The Distributive Law

Multiplication is distributive over addition: for any numbers a, b and c

$$a(b + c) = (ab + ac)$$

and

$$(b + c)a = (ba + ca)$$

The distributive law allows us to 'multiply out brackets'.

Use pencil and paper to verify the following identities:

(a) $(a + b)^2 = a^2 + 2ab + b^2$

(b) $(a - b)^2 = a^2 - 2ab + b^2$

Expanding a Pair of Brackets

By applying the distributive law and combining like terms we get the following results

$$
\begin{aligned}
(x+a)(x+b) &= x(x+b) + a(x+b) \\
&= x^2 + bx + ax + ab \\
&= x^2 + (a+b)x + ab
\end{aligned}
$$

$$
\begin{aligned}
(x+a)(x-a) &= x(x-a) + a(x-a) \\
&= x^2 - xa + ax - a^2 \\
&= x^2 - a^2
\end{aligned}
$$

Notice the terms in the first bracket each multiply the second bracket.

Here are some harder examples:

$$
\begin{aligned}
(2x+3)(3x+4) &= 2x(3x+4) + 3(3x+4) \\
&= 6x^2 + 8x + 9x + 12 \\
&= 6x^2 + 17x + 12
\end{aligned}
$$

$$
\begin{aligned}
(-3x+2)(2x-4) &= -3x(2x-4) + 2(3x-4) \\
&= -6x^2 + 12x + 6x - 8 \\
&= -6x^2 + 18x - 8
\end{aligned}
$$