

Chapter 8 Applications

Name: *KEY*

1. **GEOMETRY** A right triangle with an area of $x^2 - 4$ square units has a leg that measures $2x + 4$ units. Determine the length of the other leg of the triangle.

$$A = \frac{1}{2}bh$$

$$x^2 - 4 = \frac{1}{2}(2x + 4) \cdot h$$

$$x^2 - 4 = (x + 2)h$$

$$h = \boxed{(x - 2) \text{ units}}$$

$$\frac{(x + 2)(x - 2)}{(x + 2)} = h$$

2. **GEOMETRY** A rectangular pyramid has a base area of $\frac{x^2 + 3x - 10}{2x}$ square centimeters and a height of $\frac{x^2 - 3x}{x^2 - 5x + 6}$ centimeters. Write a rational expression to describe the volume of the rectangular pyramid.

$$V = \frac{1}{3} \cdot \underset{\text{(Base Area)}}{B} \cdot h \quad \text{or} \quad \frac{B \cdot h}{3}$$

$$V = \frac{1}{3} \cdot \frac{x^2 + 3x - 10}{2x} \cdot \frac{x^2 - 3x}{x^2 - 5x + 6}$$

$$V = \frac{1}{3} \cdot \frac{(x + 5)(x - 2)}{2x} \cdot \frac{x(x - 3)}{(x - 3)(x - 2)} = \boxed{\frac{x + 5}{6} \text{ cm}^3}$$

3. **GEOMETRY** The expressions $\frac{5x}{2}$, $\frac{20}{x + 4}$, and $\frac{10}{x - 4}$ represent the lengths of the sides of a triangle. Write a simplified expression for the perimeter of the triangle.

$P =$ All sides added

$$P = \frac{5x}{2} + \frac{20}{x + 4} + \frac{10}{x - 4}$$

$$P = \frac{5(x^3 - 4x - 16)}{2(x + 4)(x - 4)} \text{ units}$$

$$P = \frac{5x(x^2 - 16) + 20(2(x - 4)) + 10(2(x + 4))}{2(x + 4)(x - 4)}$$

$$P = \frac{5x^3 - 80x + 40x - 160 + 20x + 80}{2(x + 4)(x - 4)} = \frac{5x^3 - 20x - 80}{2(x + 4)(x - 4)}$$

4. **NAVIGATION** The current in a river is 6 miles per hour. In her motorboat Marissa can travel 12 miles upstream or 16 miles downstream in the same amount of time. What is the speed of her motorboat in still water? Is this a reasonable answer? Explain.

boat speed: x mph
current speed: 6 mph

} against current: $x-6$
with current: $x+6$

$$\frac{12}{x-6} = \frac{16}{x+6}$$

$$12(x+6) = 16(x-6)$$

$$12x + 72 = 16x - 96$$

$$-4x = -168$$

$$\boxed{x = 42 \text{ mph}}$$

The boat will travel 48 mph w/current & 36 mph against the current.

5. **WORK** Adam, Bethany, and Carlos own a painting company. To paint a particular house alone, Adam estimates that it would take him 4 days, Bethany estimates $5\frac{1}{2}$ days, and Carlos 6 days. If these estimates are accurate, how long should it take the three of them to paint the house if they work together? Is this a reasonable answer?

x : # of days to paint house as a team

$$\frac{x}{4} + \frac{x}{5.5} + \frac{x}{6} = 1$$

$$33x + 24x + 22x = 132$$

$$79x = 132$$

$$x = \frac{132}{79} = 1\frac{53}{79} \approx 1.67 \text{ days}$$

about $1\frac{2}{3}$ days

8-3 Study Guide and Intervention

Graphing Rational Functions

Domain and Range

Rational Function	an equation of the form $f(x) = \frac{p(x)}{q(x)}$, where $p(x)$ and $q(x)$ are polynomial expressions and $q(x) \neq 0$
Domain	The domain of a rational function is limited to values for which the function is defined.
Vertical Asymptote	An asymptote is a line that the graph of a function approaches. If the simplified form of the related rational expression is undefined for $x = a$, then $x = a$ is a vertical asymptote.
Point Discontinuity	Point discontinuity is like a hole in a graph. If the original related expression is undefined for $x = a$ but the simplified expression is defined for $x = a$, then there is a hole in the graph at $x = a$.
Horizontal Asymptote	Often a horizontal asymptote occurs in the graph of a rational function where a value is excluded from the range.

Example

Determine the equations of any vertical asymptotes and the values

of x for any holes in the graph of $f(x) = \frac{4x^2 + x - 3}{x^2 - 1}$.

First factor the numerator and the denominator of the rational expression.

$$f(x) = \frac{4x^2 + x - 3}{x^2 - 1} = \frac{(4x - 3)(x + 1)}{(x + 1)(x - 1)}$$

The function is undefined for $x = 1$ and $x = -1$.

Since $\frac{(4x - 3)(x + 1)}{(x + 1)(x - 1)} = \frac{4x - 3}{x - 1}$, $x = 1$ is a vertical asymptote. The simplified expression is defined for $x = -1$, so this value represents a hole in the graph.

Exercises

Determine the equations of any vertical asymptotes and the values of x for any holes in the graph of each rational function.

1. $f(x) = \frac{4}{x^2 + 3x - 10}$

VA: $x = -5$ & $x = 2$

Holes: None

4. $f(x) = \frac{3x - 1}{3x^2 + 5x - 2}$

VA: $x = -2$

Holes: $x = 1/3$

7. $f(x) = \frac{x + 1}{x^2 - 6x + 5}$

VA: $x = 1$ & $x = 5$

Holes: None

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2. $f(x) = \frac{2x^2 - x - 10}{2x - 5}$

VA: None

Holes: $x = 5/2$

5. $f(x) = \frac{x^2 - 6x - 7}{x^2 + 6x - 7}$

VA: $x = 1$ & $x = -7$

Holes: None

8. $f(x) = \frac{2x^2 - x - 3}{2x^2 + 3x - 9}$

VA: $x = -3$

Holes: $x = 3/2$

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3. $f(x) = \frac{x^2 - x - 12}{x^2 - 4x}$

VA: $x = 0$

Holes: $x = 4$

6. $f(x) = \frac{3x^2 - 5x - 2}{x + 3}$

VA: $x = -3$

Holes: None

9. $f(x) = \frac{x^3 - 2x^2 - 5x + 6}{x^2 - 4x + 3}$ ← use table

VA: None

Holes: $x = 1$ & $x = 3$

Glencoe Algebra 2