

3.1 Factoring Polynomial Expressions: Part 2

We use these strategies to factor polynomials that appear more complex:

Example #1: Factor each trinomial.

a) $|x^2 + 1.4x - 1.2 \rightarrow$ Factor out 0.1 to give integer coefficients

$$= 0.1(10x^2 + 14x - 12)$$

$(10)(-12) = -120$

$$= 0.1(10x^2 + 20x - 6x - 12)$$

$$= 0.1[10x(x+2) - 6(x+2)]$$

$$= 0.1(\underbrace{10x-6}(x+2)) \Rightarrow = 0.1(2)(5x-3)(x+2)$$

factor out a 2

$$= \boxed{0.2(5x-3)(x+2)}$$

$$2x^2 + 7x + 3$$

$$= 2x^2 + x + 6x + 3$$

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

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

$2(3) = 6$
 $\frac{6}{2} \times \frac{1}{3} = 6$
 $\frac{6}{6} + \frac{1}{3} = 7$

b) $x^2 - \frac{17}{3}x - 2 \rightarrow$ Factor out $\frac{1}{3}$ to get integer coefficients

$$= \frac{1}{3}(3x^2 - 17x - 6)$$

$(3)(-6) = -18$

$$= \frac{1}{3}(3x^2 - 18x + x - 6)$$

$$= \frac{1}{3}[3x(x-6) + 1(x-6)]$$

$$= \frac{1}{3}(3x+1)(x-6)$$

Example #2: Factor each polynomial expression.

a) $2(x-6)^2 + 10(x-6) - 48$

let $a = x-6$

$$2a^2 + 10a - 48$$

$$= 2(a^2 + 5a - 24)$$

$\frac{8}{-} \times \frac{-3}{-} = -24$
 $\frac{8}{-} + \frac{-3}{-} = 5$

$$= 2(a+8)(a-3)$$

let's put $a = x-6$ back in!

$$= 2[(x-6)+8][(x-6)-3]$$

$$= 2(x+2)(x-9)$$

$$x^2 + 5x + 6$$

$$= (x+2)(x+3)$$

$$b) 3(2x+5)^2 + 10(2x+5) - 8$$

$$\text{let } a = 2x + 5$$

$$\begin{aligned} & 3a^2 + 10a - 8 \\ = & 3a^2 + 12a - 2a - 8 \\ = & 3a(a+4) - 2(a+4) \\ = & (3a-2)(a+4) \\ = & [3(2x+5)] [(2x+5)+4] \\ = & (6x+15-2)(2x+9) \\ = & (6x+13)(2x+9) \end{aligned}$$

$$mn = 3(-8) = -24$$

$$\begin{array}{c} / \quad \backslash \\ 12 \quad -2 \end{array}$$

Example #3: Factor each polynomial expression.

$$\begin{aligned} a) & (3x+4)^2 - (2y-1)^2 \\ = & [(3x+4) + (2y-1)][(3x+4) - (2y-1)] \\ = & (3x+4+2y-1)(3x+4-2y+1) \\ = & (3x+2y+3)(3x-2y+5) \end{aligned}$$

$$\begin{aligned} & m^2 - 4n^2 \\ = & (m-2n)(m+2n) \end{aligned}$$

$$\begin{aligned} b) & 27(2x-3)^2 - 75(y-4)^2 \\ = & 3[9(2x-3)^2 - 25(y-4)^2] \\ = & 3[(3(2x-3))^2 - (5(y-4))^2] \\ = & 3[3(2x-3) - 5(y-4)][3(2x-3) + 5(y-4)] \\ = & 3(6x-9-5y+20)(6x-9+5y-20) \\ = & 3(6x-5y+11)(6x-5y-29) \end{aligned}$$