Name: _____ Date: _____ Period: _____

Show all reasoning. Label holes, vertical asymptotes (VA), intercepts, and one-sided limits precisely.

1. Identify holes and vertical asymptotes; calculate each hole coordinate.

$f(x) = \dfrac{(x + 5)(x - 2)}{(x - 2)(x + 3)}$

2. Factor first; identify and classify all discontinuities.

$g(x) = \dfrac{x^2 - x - 12}{x^2 - 8x + 16}$

3. Identify holes and vertical asymptotes.

$h(x) = \dfrac{(x + 6)^2(x - 3)}{(x + 6)^3(x + 1)}$

4. Find all real vertical asymptotes, if any, and explain.

$q(x) = \dfrac{x^2 + 1}{x^2 + 4x + 4}$

5. Write both one-sided infinite limits at the VA.

$f(x) = \dfrac{-2x}{x + 4}$

6. Write one-sided limits near $x = 6$.

$g(x) = \dfrac{5}{(x - 6)^2}$

7. Complete a table near $x = -2$, identify VA and one-sided limits.

$p(x) =$

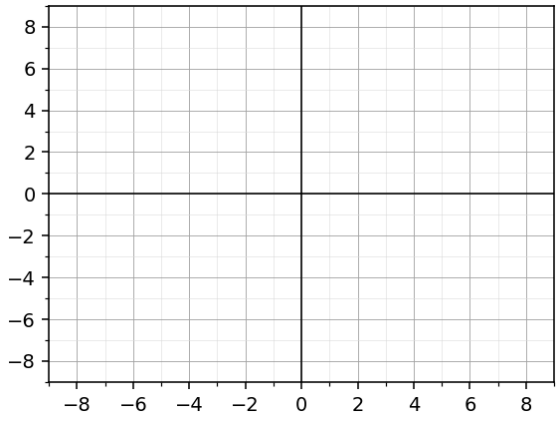
$$\frac{x - 3}{x + 2}$$

x	-2.1	-2.01	-2.001	-2	-1.999	-1.99	-1.9
$f(x)$							

8. Graph the rational function on the grid; identify VAs and their one-sided limits.

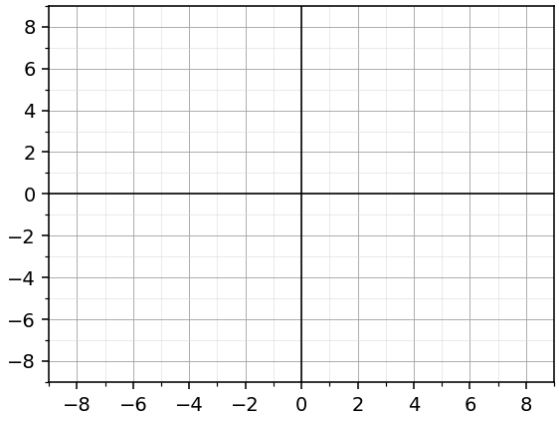
$f(x) =$

$$\frac{-4}{(x + 1)(x - 4)}$$



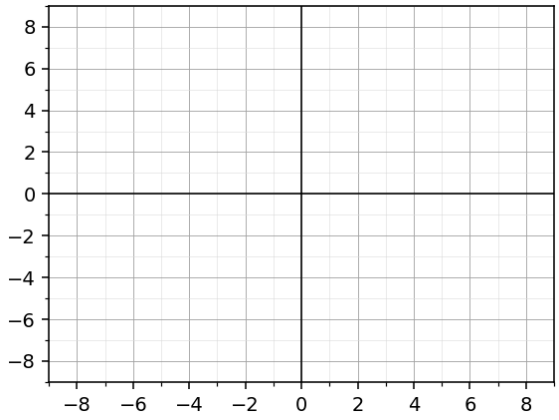
9. Construct a function with holes at x = 2 and x = −5 and a VA at x = 0.

Use factored form.



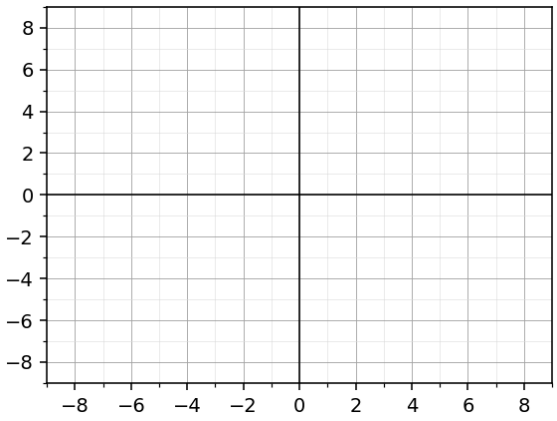
10. Construct a function with a hole at x = −1, a VA at x = 7, and an x-intercept at x = 4.

Use factored form.



11. Write an equation for a rational function with horizontal asymptote $y = -2$, VA $x = -3$, and a hole at $(1, -1)$.

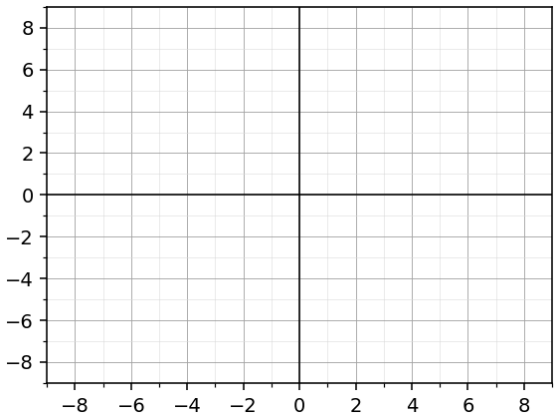
Use factored form.



12. Analyze and sketch: VA, horizontal asymptote, intercepts, hole coordinate, domain, and range.

$s(x) =$

$$\frac{2(x-5)(x+1)}{(x+1)(x-2)}$$



13. AP-style MCQ: Which describes r(x)? A. Hole x=−5 and VA x=3 B. Hole x=3 and VA x=−5 C. Holes at both D. VAs at both

$$r(x) = \frac{(x + 5)(x - 1)}{(x - 3)(x + 5)}$$

14. AP-style MCQ: Which expression has a hole at x=2 and a VA at x=−4? A. [[(x − 2)|(x + 4)]] B. [[(x − 2)(x + 1)|(x − 2)(x + 4)]] C. [[(x + 4)(x + 1)|(x − 2)(x + 4)]] D. [[(x + 4)|(x − 2)]]

Select A, B, C, or D.

15. Multiplicity analysis: Classify discontinuities.

$y =$

$$\frac{(x+3)^3(x-2)^2(x-6)}{(x+3)(x-2)^4(x-6)}$$

16. Free response: Explain the behavior near $x = -4$ using a table, identify the VA, the hole, and the horizontal asymptote.

$f(x) =$

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