To factor a quadratic of the form $x^2 + bx + c$, write it as:

$$(x + r_1)(x + r_2) \quad \text{where} \quad c = r_1 \cdot r_2 \quad \text{and} \quad b = r_1 + r_2.$$ 

Quadratic factorisation involves a process of multiplying and adding to determine the values of $r_1$ and $r_2$.

**EXAMPLE: Factorise $a^2 - 2a - 8$**

The $c$ term in this example is $-8$, so we need to find a pair of factors with a product of $-8$. The $b$ term is $-2$, so you need to find a pair of factors with a sum of $-2$. Since the product is negative $(-8)$ and the sum is negative $(-2)$, one factor must be negative.

From the pairs of factors which one when added together gives $-2$?

- $-1 + 8 = 7$
- $-2 + 4 = +2$
- $1 + -8 = -7$
- $2 + -4 = -2$

Now insert your brackets with a – ve & + ve $(a + \quad)(a - \quad)$

Place the 2 and 4 inside the brackets in the right order so when it is expanded we get $a^2 - 2a - 8$

If we inserted them the other way around we would get $a^2 + 2a - 8$ which is not correct.

Picture adapted from [maths.nayland.school.nz](http://maths.nayland.school.nz)
Factorise $4m^2 + 56m + 132$

First remove 4 as a factor, the greatest common factor of $4m^2 + 56m + 132$.

\[4m^2 + 56m + 132 = 4(m^2 + 14m + 33)\]

To factorise a quadratic of the form $x^2 + bx + c$, write it as $(x + r_1)(x + r_2)$ where $c = r_1 \cdot r_2$ and $b = r_1 + r_2$.

Next look at the quadratic inside the brackets, $m^2 + 14m + 33$.

The $c$ term is 33, so you need to find a pair of factors with a product of 33. The $b$ term is 14, so you need to find a pair of these factors with a sum of 14. Since the product is positive (33) and the sum is positive (14), you need both factors to be positive.

Make a list of the possible factor pairs.

<table>
<thead>
<tr>
<th>Factor pairs of $c = 33$</th>
<th>Sum of factor pairs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 · 33 = 33</td>
<td>1 + 33 = 34</td>
</tr>
<tr>
<td>3 · 11 = 33</td>
<td>3 + 11 = 14</td>
</tr>
</tbody>
</table>

Next see which factor pair has a sum of 14.

The correct factor pair is 3 and 11.

Use those numbers to factor the quadratic inside the brackets, $m^2 + 14m + 33$.

\[4(m^2 + 14m + 33)\]
\[4(m + 3)(m + 11)\]

Finally, check your work.

Multiply, applying the distributive property (F.O.I.L.)

Combine like terms

Apply the distributive property

Yes, $4m^2 + 56m + 132 = 4(m + 3)(m + 11)$!