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Lesson 4: Are You Rational?

Solidify Understanding



Ready

Find the roots and domain for each function.

1. $f(x) = (x + 5)(x - 2)(x - 7)$ 2. $g(x) = x^2 + 7x + 6$

3. $k(x) = \frac{1}{(x + 5)(x - 2)(x - 7)}$ 4. $h(x) = \frac{1}{(x^2 + 7x + 6)}$

5. Do the roots of the polynomials in problems 1 and 2 tell you anything about the graph of the reciprocal of the polynomial represented in $k(x)$ and $h(x)$? Explain.

6. Do the y -intercepts of the polynomials in problems 1 and 2 tell you anything about the y -intercepts of the functions in problems 3 and 4? Explain.

7. Rational functions are needed because polynomial functions are not closed under division. A rational function is defined as the ratio of two polynomial functions or

$f(x) = \frac{p(x)}{q(x)}$ where $q(x) \neq 0$. We know that the values of x that make $q(x) = 0$ are not in the domain of $f(x)$. Is it possible for $f(x) = \frac{p(x)}{q(x)}$ to equal 0? Justify your answer.



Set

For each function identify the degree of the numerator and the denominator.

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8. $f(x) = \frac{(x+5)(x-2)(x-7)}{(x+9)(x-6)}$

9. $g(x) = \frac{(5x+8)(x-4)}{(3x+9)(x)}$

10. $h(x) = \frac{(6x+7)(x-4)}{(3x+9)(x)(x^2)}$

11. Which function in problems 8–10 has a horizontal asymptote at $y = 0$?



Write the equation of the vertical asymptote(s) of the following functions. Indicate if the graph of the function has a hole in it instead of a vertical asymptote.

12. $f(x) = \frac{9x^2 + 30x + 25}{3x^2 + 5x}$

13. $f(x) = \frac{x^2 + 2x - 8}{x^2 - 16}$

14. $f(x) = \frac{36x^2 - 49}{x^2 - 14x + 49}$



Use long division to rewrite the rational function in an equivalent form that reveals the slant asymptote. Then, write the equation of the slant asymptote.

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

16. $g(x) = \frac{x^2 - 3x - 5}{x - 4}$

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



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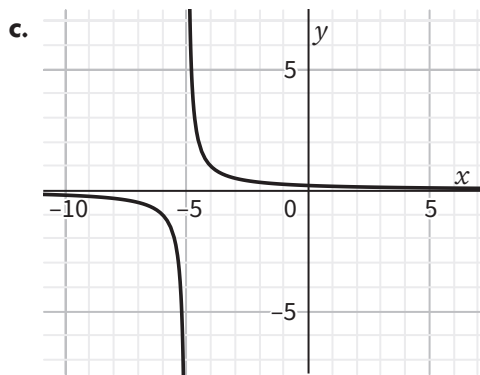


State the domain of the following rational functions, write the equation of the vertical asymptote, and sketch in the vertical asymptote on the graph. Put an open circle on the graph anywhere it is undefined.

18. $y = \frac{(x - 2)}{(x - 2)(x + 5)}$

a. domain:

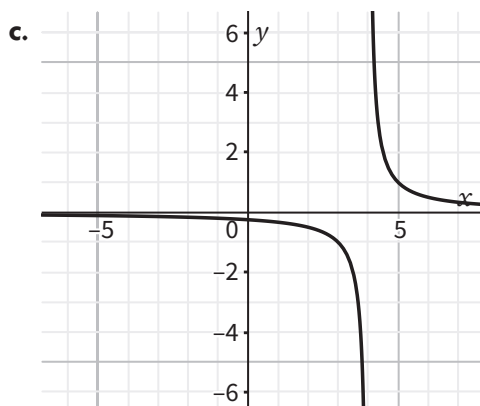
b. vertical asymptote:



19. $y = \frac{(x + 6)}{(x - 4)(x + 6)}$

a. domain:

b. vertical asymptote:





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20. $y = \frac{(x - 7)(x + 10)}{(x + 10)(x - 3)(x - 7)}$

a. domain:

b. vertical asymptote:

