

# Algebra 2 · Rational Functions and Their Graphs · Worksheet

Common Core F-IF.C.7d, F-IF.B.4 · mathovore.fr

Name: \_\_\_\_\_ Date: \_\_\_\_/\_\_\_\_/\_\_\_\_ Score: \_\_\_\_\_

This algebra 2 rational functions worksheet gives 22 problems on rational functions and their graphs, ordered from easy to hard, with a separate answer key.

These 22 problems practice Common Core standards F-IF.C.7d and F-IF.B.4. Find domains, intercepts, vertical and horizontal asymptotes, and holes; graph functions of the form  $y = a/(x - h) + k$ ; and solve inverse variation problems.

The first problems are quick skill checks, the middle ones use graphs, and the last six are word problems about trips, costs and mixtures.

**Algebra 2 Common Core: F-IF.C.7d · F-IF.B.4**

## Algebra 2 Rational Functions Worksheet: problems 1-5

### Problem 1: Domain of a rational function

State the domain of each function.

- a.  $f(x) = \frac{3}{x+2}$
- b.  $g(x) = \frac{1}{x-7}$
- c.  $h(x) = \frac{x}{2x-6}$
- d.  $k(x) = \frac{x+1}{x^2-25}$

### Problem 2: Evaluate a rational function

Let  $f(x) = \frac{x+1}{x-2}$ . Find  $f(-1)$ ,  $f(0)$ ,  $f(1)$ ,  $f(3)$  and  $f(5)$ .

### Problem 3: Table for $y = 6/x$

Copy and complete the table for  $y = \frac{6}{x}$ .

|     |    |    |    |    |   |   |   |   |
|-----|----|----|----|----|---|---|---|---|
| $x$ | -6 | -3 | -2 | -1 | 1 | 2 | 3 | 6 |
| $y$ |    |    |    |    |   |   |   |   |

### Problem 4: Vertical asymptotes

Find every vertical asymptote.

- a.  $y = \frac{4}{x+3}$
- b.  $y = \frac{2x}{x-1}$
- c.  $y = \frac{1}{x^2-4}$
- d.  $y = \frac{x+5}{x^2+3x}$

### Problem 5: Horizontal asymptotes

Find the horizontal asymptote of each function, or write none.

- a.  $y = \frac{3x+1}{x-4}$
- b.  $y = \frac{5}{x^2+1}$
- c.  $y = \frac{2x^2-1}{3x^2+x}$
- d.  $y = \frac{x^2+1}{x-1}$
- e.  $y = \frac{-4x}{2x+7}$

## Algebra 2 Rational Functions Worksheet: problems 6-10

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### Problem 6: Intercepts

Find the x-intercept and the y-intercept of each function.

- a.  $f(x) = \frac{2x-6}{x+1}$
- b.  $g(x) = \frac{x+4}{x-2}$

### Problem 7: Find the hole

Factor, cancel, and give the coordinates of the hole in each graph.

- a.  $f(x) = \frac{x^2-9}{x-3}$
- b.  $g(x) = \frac{x^2+x-6}{x-2}$
- c.  $h(x) = \frac{(x-4)(x+1)}{(x-4)(x+2)}$

### Problem 8: Hole, asymptote and end behavior

Let  $f(x) = \frac{x^2-4x+3}{x^2-1}$ . Find the hole, the vertical asymptote and the horizontal asymptote.

### Problem 9: Shifts of $y = 1/x$

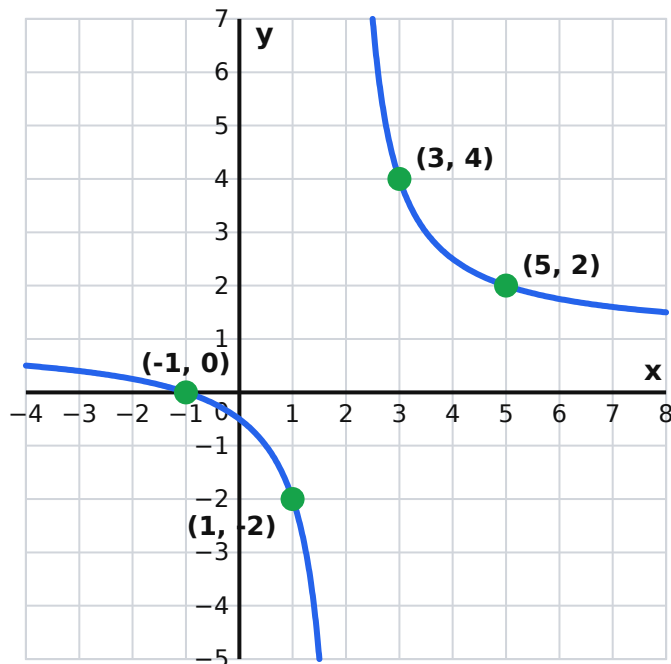
Describe how each graph is related to  $y = \frac{1}{x}$ , then name its asymptotes.

- a.  $y = \frac{1}{x+3} - 2$
- b.  $y = -\frac{1}{x-5} + 4$

c.  $y = \frac{1}{x} + 6$

### Problem 10: Read a hyperbola

The graph of a rational function is shown.



