

9-4 Graphs of Rational Functions

Name _____

Date _____ Block _____

A **RATIONAL FUNCTION** is a function of the form $f(x) = \frac{p(x)}{q(x)}$, where $p(x)$ and $q(x)$ are polynomial functions with no common factors other than 1, and $q(x) \neq 0$.

Zeros

The **zeros** are the values of x where the **numerator equals zero**.

Vertical Asymptotes

Set the denominator equal to zero and solve for x . There will be a vertical asymptote at each zero of $q(x)$.

Horizontal Asymptotes

- If the degree of $p(x)$ is **less than** the degree of $q(x)$, then there will be a horizontal asymptote at $y = 0$.
- If the degree of $p(x)$ is **equal to** the degree of $q(x)$, then there will be a horizontal asymptote at $y = \frac{\text{leading coefficient of } p(x)}{\text{leading coefficient of } q(x)}$.
- If the degree of $p(x)$ is **greater than** the degree of $q(x)$, then there will not be a horizontal asymptote.

Oblique/Slant Asymptotes

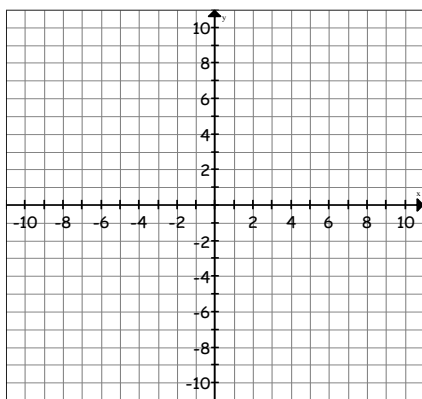
A **slant asymptote** exists when the degree of the numerator is **exactly one greater** than the degree of the denominator. Use long division to find the equation of the slant asymptote (ignore/discard the remainder).

Holes

A **hole** is a point of discontinuity and occurs when there is a **common factor** in the numerator and denominator

Graph each function and state the indicated parts.

