Factoring $ax^2 + bx + c$ Using Boxes

1. Find two numbers whose product is $a \cdot c$ and whose sum is b
2. Write the middle term, $b \cdot x$, by using the factors found in Step 1.
3. Write the four terms in the boxes, starting with the ax^2 term in the upper left hand corner and the constant term in the bottom right.
4. Factor each row of the box as before.

	Factor $4x^2 + 4x - 3$
1. Find two numbers whose product is $a \cdot c$ and whose sum is b	$a = 4,\ b = 4,\ c = -3$ $a \cdot c = 4 \cdot -3 = -12$ Factors of -12 | Sum of factors $-12 \cdot 1$ | $-12 + 1 = -11$ $-6 \cdot 2$ | $-6 + 2 = -4$ $-4 \cdot 3$ | $-4 + 3 = -1$ $-3 \cdot 4$ | $-3 + 4 = 1$ **$-2 \cdot 6$** | **$-2 + 6 = 4$** The two factors of -12 whose sum is 4 is ***-2*** and ***6***
2. Write the middle term, $b \cdot x$, by using the factors found in Step 1.	$4x^2 + \mathbf{4x} - 3$ $= 4x^2 - \mathbf{2x} + \mathbf{6x} - 3$
3. Write the four terms in the boxes, starting with the ax^2 term in the upper left hand corner and the constant term in the bottom right.	$4x^2$ | $\mathbf{-2x}$ $\mathbf{6x}$ | -3
4. Factor each row of the box as before.	$2x$ | -1 $2x$: $4x^2$ | $-2x$ 3: $6x$ | -3 $4x^2 + 4x - 3 = (2x + 3)(2x - 1)$

Factoring $ax^2 + bx + c$ by Grouping (ac Method)

1. Find two numbers whose product is $a \cdot c$ and whose sum is b.
2. Write the middle term, $b \cdot x$, by using the factors found in Step 1.
3. Factor by grouping.

	Factor $4x^2 + 4x - 3$
1. Find two numbers whose product is $a \cdot c$ and whose sum is b	$a = 4,\ b = 4,\ c = -3$ $a \cdot c = 4 \cdot -3 = -12$ Factors of -12 | Sum of factors $-12 \cdot 1$ | $-12 + 1 = -11$ $-6 \cdot 2$ | $-6 + 2 = -4$ $-4 \cdot 3$ | $-4 + 3 = -1$ $-3 \cdot 4$ | $-3 + 4 = 1$ **$-2 \cdot 6$** | **$-2 + 6 = 4$** The two factors of -12 whose sum is 4 is ***-2*** and ***6***
2. Write the middle term, $b \cdot x$, by using the factors found in Step 1.	$4x^2 + \mathbf{4x} - 3$ $= 4x^2 - \mathbf{2x} + \mathbf{6x} - 3$
3. Factor by grouping.	$4x^2 - 2x + 6x - 3$ $= (4x^2 - 2x) + (6x - 3)$ $= 2x(2x - 1) + 3(2x - 1)$ $= (2x - 1)(2x + 3)$

On a separate sheet of paper, use your preferred method to factor the following polynomials. Show all work.

a) $5x^2 + 7x + 2$
b) $25x^2 + 110x + 121$
c) $4x^2 - 4xy - 3y^2$
d) $5 + 6x + x^2$