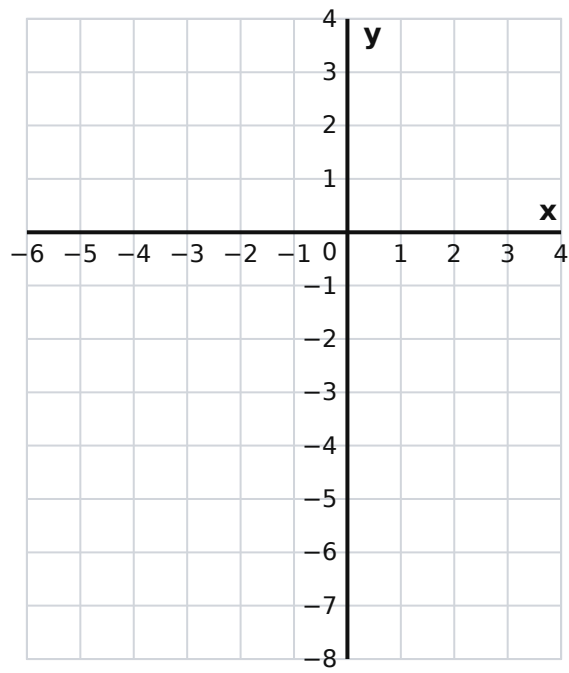
A hyperbola with two branches.

- Name the vertical and horizontal asymptotes.
- State the domain and the range.
- Write the equation in the form  $y = \frac{a}{x-h} + k$ .

## Algebra 2 Rational Functions Worksheet: problems 11-15

### Problem 11: Graph a rational function

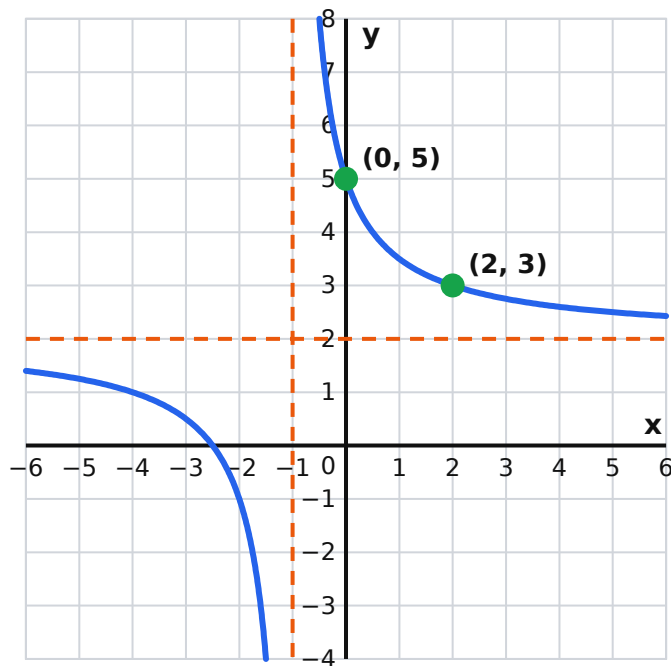
Graph  $y = \frac{2}{x+1} - 3$  on a coordinate plane. Draw the asymptotes as dashed lines and plot at least four points.



Blank grid.

### Problem 12: Equation from a graph

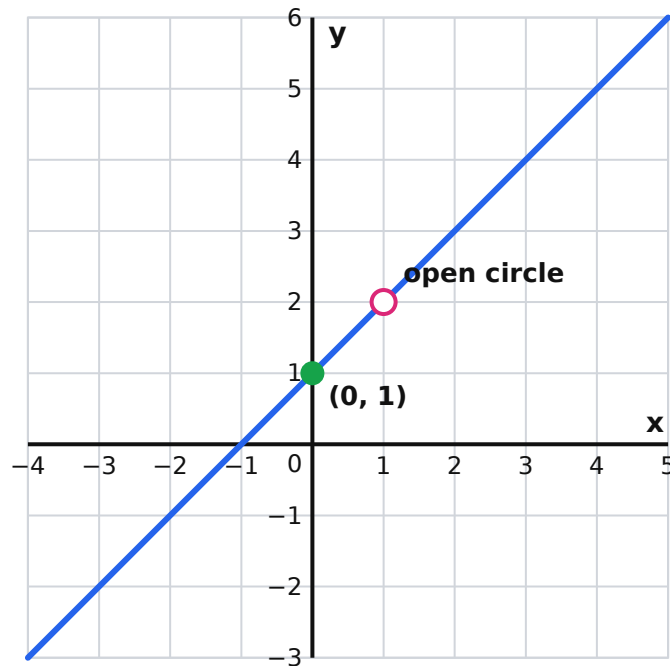
Write an equation for the graph shown.



Dashed lines are the asymptotes.

### Problem 13: A graph with a hole

The graph of  $f(x) = \frac{x^2-1}{x-1}$  is shown.



A line with one open circle.

