Objective: Add and Subtract Rational Expressions.

#### Concept

A rational expression has the form  $\frac{p(x)}{q(x)}$  where p(x) and q(x) are polynomials. Since there will be a variable in the denominator, a rational expression has excluded values. These are values of x that would make the denominator equal to 0. Denominators can't be equal to 0 because that represents division by 0 which is undefined (not mathematically possible).

## **Excluded Values of a Rational Expression**

To find the excluded values of a rational expression, find the values of the variable that make the denominator equal to 0.

For 
$$\frac{x+3}{x^2-5x-6}$$
, solve for where  $x^2-5x-6=0$   
 $(x-6)(x+1)=0$   
 $x-6=0, x+1=0$   
 $x=6$   $x=-1$   
Conclusion:  $x \neq 6, x \neq -1$ 



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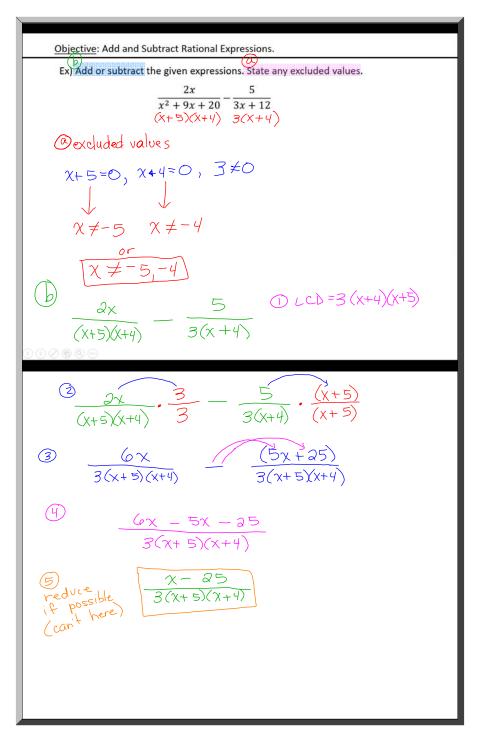
### Concept

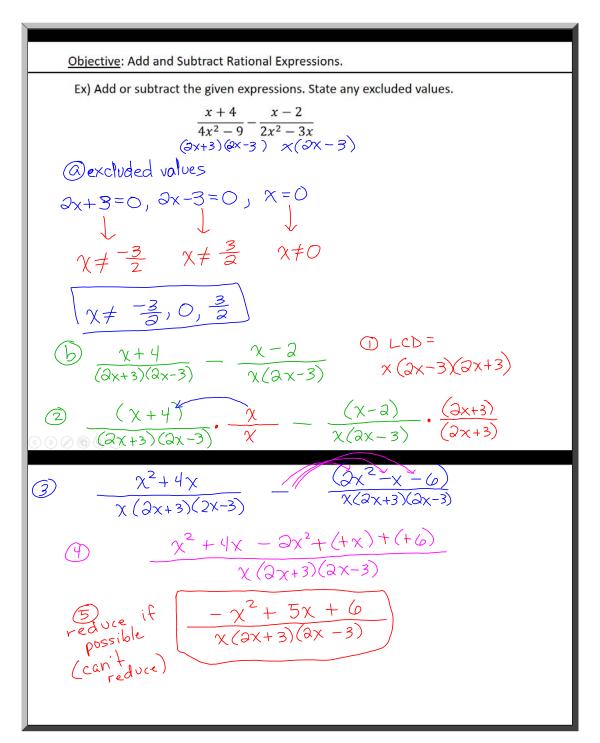
We add and subtract rational expressions using the same basic procedure used to add and subtract numeric fractions.

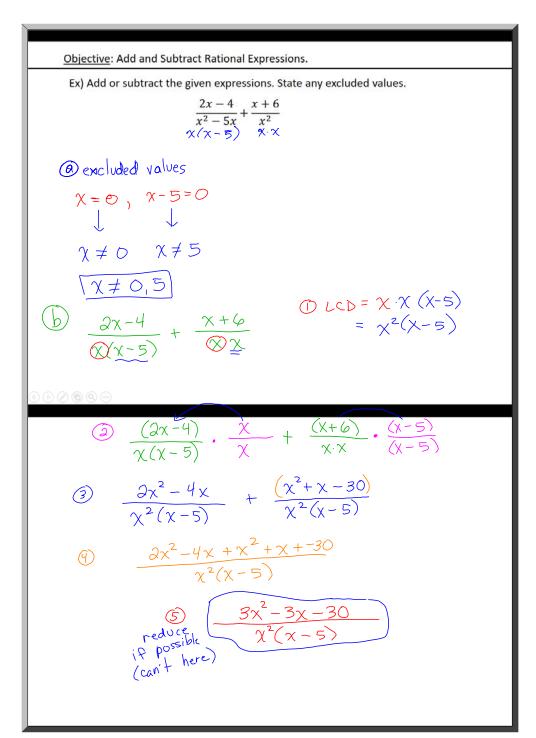
# To Add and Subtract Rational Expressions:

