

Rational Route Maps

Solve, graph, and interpret rational functions.

HIGH SCHOOL • MA.912.AR.8.3

MA.912.AR.8.3 "Solve and graph mathematical and real-world problems that are modeled with rational functions. Interpret key features and determine constraints in terms of the context."

NAME _____

DATE _____

GRAPH CLUES

A denominator value of 0 is excluded from the domain. A noncanceled denominator zero gives a vertical asymptote, and the degrees and leading coefficients help you find the horizontal asymptote.

WORKED EXAMPLE

For $f(x) = (x-11)/(x+13)$, find the vertical asymptote, horizontal asymptote, and intercepts.

1. Set $x+13=0$, so the vertical asymptote is $x=-13$.
2. The degrees match, so the horizontal asymptote is $y=1$.
3. Set $x-11=0$, so the x-intercept is $(11,0)$.
4. Find $f(0)=-11/13$, so the y-intercept is $(0,-11/13)$.

Answer: VA: $x=-13$; HA: $y=1$; x-intercept: $(11,0)$; y-intercept: $(0,-11/13)$

PRACTICE 5 problems

- 1** For $f(x) = (x+2)/(x-5)$, state the domain restriction and vertical asymptote.

ANSWER _____

- 2** Find the horizontal asymptote of $f(x) = (3x-4)/(2x+7)$.

ANSWER _____

- 3** Find both intercepts of $f(x) = (x-6)/(x+3)$.

ANSWER _____

- 4** Solve: $8/(x-1)=2$

ANSWER _____

- 5** For $f(x) = (2x+1)/(x-4)$, list the vertical asymptote, horizontal asymptote, and y-intercept.

ANSWER _____

APPLY IT Show your work

- 1** A gaming club pays a \$48 server fee and \$3 per player for a tournament. Its average cost per player is $C(n)=48/n+3$. State the allowed n -values, find $C(8)$, and explain what $y=3$ means.

WORK SPACE

ANSWER _____

- 2** During a bike commute, a student rides 24 miles and spends $1/2$ hour at lights. Total time is $T(v)=24/v+1/2$, where v is riding speed in mph. State the constraint, find $T(8)$, and interpret both asymptotes.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

For $g(x)=(x^2-25)/(x^2-10x+25)$, identify the excluded x -value, vertical asymptote, horizontal asymptote, and x -intercept. Explain why there is no hole.

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For $f(x)=(x+2)/(x-5)$, state the domain restriction and vertical asymptote.	$x \neq 5$; vertical asymptote: $x=5$
2	Find the horizontal asymptote of $f(x)=(3x-4)/(2x+7)$.	$y=3/2$
3	Find both intercepts of $f(x)=(x-6)/(x+3)$.	x-intercept: (6,0); y-intercept: (0,-2)
4	Solve: $8/(x-1)=2$	$x=5$
5	For $f(x)=(2x+1)/(x-4)$, list the vertical asymptote, horizontal asymptote, and y-intercept.	VA: $x=4$; HA: $y=2$; y-intercept: (0,-1/4)

PART 2 · APPLY IT

- n is a positive whole number; $C(8)=9$ dollars; $y=3$ means the average cost approaches \$3 per player as more players join.** Use $n>0$ because there cannot be zero players. Substitute 8: $48/8+3=9$, and the horizontal asymptote represents the per-player fee.
- $v>0$; $T(8)=7/2$ hours; vertical asymptote: $v=0$ means zero speed is not allowed and time increases without bound; horizontal asymptote: $T=1/2$ means total time approaches the stop time as speed increases.**
Substitute 8: $24/8+1/2=7/2$. The denominator excludes $v=0$, while $24/v$ approaches 0 as v increases.

CHALLENGE

Excluded value: $x=5$; VA: $x=5$; HA: $y=1$; x-intercept: (-5,0). Since $g(x)=(x+5)/(x-5)$ after canceling one factor of (x-5), one (x-5) remains in the denominator, so there is a vertical asymptote instead of a hole.

Accept equivalent domain wording, such as x is not equal to the excluded value. For graph-feature items, accept a correctly labeled feature list instead of a sketch.