLE 2

19.  $\frac{y^2 - 5y - 24}{y^2 + 3y}$
20.  $\frac{ab^3 - 9ab}{12ab^2 + 12ab - 144a}$
21.  $\frac{x^2 + 8x + 15}{x^2 - x - 12}$
22.  $\frac{x^3 + 9x^2 - 10x}{x^3 - 9x^2 - 10x}$

Find the product and the domain. SEE EXAMPLE 3

23.  $\frac{x^2 + 6x + 8}{x^2 + 4x + 3} \cdot \frac{x+3}{x+2}$
24.  $\frac{(x-y)^2}{x+y} \cdot \frac{3x+3y}{x^2-y^2}$

Find the product and the domain. SEE EXAMPLE 4

25.  $\frac{(x+5)}{(x^3-25x)} \cdot (2x^3 - 11x^2 + 5x)$
26.  $\frac{(2x^2 - 10x)}{(x-5)(x^2-1)} \cdot (3x^2 + 4x + 1)$

Find the quotient and the domain. SEE EXAMPLE 5

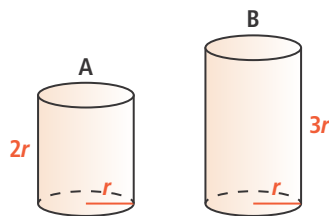
27.  $\frac{y^2 - 16}{y^2 - 10y + 25} \div \frac{3y - 12}{y^2 - 3y - 10}$
28.  $\frac{(x-y)^2}{x+y} \div \frac{3x+3y}{x^2-y^2}$
29.  $\frac{25x^2 - 4}{x^2 - 9} \div \frac{5x - 2}{x + 3}$
30.  $\frac{x^4 + x^3 - 30x^2}{x^2 - 3x - 18} \div \frac{x^3 + x^2 - 30x}{x^2 - 36}$
31. A rectangular prism with a volume of  $3x^3 + 7x^2 + 2x$  cubic units has a base area of  $x^2 + 2x$  square units. Find the height of the rectangular prism. SEE EXAMPLE 6

**APPLY**

**32. Make Sense and Persevere** An engineering firm wants to construct a cylindrical structure that will maximize the volume for a given surface area. Compare the ratios of the volume to surface area of each of the cylindrical structures shown, using the following formulas for volume and surface area of cylinders.

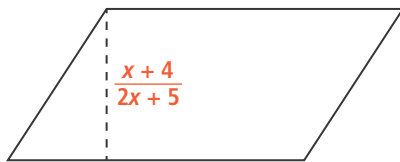
$$\text{Volume } (V) = \pi r^2 h$$

$$\text{Surface Area } (SA) = 2\pi rh + 2\pi r^2$$

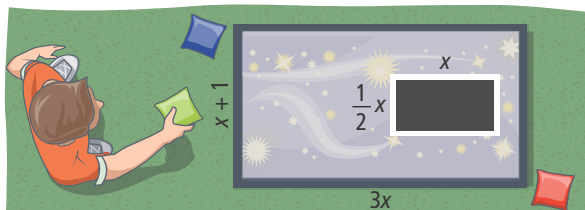


- Calculate the ratio of volume to surface area for cylinder A.
- Calculate the ratio of volume to surface area for cylinder B.
- Which of these cylinders has a greater ratio of volume to surface area?

**33. Look for Relationships** A parallelogram with an area of  $\frac{3x+12}{10x+25}$  square units has a height shown. Find the length of the base of the parallelogram.



**34. Model With Mathematics** Brie designed a carnival game that involves tossing a beanbag into the box shown. In order to win a prize, the beanbag must fall inside the black rectangle. The probability of winning is equal to the ratio of the area of the black rectangle to the total area of the face of the box shown. Find this probability in simplified form.



**ASSESSMENT PRACTICE**

**35.** Which of the following rational expressions simplify to  $\frac{y}{y+3}$ ? Select all that apply.

- $\frac{(2y^2 + y)(y + 3)}{(4y + 2)(y + 3)^2}$
- $\frac{3y^2 + y}{3y^2 + 10y + 3}$
- $\frac{2y^3 + 3y^2 + y}{(2y + 1)(y^2 + 4y + 3)}$
- $\frac{y^2 + 2y}{y^2 + 4y + 3}$
- $\frac{1}{y + 3}$

**36. SAT/ACT** For what value of  $x$  is  $\frac{2x^2 + 8x}{(x + 4)(x^2 - 9)}$  undefined?

- 8
- 3
- 0
- 4
- 9

**37. Performance Task** The approximate annual interest rate  $r$  of a monthly installment loan is given by the formula:

$$r = \frac{\left[ \frac{24(nm - p)}{n} \right]}{\left( p + \frac{nm}{12} \right)},$$

where  $n$  is the total number of payments,  $m$  is the monthly payment, and  $p$  is the amount financed.

**Part A** Find the approximate annual interest rate (to the nearest percent) for a four-year signature loan of \$20,000 that has monthly payments of \$500.

**Part B** Find the approximate annual interest rate (to the nearest tenth percent) for a five-year auto loan of \$40,000 that has monthly payments of \$750.