

Rational Graph Hunt

Read graphs and find asymptotes, intercepts, and restrictions.

HIGH SCHOOL • MA.912.AR.8.2

MA.912.AR.8.2 "Given a table, equation or written description of a rational function, graph that function and determine its key features."

NAME _____

DATE _____

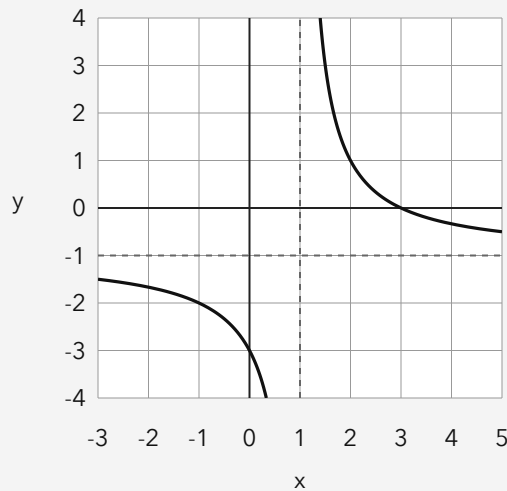
You will need: Pencil; Ruler

SPOT THE STRUCTURE

For $f(x) = a/(x-h) + k$, the denominator gives the vertical asymptote $x = h$, and the shift gives the horizontal asymptote $y = k$. Find an x-intercept by setting $f(x)$ equal to 0, and find a y-intercept by evaluating $f(0)$ when it is defined.

WORKED EXAMPLE

The graph of $f(x) = 2/(x-1) - 1$ is shown. Find both asymptotes and the x-intercept.



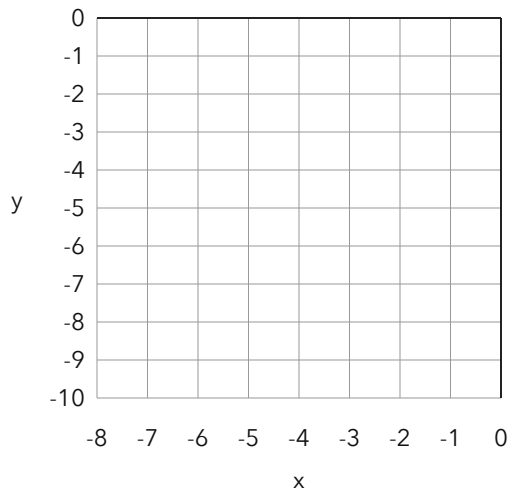
— $f(x) = 2/(x - 1) - 1$

1. Set $x - 1 = 0$, so the vertical asymptote is $x = 1$.
2. The graph levels toward $y = -1$, so $y = -1$ is the horizontal asymptote.
3. Set $2/(x - 1) - 1 = 0$. Then $x = 3$.

Answer: Vertical asymptote: $x = 1$; horizontal asymptote: $y = -1$; x-intercept: $(3, 0)$

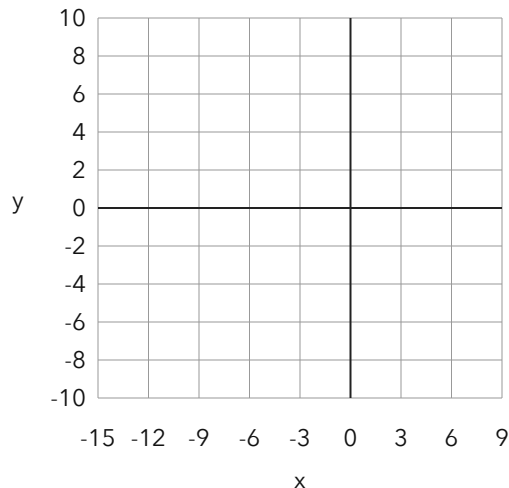
PRACTICE 4 problems

- 1** Graph $f(x) = 3/(x + 4) - 5$. State its vertical and horizontal asymptotes.



ANSWER _____

- 2** Graph $g(x) = (x - 6)/(x + 7)$. State its asymptotes and x-intercept.



ANSWER _____

- 3** For $h(x) = (3x+9)/(x-4)$, find the x-intercept and y-intercept.

ANSWER _____

- 4** For $p(x) = 5/(x-6) + 3$, state the domain and range restrictions.

