Intro to college math: Chapter 7.1
Simplifying Rational Expressions

* Rational expression — any expression that can be put in form $\frac{P}{Q}$, where Q is $\neq 0$.

* Simplifying a rational expression — to simplify a rational expression, first factor the numerator and denominator completely and the divide both the numerator and denominator by any factors they have in common.

1. Simplify. $\frac{3c-18}{4c-24}$

← cancel out what top + bottom have in common

$$\frac{3c-18}{4c-24} = \frac{3\cancel{(c-6)}}{4\cancel{(c-6)}} = \boxed{\frac{3}{4}}$$

* 1st Look at numerator (top) and factor out what it has in common.
* 2nd Look at denominator (bottom) and factor out what is has in common.
* Then cancel out what the top + down have in common.
* Write down what's left.

Reminder: To factor:

$3c - 18$ ← Think what both terms have in common

3 ← They both can be divided by a 3 evenly.

$3(\quad)$ ← Write that number on the outside of the ( )

$\frac{\cancel{3}c}{\cancel{3}} - \frac{18}{3}$ ← now think about each original term divided by the term outside the ( ).

$3(c-6)$ ← write down inside the ( ) what you get after you divide.

2. Reduce the rational expression to lowest terms. If it is already in lowest terms, enter the expression in the answer box.

$$\frac{12y-24}{11y-22}$$

$$\frac{12y-24}{11y-22} = \frac{12\cancel{(y-2)}}{11\cancel{(y-2)}} = \boxed{\frac{12}{11}}$$

* 1st Look at numerator (top) and factor out what it has in common.
* 2nd Look at denominator (bottom) and factor out what is has in common.
* Then cancel out what the top + down have in common.
* Write down what's left.

3. Reduce the rational expression to lowest terms. If it is already in lowest terms, enter the expression in the answer box.

$$\frac{2a^2-32}{2a+8}$$

$$\frac{2a^2-32}{2a+8} = \frac{2(a^2-16)}{2(a+4)} = \frac{\cancel{2}\cancel{(a+4)}(a-4)}{\cancel{2}\cancel{(a+4)}} = \boxed{a-4}$$

* First look at numerator and factor out what the terms have in common.
* Then, look at denominator and factor out what the terms have in common.
* On the top in the ( ), you have something squared minus something squared. So.... you make 2 sets of ( )( ), place a variable in each one, then a (+) in one and a (-) in another. Then right down the square root of the number in each one.

4. Reduce the rational expression to lowest terms. If it is already in lowest terms, enter the expression in the answer box. $\frac{5a-3}{25a^2-9}$

$$\frac{5a-3}{25a^2-9} = \frac{\cancel{5a-3}}{(5a+3)\cancel{(5a-3)}} = \boxed{\frac{1}{(5a+3)}}$$

$\sqrt{25a^2} = 5a$ $\quad \sqrt{9} = 3$

* First look at numerator and factor out what the terms have in common, if able

* On the bottom, take the $\sqrt{\ }$ of each term. Then make 2 sets of ( )( ). Place the $\sqrt{\ }$ of each term in the ( )( ), seperated by a (+) in one and (-) in other.

5. Simplify the following expression completely. $\frac{9k-63}{k^2+3k-70}$

$$\frac{9k-63}{k^2+3k-70} = \frac{9\cancel{(k-7)}}{\cancel{(k-7)}(k+10)} = \boxed{\frac{9}{k+10}}$$

$(k-7)(k+10)$

70
1·70
2·35
5·14
7·10

* First factor out what terms on top have in common

* On bottom of fraction, you will factor. Write the last number down to the side and list all the numbers that can multiply together to get that number. Then circle the pair that add or subtract to get the middle number; and place them in the ( ).

5. Reduce the rational expression to lowest terms. If it is already in lowest terms, enter the expression in the answer box. $\frac{3y-3}{3y^2+6y-9}$

$$\frac{3y-3}{3y^2+6y-9} = \frac{3(y-1)}{3(y^2+2y-3)} = \frac{\cancel{3}(\cancel{y-1})}{\cancel{3}(\cancel{y-1})(y+3)} = \boxed{\frac{1}{y+3}}$$

$(y-1)(y+3)$ 3 $1 \cdot 3$

* First factor out what terms on top have in common
* On bottom of fraction, you will factor. Write the last number down to the side and list all the numbers that can multiply together to get that number. Then circle the pair that add or subtract to get the middle number; and place them in the ( ).

6. Simplify the expression. $\frac{x^2+10x+24}{x^2+5x+4}$

$$\frac{x^2+10x+24}{x^2+5x+4} = \frac{(\cancel{x+4})(x+6)}{(x+1)(\cancel{x+4})} = \boxed{\frac{x+6}{x+1}}$$

24: $1 \cdot 24$, $2 \cdot 12$, $3 \cdot 8$, $4 \cdot 6$

4: $1 \cdot 4$, $2 \cdot 2$

* On both the top + bottom: Write the last number down to the side and list all the numbers that can multiply together to get that number. Then circle the pair that add or subtract to get the middle number. Then make 2 sets of ( )( ) and place the variable + pair on numbers in each one.

7. Simplify the expression. $\dfrac{z^2-3z-10}{z^2+9z+20}$

$$\frac{z^2-3z-10}{z^2+9z+20} = \boxed{\frac{(z+2)(z-5)}{(z+4)(z+5)}}$$

10
1 · 10
2 · 5

20
1 · 20
2 · 10
4 · 5

* On both the top + bottom: Write the last number down to the side and list all the numbers that can multiply together to get that number. Then circle the pair that add or subtract to get the middle number. Then make 2 sets of ( )( ) and place the variable + pair on numbers in each one.