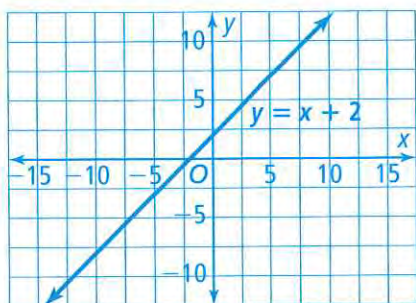


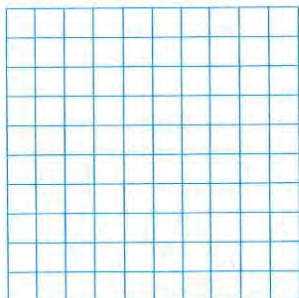
EXPLORE & REASON

Consider the following graph of the function $y = x + 2$.



A. What is the domain of this function?

B. Sketch a function that resembles the graph, but restrict its domain to exclude 2.



C. **Look for Relationships** Consider the function you have sketched. What kind of function might have a graph like this? Explain. © MP.7

HABITS OF MIND

Reason Does the graph of $y = \frac{2x+6}{x+3}$ have a vertical asymptote at $x = -3$? Explain. © MP.2

**EXAMPLE 1** **Try It! Write Equivalent Rational Expressions**

1. Write an expression equivalent to $\frac{3x^5 - 18x^4 - 21x^3}{2x^6 - 98x^4}$.
Remember to give the domain for your expression.

EXAMPLE 2 **Try It! Simplify a Rational Expression**

2. Simplify each expression and show the domain for which the identity with the two expressions is valid.

a. $\frac{x^2 + 2x + 1}{x^3 - 2x^2 - 3x}$

b. $\frac{x^3 + 4x^2 - x - 4}{x^2 + 3x - 4}$

HABITS OF MIND

Critique Reasoning Bailey simplified the rational expression $\frac{x^2 + 2x + 4}{x^2 + x + 2}$ by dividing out the x^2 -terms, and then dividing out a factor of $x + 2$ to get 2 as the simplified form of the rational expression. Is Bailey correct? Why or why not?

MP.3

EXAMPLE 3 **Try It! Multiply Rational Expressions**

3. Find the simplified form of each product, and give the domain.

a. $\frac{x^2 - 16}{9 - x} \cdot \frac{x^2 + x - 90}{x^2 + 14x + 40}$

b. $\frac{x + 3}{4x} \cdot \frac{3x - 18}{6x + 18} \cdot \frac{x^2}{4x + 12}$



**EXAMPLE 4** **Try It! Multiply a Rational Expression by a Polynomial**

4. Find the simplified form of each product and the domain.

a. $\frac{x^3 - 4x}{6x^2 - 13x - 5} \cdot (2x^3 - 3x^2 - 5x)$ b. $\frac{3x^2 + 6x}{x^2 - 49} \cdot (x^2 + 9x + 14)$

HABITS OF MIND

Generalize Why is it important to identify the domain of a rational expression before you simplify it rather than after? **MP.8**

EXAMPLE 5 **Try It! Divide Rational Expressions**

5. Find the simplified quotient and the domain of each expression.

a. $\frac{1}{x^2 + 9x} \div \left(\frac{6 - x}{3x^2 - 18x}\right)$ b. $\frac{2x^2 - 12x}{x + 5} \div \left(\frac{x - 6}{x + 5}\right)$

EXAMPLE 6 **Try It! Use Division of Rational Expressions**

6. The company compares the ratios of surface area to volume for two more containers. One is a rectangular prism with a square base. The other is a rectangular prism with a rectangular base. One side of the base is equal to the side-length of the first container, and the other side is twice as long. The surface area of this second container is $4x^2 + 6xh$. The heights of the two containers are equal. Which has the smaller surface area-to-volume ratio?

**HABITS OF MIND**

Use Structure Is the domain of the quotient $\frac{2x^2 - 12x}{x + 5} \div \left(\frac{x - 6}{x + 5}\right)$ different from the domain of the product $\left(\frac{2x^2 - 12x}{x + 5}\right)\left(\frac{x - 6}{x + 5}\right)$? Explain. **MP.7**

Do You UNDERSTAND?

1. **ESSENTIAL QUESTION** How does understanding operations with fractions help you multiply and divide rational expressions?

2. **Vocabulary** In your own words, define **rational expression** and provide an example of a rational expression.

3. **Error Analysis** A student divided the rational expressions as follows:

$$\frac{4x}{5y} \div \frac{20x^2}{25y^2} = \frac{4x}{8y} \div \frac{4 \cdot 20}{25y^2} = \frac{16x}{25y^3}$$

 Describe and correct the errors the student made. © MP.3

4. **Make Sense and Persevere** Why state the domain when simplifying rational expressions? © MP.1

Do You KNOW HOW?

5. What is the simplified form of the rational expression $\frac{x^2 - 36}{x^2 + 3x - 18}$? What is the domain?

6. Find the product and give the domain of $\frac{y+3}{y+2} \cdot \frac{y^2+4y+4}{y^2-9}$.

7. Find and simplify the ratio of the volume of Figure A to the volume of Figure B.