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



y-intercept: _____

zeros: _____

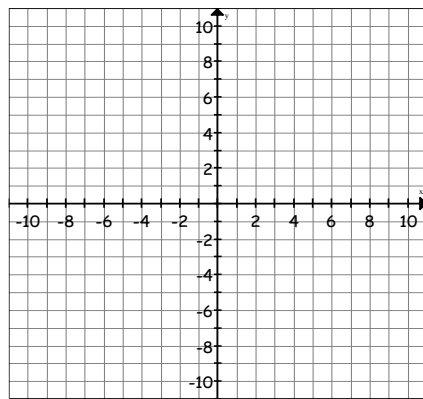
asymptotes: _____

holes: _____

domain: _____

range: _____

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



y-intercept: _____

zeros: _____

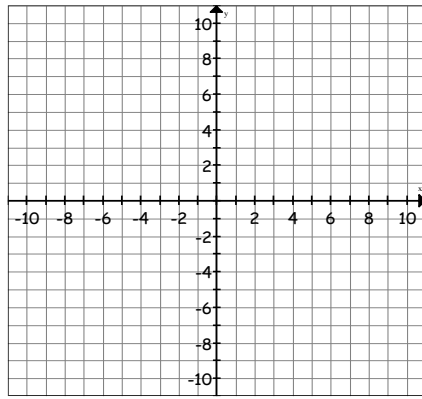
asymptotes: _____

holes: _____

domain: _____

range: _____

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



y-intercept: _____

zeros: _____

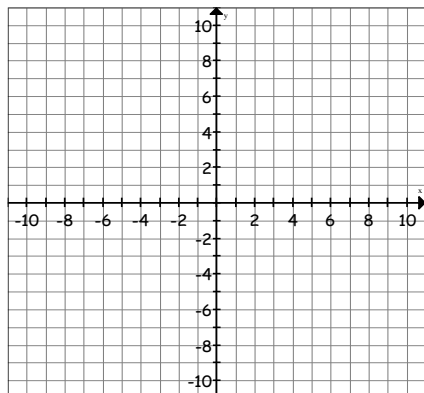
asymptotes: _____

holes: _____

domain: _____

range: _____

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



y-intercept: _____

zeros: _____

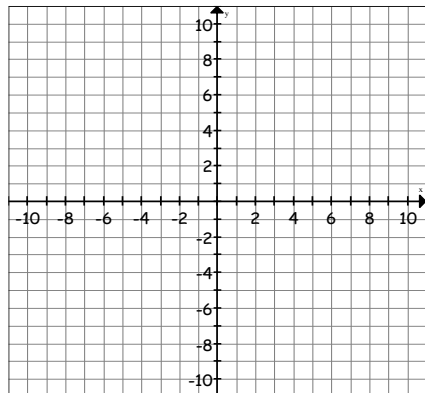
asymptotes: _____

holes: _____

domain: _____

range: _____

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



y-intercept: _____

zeros: _____

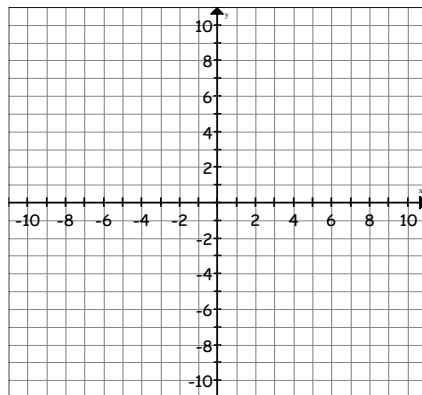
asymptotes: _____

holes: _____

domain: _____

range: _____

$$6. f(x) = \frac{4}{x^2 - x - 6}$$



y-intercept: _____

zeros: _____

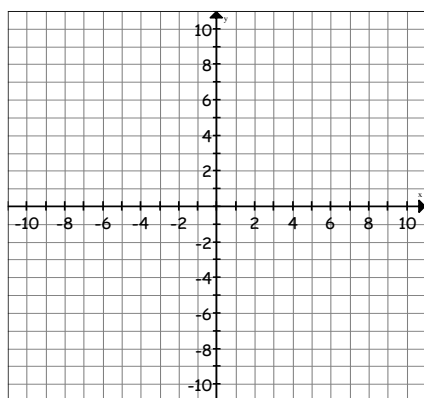
asymptotes: _____

holes: _____

domain: _____

range: _____

$$7. f(x) = \frac{2x-6}{x+4}$$



y-intercept: _____

zeros: _____

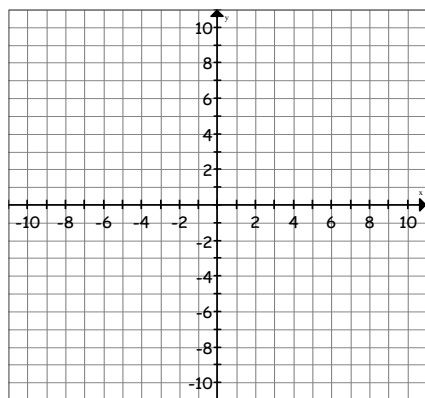
asymptotes: _____

holes: _____

domain: _____

range: _____

$$8. f(x) = \frac{5x+1}{x^2-1}$$



y-intercept: _____

zeros: _____

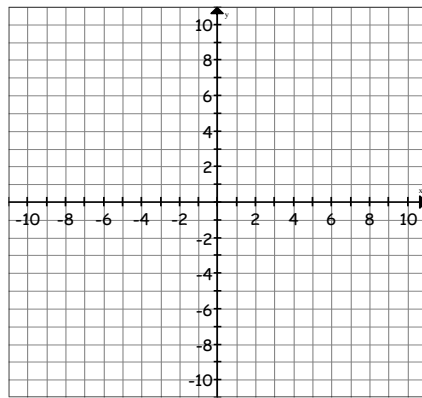
asymptotes: _____

holes: _____

domain: _____

range: _____

$$9. f(x) = \frac{x+1}{x^2-4}$$



y-intercept: _____

zeros: _____

asymptotes: _____

holes: _____

domain: _____

range: _____