

Multiplying Out(expanding) - a pair of brackets with a single term in front

The term outside the brackets multiplies each of the terms in turn inside the brackets.

example:

$$\begin{aligned} & x(a + b + c) \\ & = xa + xb + xc \end{aligned}$$

further examples:

$$\begin{aligned} & 3p(2x - 5y) \\ & = 6px - 15py \end{aligned}$$

$$\begin{aligned} & 2xy(p + 2q) \\ & = 2xyp + 4xyq \end{aligned}$$

$$\begin{aligned} & 3x^2(y + 4z^2) \\ & = 3x^2y + 12x^2z^2 \end{aligned}$$

$$\begin{aligned} & -2x(3p^2 - 2q^2) \\ & = -6xp^2 + 4xq^2 \end{aligned}$$

$$\begin{aligned} & 3q^3(5r^3 - 2p^2) \\ & = 15q^3r^3 - 6q^3p^2 \end{aligned}$$

$$\begin{aligned} & 2r^2(6x - y) \\ & = 12r^2x - 2r^2y \end{aligned}$$

Multiplying Out(expanding) - two pairs of brackets

Think of the two terms in the first bracket as separate single terms in front of a pair of brackets.

example:

$$(3a - 2b)(a + b)$$

Multiply the **contents** of the 2nd bracket by the **1st term** in the 1st bracket.

$$\begin{aligned} & \underline{(3a - 2b)(a + b)} \\ & 3a(a + b) \\ & = 3a^2 + 3ab \end{aligned}$$

Multiply the **contents** of the 2nd bracket by the **2nd term** in the 1st bracket.

$$\begin{aligned} & \underline{(3a - 2b)(a + b)} \\ & - 2b(a + b) \\ & = -2ab - 2b^2 \end{aligned}$$

Add the two results together.

$$\begin{array}{r} 3a^2 + 3ab \\ \underline{- 2ab - 2b^2} \\ 3a^2 + ab - 2b^2 \end{array}$$

Example #1

$$\begin{array}{r} (7x-5)(2x-3) \\ 14x^2 - 21x \\ \underline{-10x+15} \\ 14x^2 - 31x + 15 \end{array}$$

Example #2

$$\begin{array}{r} (2x-2)(5x+3) \\ 10x^2 + 6x \\ \underline{-10x-6} \\ 10x^2 - 4x - 6 \end{array}$$

Example #3

$$\begin{array}{r} (2x+9)(3x-11) \\ 6x^2 - 22x \\ \underline{+27x-99} \\ 6x^2 + 5x - 99 \end{array}$$

Squared Brackets

$$\begin{aligned}(x+y)^2 &= (x+y)(x+y) \\ &= x^2 + xy \\ &\quad + xy + y^2 \\ &= x^2 + 2xy + y^2\end{aligned}$$

**note:** a common mistake

$$(x+y)^2 \neq x^2 + y^2$$

Difference of Two Squares

Brackets - Simple Factorising - This involves taking out a common term from each expression and placing it in front of the brackets.

examples:

$$3x^2 - 9x$$

$$\underline{3x(x-3)}$$

$$4x^3 - 6x^2$$

$$\underline{2x^2(2x-3)}$$

$$5x^2y - 10xy^2$$

$$\underline{5xy(x-2y)}$$

$$8x - 12xy$$

$$\underline{4x(2-3y)}$$

$$3xy^3 - 15x^2y$$

$$\underline{3xy(y^2-5x)}$$

$$7x^2y^2 - 21xy$$

$$\underline{7xy(xy-3)}$$

Factorising Quadratic Expressions

This is best illustrated with an example:

$$x^2 - 7x + 12$$

You must first ask yourself which two factors when multiplied will give **12** ?

The factors of 12 are : .....**1 x 12**, .....**2 x 6**, .....**3 x 4**

Now which numbers in a group added or subtracted will give **7** ?

1 : 12 gives 13, 11 .....**2** : 6 gives 8, 4 .....**3** : **4** gives **7**, 1

so

$$x^2 - 7x + 12 = (x \pm 3)(x \pm 4)$$

which of the '+' & '-' terms makes **+12**? .....and when added gives **-7**?

these are the choices: (+3)(+4), (-3)(+4), (+3)(-4) or **(-3)(-4)**

clearly, **(-3)(-4)** are the two factors we want

therefore

$$\underline{x^2 - 7x + 12 = (x - 3)(x - 4)}$$

Example #1

$$x^2 - x - 20$$

$$(x \pm 5)(x \pm 4)$$

$$\underline{(x - 5)(x + 4)}$$

Example #2

$$x^2 + x - 42$$

$$(x \pm 7)(x \pm 6)$$

$$\underline{(x + 7)(x - 6)}$$

Example #3

$$x^2 - 13x + 30$$

$$(x \pm 10)(x \pm 3)$$

$$\underline{(x - 10)(x - 3)}$$