Algebra 2 Workbook Solutions

Rational functions

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SIMPLIFYING RATIONAL FUNCTIONS

■ 1. Simplify the rational function to lowest terms.

$$\frac{x^4+x^3-6x^2}{x^3+x^2-2x}$$

Solution:

Factor both the numerator and denominator.

$$\frac{x^4+x^3-6x^2}{x^3+x^2-2x}$$

$$\frac{x^2(x^2+x-6)}{x(x^2+x-2)}$$

$$\frac{x(x^2+x-6)}{x^2+x-2}$$

The quadratic expression in the numerator is factored as $(x+3)(x-2)$ and the quadratic expression in the denominator is factored as $(x+2)(x-1)$, so we get

$$\frac{x(x+3)(x-2)}{(x+2)(x-1)}$$

In this case there's no common factor, and therefore nothing to cancel.

2. Reduce the fraction to its lowest terms.

$$\frac{10x^2 - 5x + 20}{15x^2}$$

Solution:

Look for a common factor in each term. In this case the common factor is 5.

$$\frac{10x^2 - 5x + 20}{15x^2}$$

$$\frac{5(2x^2 - x + 4)}{5(3x^2)}$$

$$\frac{2x^2 - x + 4}{3x^2}$$

3. Reduce the fraction to its lowest terms.

$$\frac{18y^2 + 6y}{8y}$$

Solution:

Look for a common factor in each term. In this case the common factor is $2y$.

$$\frac{18y^2 + 6y}{8y}$$

$$\frac{2y(9y + 3)}{2y(4)}$$

$$\frac{9y + 3}{4}$$

■ 4. Simplify each expression in the difference.

$$\frac{3ab + 2a^2b^2}{5ab} - \frac{12a^3b^3 + 3a^2b^2}{6a^2b^2}$$

Solution:

Look for a common factor in each term. In this case the common factor of the first fraction is ab and the common factor of the second fraction is $3a^2b^2$.

$$\frac{3ab + 2a^2b^2}{5ab} - \frac{12a^3b^3 + 3a^2b^2}{6a^2b^2}$$

$$\frac{ab(3 + 2ab)}{ab(5)} - \frac{3a^2b^2(4ab + 1)}{3a^2b^2(2)}$$

$$\frac{3 + 2ab}{5} - \frac{4ab + 1}{2}$$

■ 5. Simplify each expression in the sum.

$$\frac{2ab^2 + 3a^2b^3}{a^3b^3} + \frac{2ab^3 + b^4}{ab^3}$$

Solution:

Look for a common factor in each term. In this case the common factor of the first fraction is ab^2 and the common factor of the second fraction is b^3.

$$\frac{2ab^2 + 3a^2b^3}{a^3b^3} + \frac{2ab^3 + b^4}{ab^3}$$

$$\frac{ab^2(2 + 3ab)}{ab^2(a^2b)} + \frac{b^3(2a + b)}{b^3(a)}$$

$$\frac{2 + 3ab}{a^2b} + \frac{2a + b}{a}$$

■ 6. Simplify each expression in the difference.

$$\frac{21x^2y^2}{14x^3y} - \frac{24xy + 12y}{96y}$$

Solution:

Look for a common factor in each term. In this case the common factor of the first fraction is $7x^2y$ and the common factor of the second fraction is $12y$.

$$\frac{21x^2y^2}{14x^3y}-\frac{24xy+12y}{96y}$$

$$\frac{7x^2y(3y)}{7x^2y(2x)}-\frac{12y(2x+1)}{12y(8)}$$

$$\frac{3y}{2x}-\frac{2x+1}{8}$$

ADDING AND SUBTRACTING RATIONAL FUNCTIONS

■ 1. Simplify the expression.

$$\frac{2}{3ab}+\frac{b}{4a}+\frac{ab}{6}$$

Solution:

In order to combine the three fractions in the expression we need to find a common denominator. Make a chart of with each denominator to find the least common multiple.

	Coefficients	a-terms	b-terms
3ab	3	a	b
4a	2*2	a	
6	2*3		

To find the least common multiple, find the largest multiple from each column. For the coefficients multiply each unique factor together to get $2\cdot 2\cdot 3=12$. The largest common multiple in the a column is a and the largest common multiple in the b column is b. The least common multiple is therefore $12ab$.