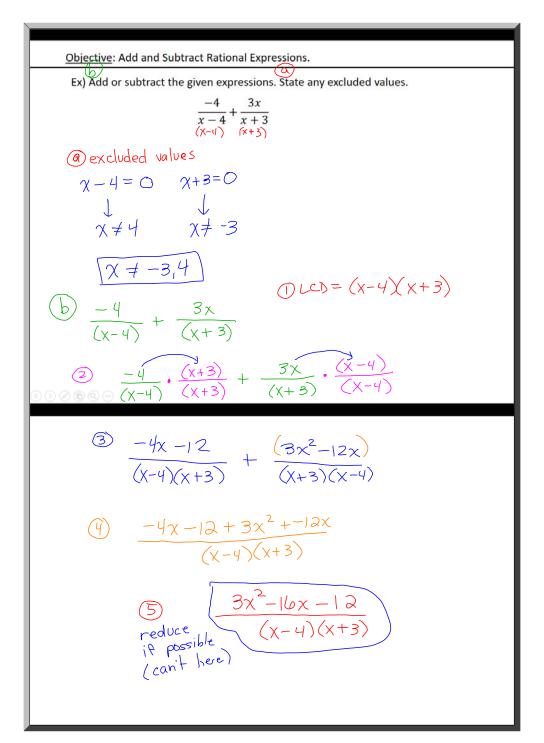
- 1. Find the lowest common denominator (LCD).
- 2. Multiply each rational expression by a ratio of 1 using missing factors in the LCD.
- 3. Add or subtract the numerators of the rational expressions; place this over the denominator of the LCD.

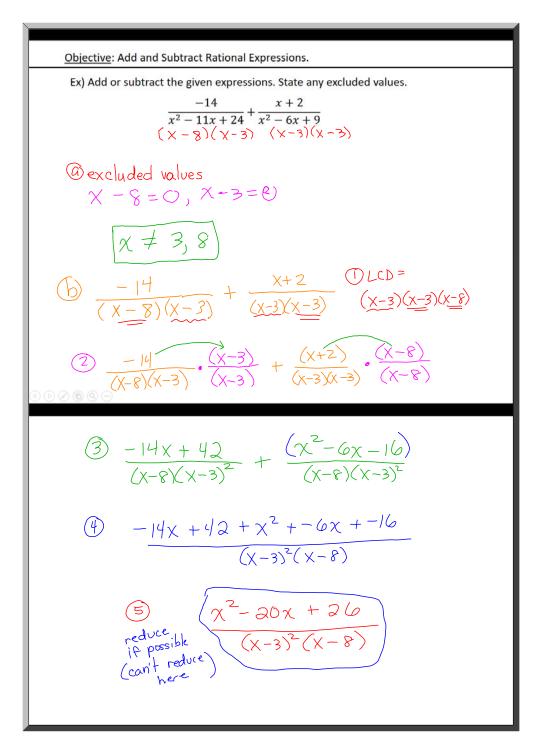












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## Closure

A set of numbers or expressions is said to be closed, or to have **closure**, under a given operation if the result of the operation on any two numbers or expressions in the set is also in the set.

The Set of Rational Expressions includes all expressions of the form  $\frac{p(x)}{q(x)}$ , where p(x) and q(x) are polynomials and  $q(x) \neq 0$ .

Is the Set of Rational Expressions closed under addition?

Yes, because the sum of two rational expressions will always be another rational expression.

$$\frac{p(x)}{q(x)} + \frac{r(x)}{s(x)} = \frac{p(x)s(x) + q(x)r(x)}{q(x)s(x)}$$

Is the Set of Rational Expressions closed under subtraction?

Yes, because the difference of two rational expressions will always be another rational expression.

$$\frac{p(x)}{q(x)} - \frac{r(x)}{s(x)} = \frac{p(x)s(x) - q(x)r(x)}{q(x)s(x)}$$