Example 2

Simplify each of the following

(i) $\frac{6y}{x(x+4y)} - \frac{3}{2x}$ (ii) $\frac{5}{3x-4} + \frac{2x+5}{3}$

WRITE AS SINGLE FRACTION

LCD = $2 \times (x+4y)$

$= \frac{2(6y) - (x+4y)(3)}{2x(x+4y)}$

EXPAND

CAREFUL WITH SIGN!

$= \frac{12y - 3x - 12y}{2x(x+4y)}$

X IS COMMON FACTOR

$= \frac{-3x}{2x(x+4y)}$

$= \frac{-3}{2(x+4y)}$

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(i) $\frac{6y}{x(x+4y)} - \frac{3}{2x}$ (ii) $\frac{5}{3x-4} + \frac{2x+5}{3}$

SINGLE FRACTION?

LCD = $(3)(3x-4)$

$= \frac{5(3) + (2x+5)(3x-4)}{(3x-4)(3)}$

EXPAND TOP

$= \frac{15 + [6x^2 - 8x + 15x - 20]}{3(3x-4)}$

SIMPLIFY

$= \frac{6x^2 + 7x - 5}{3(3x-4)}$

FACTORISE QUADRATIC

$= \frac{(3x+5)(2x-1)}{3(3x-4)}$

NO COMMON FACTORS!

Example 3

Simplify $\dfrac{y - \dfrac{x^2 + y^2}{y}}{\dfrac{1}{x} - \dfrac{1}{y}}$.

Trick $\times \left(\frac{xy}{xy}\right)$

$$\frac{xy\left(y - \frac{x^2+y^2}{y}\right)}{xy\left(\frac{1}{x} - \frac{1}{y}\right)}$$

$$= \frac{y^2x - x^3 - y^2x}{y - x}$$

$$= \frac{-x^3}{y-x}$$

3. By factorising the numerator and the denominator fully, simplify each of the following.

(iii) $\dfrac{t^2 + 3t - 4}{t^2 - 3t + 2}$

(iv) $\dfrac{x}{x^2 - 4} - \dfrac{1}{x + 2}$

Bowtie

$$= \frac{x(x+2) - 1(x^2-4)}{(x^2-4)(x+2)}$$

expand & simplify

$$= \frac{x^2 + 2x - x^2 + 4}{(x^2-4)(x+2)}$$

$$= \frac{2x + 4}{(x^2-4)(x+2)}$$ HCF

DOTS

FACTORISE

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

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

5. Simplify the following:

(i) $\frac{1}{x^2-9} - \frac{2}{x^2-x-6}$ (ii) $\frac{3}{x^2+x-2} - \frac{2}{x^2+3x+2}$

SINGLE FRACTION
LCD?

FACTORISE DOTS, QUAD.

LCD = $(x-3)(x+3)(x+2)$

expand

$$\frac{1}{x^2-9} - \frac{2}{x^2-x-6}$$

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

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

$$= \frac{x+2-2x-6}{(x-3)(x+3)(x+2)}$$

$$= \frac{-x-4}{(x-3)(x+3)(x+2)}$$

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(i) $\frac{1}{x^2-9} - \frac{2}{x^2-x-6}$ (ii) $\frac{3}{x^2+x-2} - \frac{2}{x^2+3x+2}$

SINGLE FRACTION
LCD?

FACTORISE DENOMINATORS
QUADRATIC FACTORS

SINGLE FRACTION?

LCD = $(x+2)(x+1)(x-1)$

expand

$$\frac{3}{x^2+x-2} - \frac{2}{x^2+3x+2}$$

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

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

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

$$= \frac{x+5}{(x+2)(x-1)(x+1)} \checkmark \quad \text{or} \quad \frac{x+5}{(x+2)(x^2-1)}$$