Now we need to multiply each fraction by a well-chosen 1 that will make the denominator $12ab$.

$$\frac{2}{3ab}\cdot\frac{4}{4}+\frac{b}{4a}\cdot\frac{3b}{3b}+\frac{ab}{6}\cdot\frac{2ab}{2ab}$$

$$\frac{8}{12ab}+\frac{3b^2}{12ab}+\frac{2a^2b^2}{12ab}$$

$$\frac{8+3b^2+2a^2b^2}{12ab}$$

■ 2. Simplify the expression.

$$\frac{x+1}{x-1}+\frac{2x}{x-5}+\frac{x+2}{x^2-6x+5}$$

Solution:

In order to combine the three fractions in the expression we need to find a common denominator. Factor the denominator of third fraction as completely as possible.

$$\frac{x+1}{x-1}+\frac{2x}{x-5}+\frac{x+2}{(x-1)(x-5)}$$

We can see that the common denominator is $(x-1)(x-5)$, so we'll multiply each fraction by whatever's needed to get to that denominator.

$$\frac{x+1}{x-1}\cdot\frac{x-5}{x-5}+\frac{2x}{x-5}\cdot\frac{x-1}{x-1}+\frac{x+2}{(x-1)(x-5)}$$

$$\frac{(x+1)(x-5)}{(x-1)(x-5)}+\frac{2x(x-1)}{(x-5)(x-1)}+\frac{x+2}{(x-1)(x-5)}$$

$$\frac{x^2-4x-5}{(x-1)(x-5)}+\frac{2x^2-2x}{(x-5)(x-1)}+\frac{x+2}{(x-1)(x-5)}$$

$$\frac{x^2-4x-5+2x^2-2x+x+2}{(x-1)(x-5)}$$

$$\frac{3x^2-5x-3}{(x-1)(x-5)}$$

$$\frac{3x^2-5x-3}{x^2-6x+5}$$

■ 3. Simplify the expression.

$$\frac{a}{3xy}+\frac{b}{15y^2}+\frac{c}{5x^3y^2}$$

Solution:

In order to combine the three fractions in the expression we need to find a common denominator. Make a chart of with each denominator to find the least common multiple.

	Coefficients	x-terms	y-terms
3xy	3	x	y
$15x^2$	3*5		y^2
$5x^3y^2$	5	x^3	y^2

To find the least common multiple, find the largest multiple from each column. For the coefficients multiply each unique factor together to get $3 \cdot 5 = 15$. The largest common multiple in the x column is x^3 and the largest common multiple in the y column is y^2. The least common multiple is therefore $15x^3y^2$.

Now we need to multiply each fraction by a well-chosen 1 that will make the denominator $15x^3y^2$.

$$\frac{a}{3xy} \cdot \frac{5x^2y}{5x^2y} + \frac{b}{15y^2} \cdot \frac{x^3}{x^3} + \frac{c}{5x^3y^2} \cdot \frac{3}{3}$$

$$\frac{5ax^2y}{15x^3y^2} + \frac{bx^3}{15x^3y^2} + \frac{3c}{15x^3y^2}$$

$$\frac{5ax^2y + bx^3 + 3c}{15x^3y^2}$$

■ 4. Simplify the expression.

$$\frac{x}{2x^2y} + \frac{y}{3z} + \frac{z}{5yz^2}$$

Solution:

In order to combine the three fractions in the expression we need to find a common denominator. Make a chart of with each denominator to find the least common multiple.

	Coefficients	x-terms	y-terms	z-terms
$2x^2y$	2	x^2	y	
3z	3			z
$5yz^2$	5		y	z^2

To find the least common multiple, find the largest multiple from each column. For the coefficients multiply each unique factor together to get $2 \cdot 3 \cdot 5 = 30$. The largest common multiple in the x column is x^2 and the largest common multiple in the y column is y. The largest common multiple in the z column is z^2. The least common multiple is therefore $30x^2yz^2$.

Now we need to multiply each fraction by a well-chosen 1 that will make the denominator $30x^2yz^2$.

$$\frac{x}{2x^2y} \cdot \frac{15z^2}{15z^2} + \frac{y}{3z} \cdot \frac{10x^2yz}{10x^2yz} + \frac{z}{5yz^2} \cdot \frac{6x^2}{6x^2}$$

$$\frac{15xz^2}{30x^2yz^2} + \frac{10x^2y^2z}{30x^2yz^2} + \frac{6x^2z}{30x^2yz^2}$$

$$\frac{15xz^2 + 10x^2y^2z + 6x^2z}{30x^2yz^2}$$

There's a factor of xz that's common to every term in the numerator and denominator, so we can cancel that, simplifying the rational function to

$$\frac{15z + 10xy^2 + 6x}{30xyz}$$

■ 5. Simplify the expression.

$$\frac{3ab}{4c} + \frac{2bc}{6a^3} + \frac{5}{8ab^2c^3}$$

Solution:

In order to combine the three fractions in the expression we need to find a common denominator. Make a chart of with each denominator to find the least common multiple.

