

## Advanced Factorisation

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Some expressions require a certain amount of recognition before they can be factorised.

The expression  $p^2 - q^2 + 3p - 3q$  can be factorised, but only when it is recognised that the first two terms can be factorised as a difference of squares:  $p^2 - q^2 = (p - q)(p + q)$ .

The last two terms can also be factorised as  $3(p - q)$ , so that  $(p - q)$  is a common factor.

$$\begin{aligned} p^2 - q^2 + 3p - 3q &= (p - q)(p + q) + 3(p - q) \\ &= (p - q)((p + q) + 3) \\ &= (p - q)(p + q + 3) \end{aligned}$$

Some expressions with four terms, involving four different variables, can also be factorised.

The simplest is  $pq + pr + sq + sr$ .

Notice that  $p$  is a common factor of the first two terms, and  $s$  is a common factor of the last two terms. We have

$$pq + pr + sq + sr = p(q + r) + s(q + r)$$

Now  $(q + r)$  is a common factor, so we can write

$$p(q + r) + s(q + r) = (q + r)(p + s)$$

Hence  $pq + pr + sq + sr = (q + r)(p + s)$