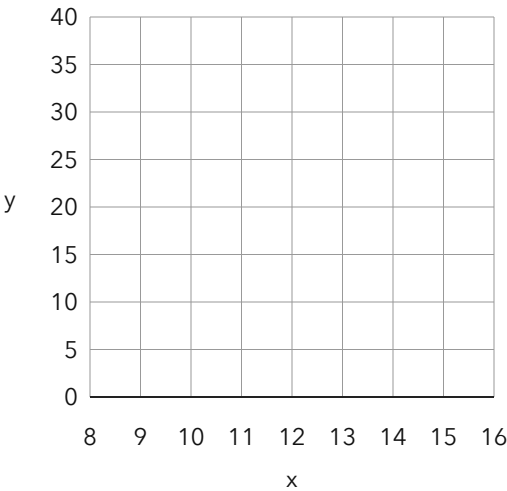
ANSWER _____

APPLY IT Show your work

1

A video club uses $T(s) = 24/(s - 8) + 6$ to model export time T in minutes for an upload speed $s > 8$. Plot the table and draw the curve. Identify the excluded boundary speed and horizontal asymptote. Use horizontal s and vertical T .

s	T(s)
9	30
10	18
11	14
12	12
14	10



REASONING AND ANSWER

2

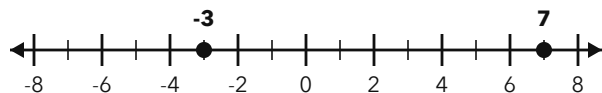
A club splits a \$180 event fee among x students. The cost per student is $C(x) = 180/x + 9$. State both asymptotes and interpret them. State the meaningful values of x .

WORK SPACE

REASONING AND ANSWER

CHALLENGE One step up

The number line marks the x -values that make the denominator of $q(x) = (x+5)/((x+3)(x-7))$ equal to zero. State both vertical asymptotes and the x -intercept. Explain why the marked values cannot be x -intercepts.



WORK SPACE AND ANSWER

PRACTICE 3

x-intercept: $(-3, 0)$; y-intercept: $(0, -9/4)$

APPLY IT 2

Horizontal asymptote: $y = 9$, the cost approaches \$9 per student as x increases.
Vertical asymptote: $x = 0$, because the fee cannot be split among zero students. In context, x is a positive whole number. The added 9 gives the horizontal asymptote. The denominator x gives a vertical asymptote at zero.

PRACTICE 4

Domain: $x \neq 6$; range: $y \neq 3$

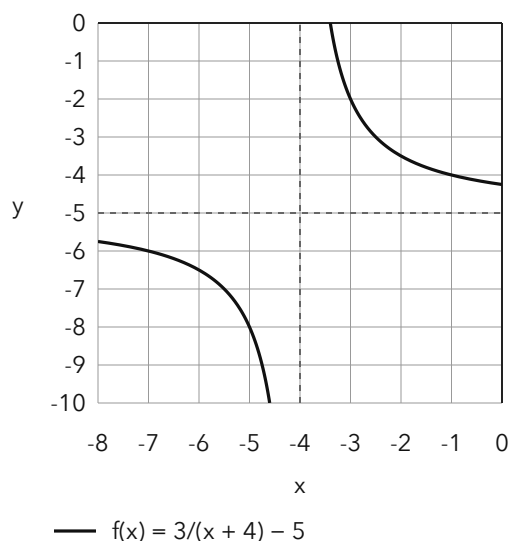
CHALLENGE

Vertical asymptotes: $x = -3$ and $x = 7$; **x-intercept:** $(-5, 0)$. At $x = -3$ and $x = 7$, the denominator is zero, so $q(x)$ is undefined and cannot have an intercept there.

Accept equivalent restriction notation, such as $x \neq 6$. For intercepts, accept either ordered-pair form or a correctly stated x - or y -value. Require actual rational graphs for practice 1, practice 2 and application 1. Branches approach asymptotes without connecting across them. Algebraic functions can have broader domains than their real-world models.

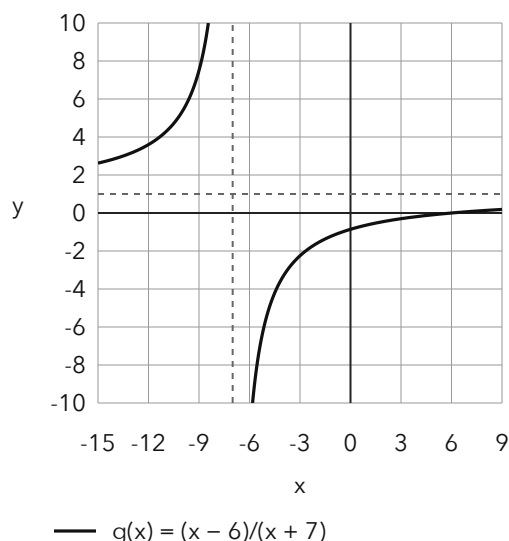
PRACTICE 1

Vertical asymptote: $x = -4$; **horizontal asymptote:** $y = -5$



PRACTICE 2

Vertical asymptote: $x = -7$; **horizontal asymptote:** $y = 1$; **x-intercept:** $(6, 0)$



APPLY IT 1

Excluded speed: $s = 8$; horizontal asymptote: $y = 6$ The denominator is zero when $s = 8$. As s increases, $24/(s-8)$ approaches 0, so T approaches 6.