	Coefficients	a-terms	b-terms	c-terms
4c	2*2			c
$6a^3$	2*3	a^3		
$8ab^2c^3$	2*2*2	a	b^2	c^3

To find the least common multiple, find the largest multiple from each column. For the coefficients multiply each unique factor together to get $2 \cdot 2 \cdot 2 \cdot 3 = 24$. The largest common multiple in the a column is a^3 and the largest common multiple in the b column is b^2. The largest common multiple in the c column is c^3. The least common multiple is therefore $24a^3b^2c^3$.

Now we need to multiply each fraction by a well-chosen 1 that will make the denominator $24a^3b^2c^3$.

$$\frac{3ab}{4c}\cdot\frac{6a^3b^2c^2}{6a^3b^2c^2}+\frac{2bc}{6a^3}\cdot\frac{4b^2c^3}{4b^2c^3}+\frac{5}{8ab^2c^3}\cdot\frac{3a^2}{3a^2}$$

$$\frac{18a^4b^3c^2}{24a^3b^2c^2}+\frac{8b^3c^4}{24a^3b^2c^3}+\frac{15a^2}{24a^3b^2c^3}$$

$$\frac{18a^4b^3c^2+8b^3c^4+15a^2}{24a^3b^2c^3}$$

■ 6. Simplify the expression.

$$\frac{x}{x+6}+\frac{x-6}{x}$$

Solution:

In order to combine the two fractions in the expression we need to find a common denominator. We can see that the common denominator is $x(x+6)$, so we'll get

$$\frac{x}{x+6}\cdot\frac{x}{x}+\frac{x-6}{x}\cdot\frac{x+6}{x+6}$$

$$\frac{x^2}{x(x+6)} + \frac{x^2-36}{x(x+6)}$$

$$\frac{x^2+x^2-36}{x(x+6)}$$

$$\frac{2x^2-36}{x(x+6)}$$

FACTORING TO FIND A COMMON DENOMINATOR

■ 1. Simplify the expression by combining the two fractions.

$$\frac{x+1}{2x^2+5x-3}+\frac{2}{x+3}$$

Solution:

The expression can be rewritten as

$$\frac{x+1}{(2x-1)(x+3)}+\frac{2}{x+3}$$

Then we can multiply the second fraction's numerator and denominator by $2x-1$ to get a common denominator, and combine the fractions as

$$\frac{x+1+2(2x-1)}{(2x-1)(x+3)}$$

$$\frac{5x-1}{(2x-1)(x+3)}$$

■ 2. What is the common denominator of the rational expressions?

$\frac{x^2-1}{x^2-4}$ and $\frac{x+1}{3x^2-3x-6}$

Solution:

The first denominator can be factored as

$$x^2 - 4$$

$$(x-2)(x+2)$$

$$\frac{x^2-1}{x^2-4} = \frac{(x-1)(x+1)}{(x-2)(x+2)}$$

The second denominator can be factored as

$$3x^2 - 3x - 6$$

$$3(x^2 - x - 2)$$

$$3(x-2)(x+1)$$

$$\frac{x+1}{3(x-2)(x+1)} = \frac{1}{3(x-2)}$$

Therefore the common denominator is

$$3(x-2)(x+2)$$

■ 3. Simplify the expression by combining the two fractions.

$$\frac{3}{x-2} - \frac{x-4}{x^2-5x+6}$$

Solution:

The expression can be rewritten as

$$\frac{3}{x-2}-\frac{x-4}{(x-2)(x-3)}$$

Then we can multiply the first fraction's numerator and denominator by $x-3$ to get a common denominator, and combine the fractions as

$$\frac{3(x-3)-(x-4)}{(x-2)(x-3)}$$

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

$$\frac{2x-5}{(x-2)(x-3)}$$

■ 4. Fill in the blank with the correct term.

$$\frac{2}{\_\_\_\_\_\_}-\frac{x-2}{x^2-9}=\frac{2(x-3)-4(x-2)}{4(x-3)(x+3)}$$

Solution:

The blank should be filled in with $4(x+3)$.

