LESSON MAKER PRO

Reciprocal Roadmaps

Sketch curves and locate their asymptotes.

HIGH SCHOOL · A2S.AF.H.20.d

A2S.AF.H.20.d "Graph reciprocal functions expressed symbolically, identifying horizontal and vertical asymptotes."

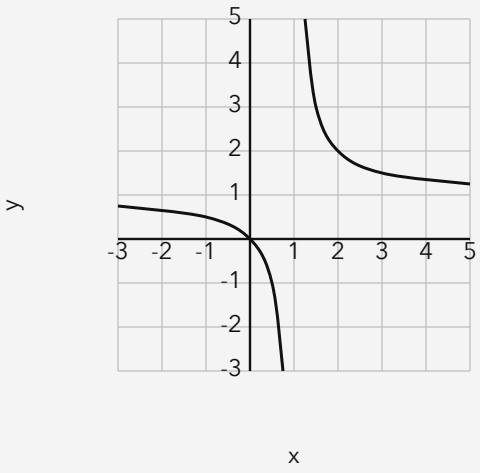
NAME _____ DATE _____

FIND THE BOUNDARIES

For y = a/(x - h) + k, the vertical asymptote is x = h because the denominator cannot be 0. The horizontal asymptote is y = k because the fraction approaches 0 as x moves far from h. Plot a point on each side of x = h to guide your sketch.

WORKED EXAMPLE

The figure shows y = 1/(x - 1) + 1. Use the graph and formula to find both asymptotes.



1. Set the denominator to 0: x - 1 = 0, so x = 1.
2. The fraction approaches 0 far from x = 1, so y approaches 1.
3. Check that the graph nears these lines without crossing x = 1.

Answer: Vertical asymptote: x = 1. Horizontal asymptote: y = 1.

PRACTICE 4 problems

1 Sketch y = 3/(x + 2) - 1 on your own axes. Mark both asymptotes and one point on each branch.

ANSWER _____

2 Sketch y = -2/(x - 3) + 2 on your own axes. Mark both asymptotes and one point on each branch.

ANSWER _____

3 Sketch $y = 4/(x + 1) + 3$ on your own axes. Mark both asymptotes and one point on each branch.

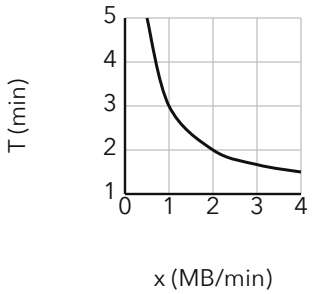
ANSWER _____

4 Sketch $y = -3/(x - 4) - 2$ on your own axes. Mark both asymptotes and one point on each branch.

ANSWER _____

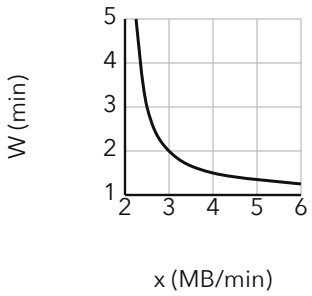
APPLY IT Show your work

1 A 2 MB clip takes T(x) = 2/x + 1 minutes to upload at speed x MB/min, where x > 0. Use the graph to name both asymptotes. What happens to the upload time as the speed approaches 0?



ANSWER _____

2 For speeds x > 2 MB/min, a game download has modeled wait W(x) = 1/(x - 2) + 1 minutes. Use the graph to name both asymptotes. What does the horizontal asymptote mean?



ANSWER _____

CHALLENGE One step up

Rewrite y = (2x + 1)/(x - 3) as a shifted reciprocal function. Then sketch it on your own axes, marking both asymptotes and one point on each branch.

WORK SPACE AND ANSWER

ANSWER KEY

Reciprocal Roadmaps

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Sketch y = 3/(x + 2) - 1 on your own axes. Mark both asymptotes and one point on each branch.	**Vertical: x = -2. Horizontal: y = -1. Points include (-3, -4) and (-1, 2).**
2	Sketch y = -2/(x - 3) + 2 on your own axes. Mark both asymptotes and one point on each branch.	**Vertical: x = 3. Horizontal: y = 2. Points include (2, 4) and (4, 0).**
3	Sketch y = 4/(x + 1) + 3 on your own axes. Mark both asymptotes and one point on each branch.	**Vertical: x = -1. Horizontal: y = 3. Points include (-2, -1) and (0, 7).**
4	Sketch y = -3/(x - 4) - 2 on your own axes. Mark both asymptotes and one point on each branch.	**Vertical: x = 4. Horizontal: y = -2. Points include (3, 1) and (5, -5).**

PART 2 · APPLY IT

1. **Vertical asymptote: x = 0. Horizontal asymptote: T = 1. As speed approaches 0 from above, upload time increases without bound.** The denominator approaches 0 as x approaches 0 from above. At high speeds, 2/x approaches 0, leaving a modeled upload time near 1 minute.
2. **Vertical asymptote: x = 2. Horizontal asymptote: W = 1. As speed increases, the modeled wait approaches 1 minute.** The denominator is 0 at x = 2. As x grows, 1/(x - 2) approaches 0, so W approaches 1.

CHALLENGE

y = 7/(x - 3) + 2. Vertical asymptote: x = 3. Horizontal asymptote: y = 2. Points include (2, -5) and (4, 9).

Accept other correctly plotted points on each branch. Curves should approach their asymptotes and must not cross a vertical asymptote.