- Simplify  $f(x)$  for  $x \neq 1$ .
- Give the coordinates of the open circle.
- State the domain.

### Problem 14: Write a rational function

Write a function of the form  $y = \frac{a}{x-h} + k$  with vertical asymptote  $x=2$ , horizontal asymptote  $y=-1$  and passing through  $(3,1)$ .

### Problem 15: Inverse variation constant

The variable  $y$  varies inversely with  $x$ , and  $y=8$  when  $x=5$ .

- Find the constant  $k$  and write the equation.
- Find  $y$  when  $x=20$ .
- Find  $x$  when  $y=16$ .

## Algebra 2 Rational Functions Worksheet: problems 16-20

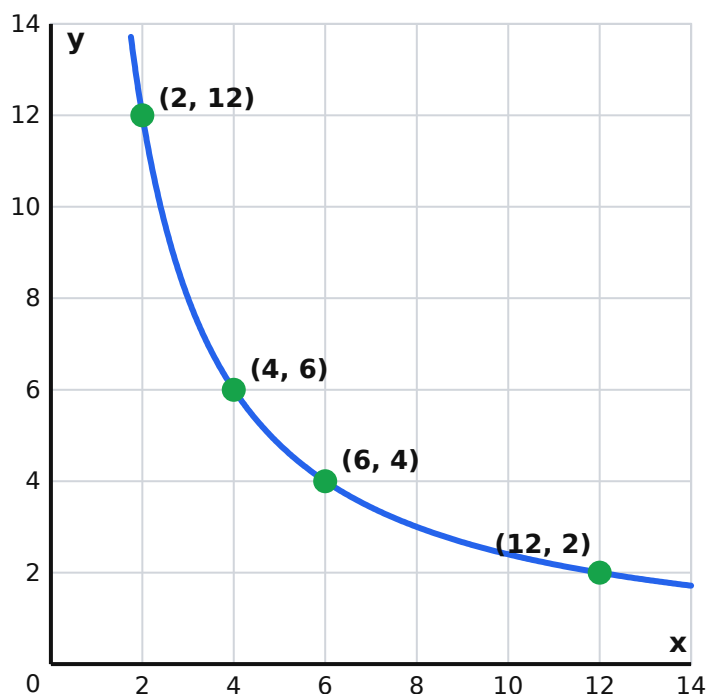
### Problem 16: Is it inverse variation?

Decide whether each table shows inverse variation. If it does, find  $k$ .

- a. (2,18),(3,12),(4,9),(6,6)
- b. (1,5),(2,10),(3,15),(4,20)
- c. (5,12),(10,6),(15,4),(20,3)

### Problem 17: Inverse variation from a graph

The graph shows an inverse variation between  $x$  and  $y$ .



An inverse variation in the first quadrant.

- a. Find  $k$  and write the equation.
- b. Find  $y$  when  $x=16$ .

### Problem 18: Road trip

Jamal's family drives 240 miles to a lake. The trip takes  $t = \frac{240}{r}$  hours at an average speed of  $r$  miles per hour.

- a. Find  $t$  for  $r=40, 48, 60$  and  $80$ .
- b. What speed makes the trip take 2.5 hours?
- c. What is the horizontal asymptote, and what does it mean here?

### Problem 19: Cookie cost

Maya bakes cookies for a bake sale. The ingredients and pans cost \$30, and each cookie costs \$0.50 more to make. The average cost per cookie for  $n$  cookies is  $C(n) = \frac{0.5n+30}{n}$  dollars.

- a. Find  $C(20)$ ,  $C(60)$  and  $C(120)$ .

- Rewrite  $C(n)$  as  $0.5 + \frac{30}{n}$  and name the horizontal asymptote.
- How many cookies must Maya bake for the average cost to be \$0.60?

### Problem 20: Bus rental

A class trip needs a bus that costs \$180. The cost per student is  $c = \frac{180}{n}$  for  $n$  students.

- Find the cost per student when 12 students go and when 20 students go.
- How many students are needed to bring the cost down to \$6 each?

## Algebra 2 Rational Functions Worksheet: problems 21-22

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### Problem 21: Bike pump

Priya's bike pump holds 90 cubic inches of air at a pressure of 15 pounds per square inch (psi). Pressure and volume vary inversely.

- Write an equation for pressure  $P$  in terms of volume  $V$ .
- Find the pressure when the air is squeezed to 54 cubic inches.
- Find the volume at 45 psi.

### Problem 22: Juice mixture

Ethan has 10 gallons of juice drink that is 20% orange concentrate, so it holds 2 gallons of concentrate. He adds  $x$  gallons of pure concentrate. The fraction of concentrate in the mixture is  $c(x) = \frac{2+x}{10+x}$ .

- Find  $c(0)$ ,  $c(10)$  and  $c(30)$  as percents.
- How many gallons must Ethan add to make the mixture 50% concentrate?
- Name the horizontal asymptote and explain why  $c(x)$  can never reach it.

## How to use this algebra 2 rational functions worksheet

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Print this algebra 2 rational functions worksheet as a PDF, solve every problem on paper, then compare with the answer key.