5. Simplify the expression by combining the two fractions.

$$\frac{4}{x^2 - 2x - 3} - \frac{1}{x^2 + 5x + 4}$$

Solution:

The expression can be rewritten as

$$\frac{4}{(x+1)(x-3)} - \frac{1}{(x+4)(x+1)}$$

$$\frac{4(x+4)}{(x+1)(x-3)(x+4)} - \frac{1(x-3)}{(x+4)(x+1)(x-3)}$$

$$\frac{4x + 16 - x + 3}{(x+1)(x-3)(x+4)}$$

$$\frac{3x + 19}{(x+1)(x-3)(x+4)}$$

6. What went wrong in the following simplification?

$$\frac{3}{x^2 - 25} - \frac{1}{x+5}$$

$$\frac{3 - x - 5}{(x-5)(x+5)}$$

Solution:

The negative sign in the second term was not distributed. It should be

$$\frac{3-x+5}{(x-5)(x+5)}$$

MULTIPLYING RATIONAL FUNCTIONS

■ 1. Simplify the expression.

$$\frac{25x^2-4}{x^2-36}\cdot\frac{x+6}{5x-2}$$

Solution:

We'll factor and cancel whatever we can, then simplify.

$$\frac{(5x-2)(5x+2)}{(x-6)(x+6)}\cdot\frac{x+6}{5x-2}$$

$$\frac{5x+2}{x-6}$$

We cancelled factors of $5x-2$ and $x+6$ which means

$5x-2\neq 0$, or $x\neq 2/5$

$x+6\neq 0$, or $x\neq -6$

So the simplified expression is

$\frac{5x+2}{x-6}$ with $x\neq -6, \frac{2}{5}$

■ 2. Simplify the expression.

$$\frac{4x^2 - 49}{9x^2 - 16} \cdot \frac{3x + 4}{2x + 7}$$

Solution:

We'll factor and cancel whatever we can, then simplify.

$$\frac{(2x - 7)(2x + 7)}{(3x - 4)(3x + 4)} \cdot \frac{3x + 4}{2x + 7}$$

$$\frac{2x - 7}{3x - 4}$$

We cancelled factors of $2x + 7$ and $3x + 4$ which means

$2x + 7 \neq 0$, or $x \neq -7/2$

$3x + 4 \neq 0$, or $x \neq -4/3$

So the simplified expression is

$$\frac{2x - 7}{3x - 4} \text{ with } x \neq -\frac{7}{2}, \ -\frac{4}{3}$$

■ 3. Simplify the expression.

$$\frac{x^2 + 8x + 16}{9x^2 + 36x + 36} \cdot \frac{3x + 6}{x + 4}$$

Solution:

We'll factor and cancel whatever we can, then simplify.

$$\frac{(x+4)(x+4)}{(3x+6)(3x+6)} \cdot \frac{3x+6}{x+4}$$

$$\frac{x+4}{3x+6}$$

We cancelled factors of $x+4$ and $3x+6$ which means

$x+4 \neq 0$, or $x \neq -4$

$3x+6 \neq 0$, or $x \neq -2$

So the simplified expression is

$\frac{x+4}{3x+6}$ with $x \neq -4, \ -2$

However, the remaining factor of $3x+6$ in the denominator still shows us that $x \neq -2$, so we don't need to exclude that value in our answer.

$\frac{x+4}{3x+6}$ with $x \neq -4$

■ 4. Simplify the expression.

$$\frac{16x^2+16x+4}{x^2+18x+81} \cdot \frac{x^2-81}{16x^2-4}$$

Solution:

We'll factor and cancel whatever we can, then simplify.

$$\frac{(4x+2)(4x+2)}{(x+9)(x+9)} \cdot \frac{(x-9)(x+9)}{(4x-2)(4x+2)}$$

$$\frac{(4x+2)(x-9)}{(x+9)(4x-2)}$$

We cancelled factors of $4x+2$ and $x+9$ which means

$4x+2 \neq 0$, or $x \neq -1/2$

$x+9 \neq 0$, or $x \neq -9$

So the simplified expression is

$$\frac{(4x+2)(x-9)}{(x+9)(4x-2)} \text{ with } x \neq -9, \ -\frac{1}{2}$$

However, the remaining factor of $x+9$ in the denominator still shows us that $x \neq -9$, so we don't need to exclude that value in our answer.

$$\frac{(4x+2)(x-9)}{(x+9)(4x-2)} \text{ with } x \neq -\frac{1}{2}$$

■ 5. Simplify the expression.

