Just in Time Quick Check

Standard of Learning A2.EO.1

Strand: Expressions and Operations

Standard of Learning A2.EO.1

The student will perform operations on and simplify rational expressions.

Students will demonstrate the following Knowledge and Skills:

a) Add, subtract, multiply, or divide rational algebraic expressions, simplifying the result.
b) Justify and determine equivalent rational algebraic expressions with monomial and binomial factors. Algebraic expressions should be limited to linear and quadratic expressions.
c) Recognize a complex algebraic fraction and simplify it as a product or quotient of simple algebraic fractions.
d) Represent and demonstrate equivalence of rational expressions written in different forms.

Just in Time Quick Check

Just in Time Quick Check Teacher Notes

Supporting and Prerequisite SOL: A2.EI.4c

Just in Time Quick Check A2.EO.1

1. Assuming the denominator does not equal 0, simplify the expression.

$$\frac{x^2 + 2x - 80}{x^2 - 12x + 32}$$

2. Simplify the expression when no denominator equals 0.

$$\frac{x^2 - 2x - 15}{x^2 - 4x - 5} \div (x^2 - 5x)$$

3. Assume no denominators equal 0, simplify the expression.

$$\frac{2x^2 + x - 6}{2x^2 - 9x + 9} \cdot \frac{3x^2 - 14x + 15}{3x^2 + x - 10}$$

4. Write the expression in simplest form.

$$\frac{\frac{x - 4}{8x^2}}{\frac{4 - x}{16x}}$$

5. What is the simplified form of the expression shown where $x \neq 3$?

$$\frac{x}{x - 3} + \frac{5}{x^2 - 6x + 9}$$

6. Demonstrate how you can tell algebraically, numerically (using a table), and graphically that the following rational expressions are equivalent.

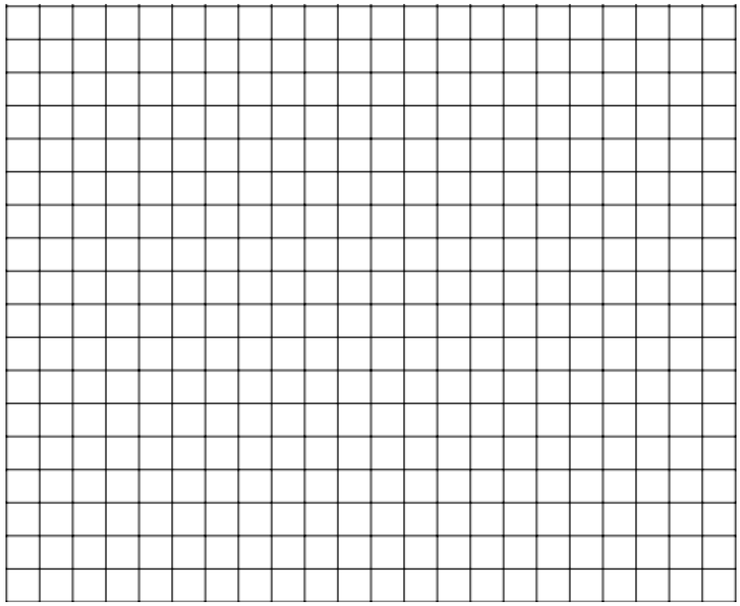
$$\frac{x^2-9}{x^2-6x+9} \text{ and } \frac{(x+3)(x-3)}{(x-3)^2}$$

Algebraically

Numerically (using a table)

X	$f(x)_1 = \frac{x^2 - 9}{x^2 - 6x + 9}$	$f(x)_2 = \frac{(x + 3)(x - 3)}{(x - 3)^2}$
0		
1		
2		
3		
4		
5		

Graphically



Summary

Explain how you know the two rational expressions are equivalent.		
Representation	$\frac{x^2 - 9}{x^2 - 6x + 9}$	$\frac{(x + 3)(x - 3)}{(x - 3)^2}$
Algebraically		
Numerically (table)		
Graphically		

A2.EO.1 Just in Time Quick Check Teacher Notes

Common Errors/Misconceptions and their Possible Indications

1. Assuming the denominator does not equal 0, simplify the expression.

$$\frac{x^2 + 2x - 80}{x^2 - 12x + 32}$$

A common error some students may make after correctly factoring each trinomial is to simplify common monomial terms from $\frac{(x+10)}{(x-4)}$ resulting in $\frac{-5}{2}$. This may indicate that some students do not understand that the entire binomial factor must be equivalent to cancel it out. Students may benefit from circling the entire binomial factor to help identify if the factors are equivalent. Teachers may find it beneficial to have students use a graphing utility to graph the original expression and then graph each step of their work to verify equivalence.

2. Simplify the expression when no denominator equals 0.

$$\frac{x^2 - 2x - 15}{x^2 - 4x - 5} \div (x^2 - 5x)$$

A common error some students may make is to rewrite the expression as a product without expressing the reciprocal of the divisor. This may indicate that some students do not recognize that the denominator of the divisor is 1. Teachers may want to have students write the divisor with a denominator of 1 prior to rewriting the expression as a product. Students may benefit from working simpler problems like $\frac{4x^2}{5} \div 2x$ to develop an understanding of the process for dividing rational expressions.

