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Study Guide and Intervention

Transforming and Analyzing Rational Functions

Example **Describe the transformation.**

What transformations of the rational parent function, *f(x)* = $\frac{1}{x}$ will result in the graph of the rational function *g(x)* = - $\frac{3}{x-2}$ + 1.5?

Solution

Step 1 **Rewrite the equation of g(x) in general form to determine the values of the parameters a, b, c, and d.**

$$g(x) = -\frac{3}{x-2} + 1.5$$

$$g(x) = -\frac{-3}{1x-2} + 1.5$$

Therefore, a = -3, b = 1, c = 2, and d = 1.5

Step 2 **Use the values of the parameters to describe the transformations of the rational parent function f(x) that are necessary to produce g(x).**

a = -3, so |a| > 1. The range values (y-coordinates) of the rational parent function are multiplied by a factor of 3 in order to vertically stretch the graph

since a < 0, the graph will be reflected across the x-axis

b = 1, so there is a no change.

c = 2, so c > 0. The graph of the rational parent function will translate 2 units to the right

d = 1.5 so the graph will translate 1.5 units up

Exercises

For questions 1-4, describe the transformation of the rational parent function, f(x) = $\frac{1}{x}$ that will result in the graph of the rational function given.

1. f(x) = $\frac{1}{x+1}$

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

3. f(x) = $\frac{1}{-0.5x}$

4. f(x) = $\frac{1}{x}$ - 5

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Transforming and Analyzing Rational Functions (cont.)

Example **Identify the domain, range, horizontal and vertical asymptotes, x-intercept and y-intercept of the rational function described by the equation shown below. Write the domain and range in set builder notation.**

$$y = \frac{12}{3x} + 2$$

Solution

Step 1 **Determine the domain and range of f(x).**

Since this is a rational function, the domain and range are *all real numbers*, excluding $x = \frac{c}{b} = 0$. The range is *all real numbers*, excluding $y = d = 2$.

Set builder notation

Domain: $\{x|x \in \mathbb{R}, x \neq 0\}$ Range: $\{y| y \in \mathbb{R}, y \neq 2\}$

Step 2 **Determine the horizontal and vertical asymptotes.**

horizontal asymptote: $y = d = 2$

vertical asymptote: $x = \frac{c}{b} = 0$

Step 3 **Determine the x-intercept of f(x).**

Use your calculator to find the x-intercepts

x-intercept (-2, 0)

Step 4 **Determine the y-intercept of f(x).**

Use your calculator to find the y-intercepts

y-intercept: there is no y-intercept

Exercises

For questions 5-10, identify the domain, range, horizontal and vertical asymptotes, x-intercept and y-intercept of the rational function. Write the domain and range in set builder notation.

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

6. $f(x) = \frac{5}{x+7} + 3$

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

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

9. $f(x) = f(x) = \frac{6}{x+3}$

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