

Factoring

This handout will illustrate one method of factoring the polynomial

$$ax^2 + bx + c.$$

The procedure is to identify factors of $a \times c$ that sum to b and rewrite the b term using these factors. We then proceed to factor by grouping.

Example 1 Factor $6x^2 + 5x - 4$.

Solution 1 We first identify the coefficients:

$$a = 6, \quad b = 5, \quad c = -4.$$

Since $a \times c = 6 \times -4 = -24$ we look for the factors of -24 . Since the b term is a positive 5, we know the negative factor must be smaller than the positive factor.

| <u>factors of -24</u> | <u>sum</u> |
|---|---|
| -1, 24 | 23 |
| -2, 12 | 10 |
| -3, 8 | 5 |
| -4, 6 | 2 |

Once we have identified the appropriate factors, we rewrite the expression using these terms:

$$6x^2 + 5x - 4 = 6x^2 + 8x + (-3x) - 4.$$

Now we proceed to factor by grouping:

$$\begin{aligned} &(6x^2 + 8x) + (-3x - 4) \\ &2x(3x + 4) - 1(3x + 4) \end{aligned}$$

Notice the expressions in parentheses above are identical. This expression is equivalent to $pq + rq$, which can be rewritten as $q(p + r)$:

$$(3x + 4)(2x - 1)$$

Remember to always check your work:

$$\begin{aligned} (3x + 4)(2x - 1) &= 3x \cdot 2x + 3x \cdot (-1) + 4 \cdot 2x + 4 \cdot (-1) \\ &= 6x^2 - 3x + 8x - 4 \\ &= 6x^2 + 5x - 4 \end{aligned}$$