3. Assume no denominators equal 0, simplify the expression.

$$\frac{2x^2 + x - 6}{2x^2 - 9x + 9} \cdot \frac{3x^2 - 14x + 15}{3x^2 + x - 10}$$

A common error some students may make is canceling out all the terms resulting in an answer of zero. This may indicate that some students believe the result when all binomial terms are cancelled out is zero instead of one. Teachers may find it beneficial to provide students with a numerical problem like $\frac{3}{5} \cdot \frac{10}{6}$ to help students understand what happens when you can cancel out all factors resulting in one.

4. Write the expression in simplest form.

$$\frac{\frac{x-4}{8x^2}}{\frac{4-x}{16x}}$$

A common error some students may make is to cancel out the expressions $(x-4)$ and $(4-x)$ resulting in an answer of 2. This may indicate that some students are not factoring out a negative one to rewrite $(4-x)$ as $-1(x-4)$ before simplifying. Students may benefit from substituting a value for x into each expression to help them understand that the expressions are not equivalent. Also, it may be beneficial to review factoring expressions with negative 1 as a greatest common factor (GCF).

When simplifying complex fractions, students may be unsure of how to rewrite the expression in another format that lends itself to simplifying. For example, students may rewrite the expression as $\frac{x-4}{8x^2} \div \frac{16x}{4-x}$ or as $\frac{x-4}{4-x} \div \frac{8x^2}{16x}$. It may be helpful to have students rewrite the expression as $\frac{x-4}{8x^2} \div \frac{4-x}{16x}$ as their first step, then rewriting the expression to show the division as multiplication of the reciprocal.

5. What is the simplified form of the expression shown when $x \neq 3$?

$$\frac{x}{x-3} + \frac{5}{x^2 - 6x + 9}$$

A common error some students may make is to add the two rational expressions before finding a common denominator. This may indicate students do not understand that the two fractions cannot be combined until each fraction has been rewritten with an equivalent denominator. It may be beneficial to have students practice numerical problems like $\frac{3}{4} + \frac{2}{5}$ to help students with the process of adding fractions. Then build to problems that do not require factoring like $\frac{4}{x-4} + \frac{2}{x+2}$ before working on problems that involve factoring prior to finding a common denominator. Students may also benefit from creating a graphic organizer to help them with the process of adding rational expressions.

6. Demonstrate how you can tell algebraically, numerically (using a table), and graphically that the following rational expressions are equivalent.

$$\frac{x^2 - 9}{x^2 - 6x + 9} \quad and \quad \frac{(x + 3)(x - 3)}{(x - 3)^2}$$

Algebraically

Numerically (using a table)

X	$f(x)_1 = \frac{x^2 - 9}{x^2 - 6x + 9}$	$f(x)_2 = \frac{(x + 3)(x - 3)}{(x - 3)^2}$
0		
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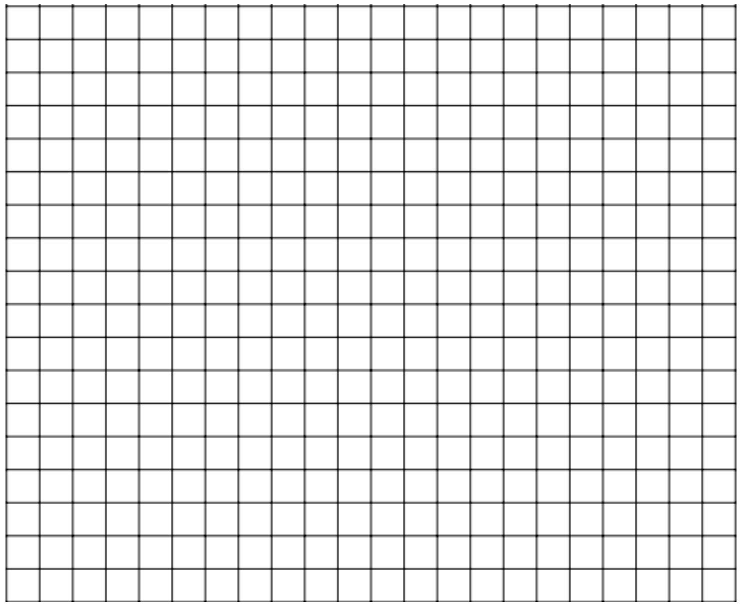
Graphically



Summary

Explain how you know the two rational expressions are equivalent.		
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Algebraically		
Numerically (table)		
Graphically		

A common error students may make is forgetting to factor both the numerator and denominator before simplifying. Another common error is to ignore the domain restrictions and fail to identify where the denominator equals zero. This may lead to students stating the expressions are equivalent where they do not exist. When determining equivalence algebraically, students may assume the two expressions are identical because they look similar without checking for restricted values. When checking for numerical equivalence, students may compare outputs without including undefined points. When checking for equivalence graphically, students may overlook holes in the graphs and believe the overlapping graphs mean complete equivalence. Teachers can help by emphasizing the importance of factoring before simplifying and provide additional practice that helps students distinguish the differences between canceling factors versus canceling terms and identifying and stating domain restrictions that will help *students understand when expressions are undefined. Teachers can also use error analysis, graphing tools and discussion prompts to build deeper understanding of when and why rational expressions are equivalent.*