$$\frac{x^2+5x-14}{x^2+2x-3} \cdot \frac{x^2+4x-5}{x^2+9x+14}$$

Solution:

We'll factor and cancel whatever we can, then simplify.

$$\frac{(x-2)(x+7)}{(x+3)(x-1)} \cdot \frac{(x-1)(x+5)}{(x+7)(x+2)}$$

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

We cancelled factors of $x+7$ and $x-1$ which means

$x+7 \neq 0$, or $x \neq -7$

$x-1 \neq 0$, or $x \neq 1$

So the simplified expression is

$$\frac{(x-2)(x+5)}{(x+3)(x+2)} \text{ with } x \neq -7,\ 1$$

■ 6. Simplify the expression.

$$\frac{2x^2-13x-24}{3x^2-x-4} \cdot \frac{3x^2-7x+4}{x^2-6x-16}$$

Solution:

We'll factor and cancel whatever we can, then simplify.

$$\frac{(2x+3)(x-8)}{(3x-4)(x+1)} \cdot \frac{(3x-4)(x-1)}{(x+2)(x-8)}$$

$$\frac{(2x+3)(x-1)}{(x+1)(x+2)}$$

We cancelled $x-8$ and $3x-4$ which means

$x-8 \neq 0$, or $x \neq 8$

$3x-4 \neq 0$, or $x \neq 4/3$

So the simplified expression is

$$\frac{(2x+3)(x-1)}{(x+1)(x+2)} \text{ with } x \neq \frac{4}{3}, 8$$

DIVIDING RATIONAL FUNCTIONS

1. Simplify the expression.

$$\frac{2x+16}{9x^2+27x} \div \frac{3x+24}{x+3}$$

Solution:

Factor the numerator and denominator of both fractions as completely as possible.

$$\frac{2(x+8)}{9x(x+3)} \div \frac{3(x+8)}{x+3}$$

Consider restrictions. The denominator of the dividend gives $x \neq -3,0$, the denominator of the divisor gives $x \neq -3$, and the numerator of the divisor gives $x \neq -8$. So the set of restrictions we should keep in mind until the end of the problem is $x \neq -8, -3,0$.

Now turn the division problem into a multiplication problem and cancel common factors.

$$\frac{2(x+8)}{9x(x+3)} \cdot \frac{x+3}{3(x+8)}$$

$$\frac{2}{9x} \cdot \frac{1}{3}$$

$$\frac{2}{27x}$$

This resulting quotient shows that $x \neq 0$, so we can eliminate that from our list of restrictions. Then the final answer is

$$\frac{2}{27x} \text{ with } x \neq -8, -3$$

■ 2. Simplify the expression.

$$\frac{3x^3 - 3x^2 - 6x}{2x^2 - 14x + 24} \div \frac{3x^2 + 21x}{x^2 - 8x + 15}$$

Solution:

Factor the numerator and denominator of both fractions as completely as possible.

$$\frac{3x(x^2 - x - 2)}{2(x^2 - 7x + 12)} \div \frac{3x(x + 7)}{(x - 3)(x - 5)}$$

$$\frac{3x(x + 1)(x - 2)}{2(x - 3)(x - 4)} \div \frac{3x(x + 7)}{(x - 3)(x - 5)}$$

Consider restrictions. The denominator of the dividend gives $x \neq 3,4$, the denominator of the divisor gives $x \neq 3,5$, and the numerator of the divisor gives $x \neq -7,0$. So the set of restrictions we should keep in mind until the end of the problem is $x \neq -7,0,3,4,5$.

Now turn the division problem into a multiplication problem and cancel common factors.

$$\frac{3x(x+1)(x-2)}{2(x-3)(x-4)} \cdot \frac{(x-3)(x-5)}{3x(x+7)}$$

$$\frac{(x+1)(x-2)(x-5)}{2(x-4)(x+7)}$$

This resulting quotient shows that $x \neq -7,4$, so we can eliminate those from our list of restrictions. Then the final answer is

$$\frac{(x+1)(x-2)(x-5)}{2(x-4)(x+7)} \text{ with } x \neq 0,3,5$$

■ 3. Simplify the expression.

$$\frac{2x^2-13x-7}{12x+6} \div \frac{3x-2}{3x^2-17x+10}$$

Solution:

Factor the numerator and denominator of both fractions as completely as possible.

$$\frac{(2x+1)(x-7)}{6(2x+1)} \div \frac{3x-2}{(3x-2)(x-5)}$$

Consider restrictions. The denominator of the dividend gives $x \neq -1/2$, the denominator of the divisor gives $x \neq 2/3,5$, and the numerator of the divisor gives $x \neq 2/3$. So the set of restrictions we should keep in mind until the end of the problem is $x \neq -1/2,2/3,5$.

