

Completing the Square

Learn it, Know it, Love It!

$$f(x) = 5x^2 + 2x - 2$$

1. Group the terms with x together with parentheses.

$$f(x) = (5x^2 + 2x) - 2$$

2. Factor the coefficient of x^2 out of the parentheses.

$$f(x) = 5\left(x^2 + \frac{2}{5}x\right) - 2$$

3. Add the square of half of the coefficient of x to the inside of the parentheses.

$$f(x) = 5\left(x^2 + \frac{2}{5}x + \left(\frac{1}{5}\right)^2\right) - 2$$

4. Subtract the number factored out in step 2 times the number added in step 3, outside the parentheses. Then simplify.

$$f(x) = 5\left(x^2 + \frac{2}{5}x + \left(\frac{1}{5}\right)^2\right) - 2 - 5\left(\frac{1}{25}\right)$$

$$= 5\left(x^2 + \frac{2}{5}x + \left(\frac{1}{5}\right)^2\right) - 2 - \left(\frac{1}{5}\right)$$

$$= 5\left(x^2 + \frac{2}{5}x + \left(\frac{1}{5}\right)^2\right) - \frac{10}{5} - \left(\frac{1}{5}\right)$$

$$= 5\left(x^2 + \frac{2}{5}x + \left(\frac{1}{5}\right)^2\right) - \frac{11}{5}$$

5. Write the expression in the parentheses as a perfect square.

$$f(x) = 5\left(x + \frac{1}{5}\right)^2 - \frac{11}{5}$$