

3. Addition and Subtraction

Example: $\frac{1}{x+1} + \frac{2}{x-1}$

Factor wherever possible.

To add fractions, we need a common denominator.

When they don't have a common factor, the common denominator will be the product of the two denominators.

common denominator: $(x+1)(x-1)$

$$\left(\frac{\overset{x-1}{\cancel{x-1}}}{\cancel{x-1}}\right)\left(\frac{1}{x+1}\right) + \left(\frac{2}{x-1}\right)\left(\frac{\overset{2x+2}{\cancel{x+1}}}{\cancel{x+1}}\right), \quad x \neq \{-1, 1\}$$

Multiply, then add the fractions; be sure to state any restrictions.

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

$$\frac{3x+1}{(x-1)(x+1)} \quad \text{or} \quad \frac{3x+1}{x^2-1} \quad x \neq \{-1, 1\}$$

W.B. p40 #6

Example: $\frac{x+3}{x-5} - \frac{x-1}{x+7}$

$$\left(\frac{\overbrace{(x+7)}^{x+7}}{\overbrace{(x+7)}^{x+7}} \right) \frac{x+3}{x-5} - \left(\frac{\overbrace{(x-1)}^{x-1}}{\overbrace{(x-5)}^{x-5}} \right) \frac{x-1}{x+7}$$

$$x \neq \{-7, 5\}$$

$$\frac{(x^2 + 10x + 21)}{(x+7)(x-5)} - \frac{(x^2 - 6x + 5)}{(x+7)(x-5)}$$

$$\textcircled{1} \frac{16x + 16}{(x+7)(x-5)}$$

$$\textcircled{2} \frac{16(x+1)}{(x+7)(x-5)}$$

$$\textcircled{3} \frac{16x + 16}{x^2 + 2x - 35}$$

1: Factor *None*

2: Common denominator
no common factor \Rightarrow cd
is their product
 $(x-5)(x+7)$

3: State restrictions

4: Do the 2 multiplications,
then subtract the numerators;
be sure to subtract each term
of the second numerator !

Example: $\frac{a-b}{a^2-1} + \frac{b-1}{a-1}$

Diff of squares

Factor wherever possible.

$$\frac{a-b}{(a+1)(a-1)} + \frac{b-1}{a-1}$$

Since there is a common factor in each denominator, we need to multiply one by the factor that will make both look the same. $(a+1)(a-1) \leftarrow$ common denominator

$$\frac{a-b}{(a+1)(a-1)} + \frac{(b-1)(a+1)}{a-1(a+1)}$$

$$a \neq \{-1, 1\}$$

State any restrictions.

Multiply, then add the numerators.

$$\frac{\cancel{a-b}}{(a+1)(a-1)} + \frac{ab+\cancel{b}-\cancel{a}-1}{(a+1)(a-1)}$$

$$\frac{ab-1}{(a+1)(a-1)} \quad \text{or} \quad \frac{ab-1}{a^2-1} \quad a \neq \{-1, 1\}$$

Example: $\frac{x}{\underbrace{x^2-9}_{\text{D.O.S}}} - \frac{1}{\underbrace{2x-6}_{\text{common factor}}}$ Factor wherever possible.

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

Make the denominators the same.

Denominators have a common factor

$$\left(\frac{2}{2}\right) \frac{x}{(x+3)(x-3)} - \frac{1}{2(x-3)} \left(\frac{x+3}{x+3}\right), \quad x \neq \{-3, 3\}$$

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

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

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

$$\text{or } \frac{1}{2x+6}$$

Example: $\frac{x+1}{x^2-2x+1} - \frac{1}{x-1}$

$$\frac{x+1}{\underline{(x-1)(x-1)}} - \frac{1}{\underline{x-1}}$$

$$x \neq \{1\}$$

$$\frac{x+1}{(x-1)(x-1)} - \frac{\textcircled{1}}{x-1} \left(\frac{x-1}{x-1} \right)$$

$$\frac{\cancel{x}+1}{(x-1)(x-1)} - \frac{\overset{+}{\cancel{x-1}}}{(x-1)(x-1)}, x \neq 1$$

$$= \frac{2}{(x-1)(x-1)} \text{ or } \frac{2}{x^2 - 2x + 1}, x \neq 1$$