Now turn the division problem into a multiplication problem and cancel common factors.

$$\frac{(2x+1)(x-7)}{6(2x+1)} \cdot \frac{(3x-2)(x-5)}{3x-2}$$

$$\frac{(x-7)(x-5)}{6}$$

This resulting quotient doesn't show any restrictions, so we need to keep our entire list of them. Then the final answer is

$$\frac{(x-7)(x-5)}{6} \text{ with } x \neq -1/2,2/3,5$$

■ 4. Simplify the expression.

$$\frac{4x^2+13x+10}{3x+6} \div \frac{3x-1}{3x^2-13x+4}$$

Solution:

Factor the numerator and denominator of both fractions as completely as possible.

$$\frac{(4x+5)(x+2)}{3(x+2)} \div \frac{3x-1}{(3x-1)(x-4)}$$

Consider restrictions. The denominator of the dividend gives $x \neq -2$, the denominator of the divisor gives $x \neq 1/3,4$, and the numerator of the divisor gives $x \neq 1/3$. So the set of restrictions we should keep in mind until the end of the problem is $x \neq -2,1/3,4$.

Now turn the division problem into a multiplication problem and cancel common factors.

$$\frac{(4x+5)(x+2)}{3(x+2)} \cdot \frac{(3x-1)(x-4)}{3x-1}$$

$$\frac{(4x+5)(x-4)}{3}$$

This resulting quotient doesn't show any restrictions, so we need to keep our entire list of them. Then the final answer is

$$\frac{(4x+5)(x-4)}{3} \text{ with } x \neq -2,1/3,4$$

■ 5. Simplify the expression.

$$\frac{4x^2-9}{x^2+12x+36} \div \frac{4x^2-12x+9}{x^2+7x+6}$$

Solution:

Factor the numerator and denominator of both fractions as completely as possible.

$$\frac{(2x-3)(2x+3)}{(x+6)(x+6)} \div \frac{(2x-3)(2x-3)}{(x+6)(x+1)}$$

Consider restrictions. The denominator of the dividend gives $x \neq -6$, the denominator of the divisor gives $x \neq -6, -1$, and the numerator of the divisor gives $x \neq 3/2$. So the set of restrictions we should keep in mind until the end of the problem is $x \neq -6, -1, 3/2$.

Now turn the division problem into a multiplication problem and cancel common factors.

$$\frac{(2x-3)(2x+3)}{(x+6)(x+6)} \cdot \frac{(x+6)(x+1)}{(2x-3)(2x-3)}$$

$$\frac{(2x+3)(x+1)}{(x+6)(2x-3)}$$

This resulting quotient shows that $x \neq -6, 3/2$, so we can eliminate those from our list of restrictions. Then the final answer is

$$\frac{(2x+3)(x+1)}{(x+6)(2x-3)} \text{ with } x \neq -1$$

■ 6. Simplify the expression.

$$\frac{15x^2+75x+90}{5x^2+50x+125} \div \frac{x^2-3x+2}{x^2-25}$$

Solution:

Factor the numerator and denominator of both fractions as completely as possible.

$$\frac{15(x^2+5x+6)}{5(x^2+10x+25)} \div \frac{(x-1)(x-2)}{(x-5)(x+5)}$$

$$\frac{15(x+3)(x+2)}{5(x+5)(x+5)} \div \frac{(x-1)(x-2)}{(x-5)(x+5)}$$

Consider restrictions. The denominator of the dividend gives $x \neq -5$, the denominator of the divisor gives $x \neq -5,5$, and the numerator of the divisor gives $x \neq 1,2$. So the set of restrictions we should keep in mind until the end of the problem is $x \neq -5,1,2,5$.

Now turn the division problem into a multiplication problem and cancel common factors.

$$\frac{15(x+3)(x+2)}{5(x+5)(x+5)} \cdot \frac{(x-5)(x+5)}{(x-1)(x-2)}$$

$$\frac{3(x+3)(x+2)(x-5)}{(x+5)(x-1)(x-2)}$$

This resulting quotient shows that $x \neq -5,1,2$, so we can eliminate those from our list of restrictions. Then the final answer is

$$\frac{3(x+3)(x+2)(x-5)}{(x+5)(x-1)(x-2)} \text{ with } x \neq 5$$

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