$$\frac{x}{2}+\frac{1}{3}=\frac{x}{4}$$

Need LCD for all terms

LCD of $\{2,3,4\} = 12$

LCD LCD

$$12\left(\frac{x}{2}+\frac{1}{3}\right)=12\left(\frac{x}{4}\right)$$

$$\frac{12x}{2}+\frac{12}{3}=\frac{12x}{4}$$

$$6x+\cancel{4} = \cancel{3x}$$

$$-3x-\cancel{4} \qquad -\cancel{3x}-4$$

$$6x-3x = -4$$

$$3x = -4$$

$$x = -\frac{4}{3}$$

Check $x = -\frac{4}{3}$

$$\frac{\left(-\frac{4}{3}\right)}{\frac{2}{1}}+\frac{1}{3}=\frac{\left(-\frac{4}{3}\right)}{\frac{4}{1}}$$

$$\left(-\frac{\cancel{4}^{2}}{3}\right)\left(\frac{1}{\cancel{2}_{1}}\right)+\frac{1}{3}=\left(-\frac{\cancel{4}^{1}}{3}\right)\left(\frac{1}{\cancel{4}_{1}}\right)$$

$$-\frac{2}{3}+\frac{1}{3}=-\frac{1}{3}$$

$$-\frac{1}{3}=-\frac{1}{3}\ \checkmark \rightarrow x=-\frac{4}{3} \text{ is the solution}$$

$$\frac{\frac{a}{b}}{\frac{c}{d}} = \frac{a}{b} \div \frac{c}{d}$$

$$= \frac{a}{b}\cdot\frac{d}{c}$$

$$= \frac{ad}{bc}$$

LCD of $\{5, x, 3\} = 15x$

$$\frac{3}{5} + \frac{1}{x} = \frac{1}{3}$$

$$15x\left(\frac{3}{5} + \frac{1}{x}\right) = 15x\left(\frac{1}{3}\right)$$

$$\frac{45x}{5} + \frac{15x}{x} = \frac{15x}{3}$$

$$9x + \cancel{15} = \cancel{5x}$$

$$\begin{array}{rcl} 9x + 15 &=& 5x \\ -5x \quad -15 & & -5x \quad -15 \\ \hline 4x &=& -15 \\ x &=& -\frac{15}{4} \end{array}$$

Check $x = -\frac{15}{4}$

$$\frac{3}{5} + \frac{1}{\left(-\frac{15}{4}\right)} = \frac{1}{3}$$

$$\frac{9}{15}\cancel{\frac{3}{5}} + -\frac{4}{15} = \cancel{\frac{1}{3}}\ \frac{5}{15}$$

$$\frac{5}{15} = \frac{5}{15} \checkmark$$

$\rightarrow x = -\frac{15}{4}$ is the solution

$$\frac{1}{\frac{a}{b}} = 1 \div \frac{a}{b}$$

$$= 1 \cdot \frac{b}{a}$$

$$= \frac{b}{a}$$

$$\frac{3}{1} - \frac{6w}{w+1} = \frac{6}{w+1}$$

$$+\frac{6w}{w+1} \qquad +\frac{6w}{w+1}$$

$$\frac{3}{1} = \frac{6}{w+1} + \frac{6w}{w+1}$$

$$\frac{3}{1} = \frac{6+6w}{w+1}$$

$$\frac{(w+1)}{(w+1)}\,3 = \frac{6+6w}{\cancel{w+1}}\left(\frac{\cancel{w+1}}{w+1}\right)$$

$$\frac{3w+3}{\cancel{w+1}} = \frac{6+6w}{\cancel{w+1}}$$

$$3w+3 = 6+6w$$

$$-3w \quad -6 \quad -6 \quad -3w$$

$$-3 = 3w$$

$$-1 = w$$

Check $w=-1$

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

$$3 - \frac{-6}{0} = \frac{6}{0}$$

undefined

cannot do anything

$w \neq -1$

$\rightarrow$ $w=-1$ is not a "solution"

$w=-1$ is an extraneous solution.

We can calculate it, but it doesn't check

"potential solution"

$\therefore$ No real solution exists

$$3-\frac{6w}{w+1}=\frac{6}{w+1}$$

$$(w+1)\left(3-\frac{6w}{w+1}\right)=\left(\frac{6}{w+1}\right)(w+1)$$

$$3(w+1)-\frac{6w\cancel{(w+1)}}{\cancel{(w+1)}}=\frac{6\cancel{(w+1)}}{\cancel{(w+1)}}$$

$$3(w+1)-6w=6$$

$$3w+3-6w=6$$

$$-3w+3=6$$

$$\underline{\quad -3 \quad -3}$$

$$-3w=3$$

$w=-1$, but $w \neq -1$, so no solution

Check $w=-1$

denominator $\neq 0$

$w+1 \neq 0$

$\underline{\;-1 \quad -1\;}$

$w \neq -1$

* if we calculate $w=-1$, then we reject -1 as a solution.

$$3 - \frac{6w}{w+1} = \frac{6}{w+1}$$

1. Factor to denominator of all rational expressions. Identify any values of the variable for which the expression is undefined.

2. Identify the LCD of all terms in the equation.

3. Multiply both sides of the equation by the LCD.

4. Solve the resulting equation.

5. Check Potential solutions for extraneous.

$p^2-9=(p+3)(p-3)$

$a^2-b^2=(a+b)(a-b)$

$$\frac{36}{p^2-9}=\frac{2p}{p+3}-1$$

$$\frac{36}{(p+3)(p-3)}=\frac{2p}{p+3}-\frac{1}{1}$$

LCD: $(p+3)(p-3)$

LCD $\neq 0$

$(p+3)(p-3)\neq 0$

$p+3\neq 0 \quad p-3\neq 0$

$p\neq 3 \quad p\neq -3$

$$\cancel{(p+3)(p-3)}\left(\frac{36}{\cancel{(p+3)(p-3)}}\right)=(p+3)(p-3)\left(\frac{2p}{p+3}-1\right)$$

$$36=\frac{2p(p-3)\cancel{(p+3)}}{\cancel{(p+3)}}-(p+3)(p-3)$$

$$36=2p(p-3)-(p+3)(p-3)$$

$$36=(2p^2-6p)-(p^2-9)$$

$$36=2p^2-6p-p^2+9$$

$$36=p^2-6p+9$$

$$\begin{array}{cc} -36 & -36 \\ \hline \end{array}$$

$$0 = p^2 - 6p - 27$$

$$0 = (p-9)(p+3)$$

$p - 9 = 0$	$p + 3 = 0$
$p = 9$	$p = -3$
	but $p \neq -3$

p = 9 is the solution

$\rightarrow p = 3$

not a solution

extraneous solution