

Simplify the following expression

$$\frac{2x}{x^2 - 6x + 9} - \frac{1}{x + 1} - \frac{8}{x^2 - 2x - 3}$$

Solution

factor the denominators

$$x^2 - 6x + 9 = (x - 3)^2$$

$$x^2 - 2x - 3 = (x + 1)(x - 3)$$

The original expression may now be written as

$$\frac{2x}{x^2 - 6x + 9} - \frac{1}{x + 1} - \frac{8}{x^2 - 2x - 3} = \frac{2x}{(x - 3)^2} - \frac{1}{x + 1} - \frac{8}{(x + 1)(x - 3)}$$

Common denominator

$$\begin{aligned} &= \frac{2x}{x^2 - 6x + 9} - \frac{1}{x + 1} - \frac{8}{x^2 - 2x - 3} \\ &= \frac{2x}{(x - 3)^2} - \frac{1}{x + 1} - \frac{8}{(x + 1)(x - 3)} \\ &= \frac{2x(x + 1) - (x - 3)^2 - 8(x + 1)}{(x + 1)(x - 3)^2} \\ &= \frac{x^2 + 15}{(x + 1)(x - 3)^2} \end{aligned}$$