

Dr Oliver Mathematics

Worked Examples

Expansion 1

From: AQA Further Mathematics Level 2 2019 Paper 2 Q17

1. Show that

$$(x + 1)(x + 3)(x + 4) - x(x^2 + 7x + 11)$$

(5)

can be written in the form

$$(x + a)(x + b),$$

where a and b are positive integers.

Solution

Let us proceed in order:

$$\begin{array}{r|rr} \times & x & +1 \\ \hline x & x^2 & +x \\ +3 & +3x & +3 \\ \hline \end{array}$$

so

$$(x + 1)(x + 3) = x^2 + 4x + 3$$

and

$$\begin{array}{r|rrr} \times & x^2 & +4x & +3 \\ \hline x & x^3 & +4x^2 & +3x \\ +4 & +4x^2 & +16x & +12 \\ \hline \end{array}$$

so

$$(x^2 + 4x + 3)(x + 4) = x^3 + 8x^2 + 19x + 12.$$

Finally,

$$\begin{aligned} & (x + 1)(x + 3)(x + 4) - x(x^2 + 7x + 11) \\ = & (x^3 + 8x^2 + 19x + 12) - (x^3 + 7x^2 + 11x) \\ = & x^2 + 8x + 12 \end{aligned}$$

we can now factorise the quadratic:

$$\left. \begin{array}{l} \text{add to:} \quad +8 \\ \text{multiply to:} \quad +12 \end{array} \right\} + 6, +2$$

$$= \underline{(x + 6)(x + 2)};$$

hence,

$$\underline{a = 6} \text{ and } \underline{b = 2}$$

(or vice versa!).

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