

Rational Expressions and Equations Step by Step

Grade 11 – Algebra 2 math · Worksheet · Standards: A-APR.D.6, A-APR.D.7, A-REI.A.2

Name: _____ Date: _____ Class: _____

These problems cover the algebra of rational expressions and the equations built from them. They follow Common Core standards A-APR.D.6, A-APR.D.7, and A-REI.A.2.

The set moves from factoring and excluded values to combining fractions, solving equations with an extraneous check, and work and rate contexts. Write the excluded values before simplifying.

Standards: A-APR.D.6, A-APR.D.7, A-REI.A.2 · **Level:** Grade 11 Algebra 2

Problem 1 Simplifying monomial fractions (easy)

Simplify $\frac{12x^3y}{18xy^2}$. Assume x and y are nonzero.

Problem 2 Excluded values (easy)

State all excluded values for each expression.

- a. $\frac{(x+4)}{(x^2-9)}$
- b. $\frac{5}{(2x-7)}$
- c. $\frac{(x-1)}{(x^2+x-12)}$

Problem 3 Simplifying by factoring (easy)

Simplify $\frac{(x^2-25)}{(x^2-3x-10)}$ and state the excluded values.

Problem 4 Multiplying rational expressions (easy)

Multiply and simplify $\frac{3x^2}{(x+5)} \cdot \frac{(x+5)}{9x}$.

Problem 5 Excluded values on a number line (easy)

The denominator of $\frac{(x-6)}{(x^2-x-20)}$ factors as $(x-5)(x+4)$. Mark the excluded values on the

number line and write the domain.



Number line for marking.

Problem 6 Dividing rational expressions (medium)

Divide and simplify $\frac{(x^2 - 4)}{(x + 3)} \div \frac{(x + 2)}{(x^2 + 3x)}$.

Problem 7 Like denominators (medium)

Combine and simplify.

a. $\frac{(3x + 1)}{(x - 4)} + \frac{(2x - 9)}{(x - 4)}$

b. $\frac{(7x + 2)}{(x + 6)} - \frac{(x - 10)}{(x + 6)}$

Problem 8 Unlike denominators (medium)

Add $\frac{7}{(x + 5)} + \frac{2}{(x - 3)}$.

Problem 9 Factoring a denominator first (medium)

Subtract $\frac{5}{(x^2 - 9)} - \frac{2}{(x - 3)}$.

Problem 10 Adding with a quadratic denominator (medium)

Add $\frac{x}{(x^2 - 5x + 6)} + \frac{4}{(x - 2)}$.

Problem 11 A first rational equation (medium)

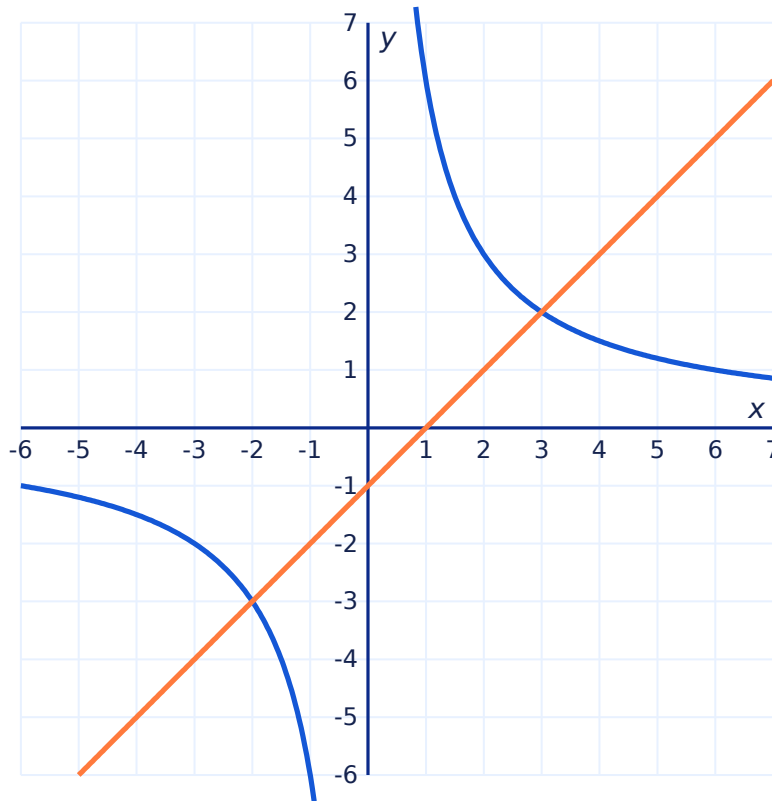
Solve $\frac{8}{x} - 3 = \frac{2}{x}$. Check the answer.

Problem 12 No solution (medium)

Solve $\frac{x}{(x - 5)} + 2 = \frac{5}{(x - 5)}$. Check every answer.

Problem 13 Solving with a graph (medium)

The graphs of $y = \frac{6}{x}$ and $y = x - 1$ are shown. Use the graph to estimate the solutions of $\frac{6}{x} = x - 1$, then solve algebraically.



Graphs of $y = 6/x$ and $y = x - 1$.

Problem 14 Two denominators and a quadratic (hard)

Solve $\frac{3}{x-1} + \frac{2}{x+4} = 1$. Give exact answers and check that neither is excluded.

Problem 15 Rejecting an extraneous solution (hard)

Solve $\frac{3}{x-2} - \frac{12}{x^2-4} = 1$.

Problem 16 Painting a fence together (hard)

A robotics club paints a fence for its field. Ana alone needs 6 hours and Ben alone needs 9 hours. How long do they need working together? The figure shows their hourly shares of the job.

Ana: $\frac{1}{6}$ per hour



Ben: $\frac{1}{9}$ per hour



Together: $\frac{5}{18}$ per hour



each bar = the whole job

Hourly shares for Ana, Ben, and both.

Problem 17 Two hoses filling a pond (hard)

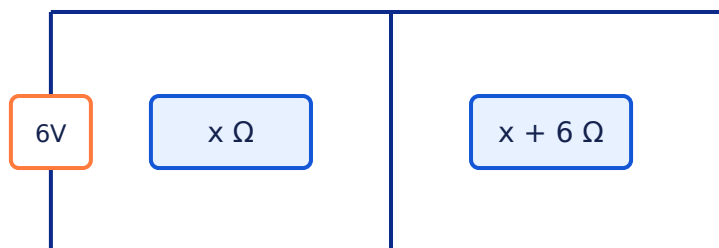
Two hoses together fill a pond in 6 hours. The slower hose alone takes 5 hours longer than the faster hose alone. How long does each hose take alone?

Problem 18 Paddling against a current (hard)

A kayaker paddles 12 miles upstream and then 12 miles back downstream in a river with a 3 mph current. The round trip takes 3 hours. Find the kayaker's speed in still water.

Problem 19 Resistors in parallel (hard)

Two resistors in parallel have resistances x ohms and $x + 6$ ohms. The combined resistance is 4 ohms, where $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$. Find both resistances.



two resistors in parallel

Two resistors in parallel.

Problem 20 A multi-step quotient (hard)

Simplify $\frac{(x^2 - 9)}{(x^2 + 2x)} \div \frac{(x + 3)}{(x^2 - 4)}$ and list every excluded value.