

Factoring Polynomials of the Form  $ax^2 + bx + c$ Example: Factor by decomposition.

$$\begin{aligned} \text{a) } & \underline{4x^2 + 11x + 6} & \begin{array}{l} \underline{3} \cdot \underline{8} = 24 \\ \underline{3} + \underline{8} = 11 \end{array} \\ & \begin{array}{c} \swarrow \quad \searrow \\ = 4x^2 + 3x + 8x + 6 \\ = \underline{x(4x+3)} + \underline{2(4x+3)} \\ = (4x+3)(x+2) \end{array} \end{aligned}$$

$$\begin{aligned} \text{b) } & \underline{6x^2 - 7x - 10} & \begin{array}{l} \underline{-12} \cdot \underline{5} = -60 \\ \underline{-12} + \underline{5} = -7 \end{array} \\ & \begin{array}{c} \swarrow \quad \searrow \\ = 6x^2 - 12x + 5x - 10 \\ = 6x(x-2) + 5(x-2) \\ = (x-2)(6x+5) \end{array} \end{aligned}$$

$$\begin{aligned} \text{c) } & \underline{8x^2 - 18x - 5} & \begin{array}{l} \underline{2} \cdot \underline{-20} = -40 \\ \underline{2} + \underline{-20} = -18 \end{array} \\ & \begin{array}{c} \swarrow \quad \searrow \\ = 8x^2 + 2x - 20x - 5 \\ = 2x(\underline{4x+1}) - 5(\underline{4x+1}) \\ = (4x+1)(2x-5) \end{array} \end{aligned}$$

$$\text{d) } 24x^2 - 20x - 24$$

Notice you can factor a GCF of 4 first

$$\begin{aligned} & = 4(\underline{6x^2 - 5x - 6}) & \begin{array}{l} \underline{-9} \cdot \underline{4} = -36 \\ \underline{-9} + \underline{4} = -5 \end{array} \\ & = 4(6x^2 - 9x + 4x - 6) \\ & = 4[3x(\underline{2x-3}) + 2(\underline{2x-3})] \\ & = 4(2x-3)(3x+2) \end{aligned}$$

$$\begin{aligned} \frac{-8 \cdot 3}{-8+3} &= -24 \\ &= -5 \end{aligned}$$

e)  $3x^2 + 7x + 2$

$$\begin{aligned} \underline{6} \cdot \underline{1} &= 6 \\ \underline{6} + \underline{1} &= 7 \end{aligned}$$

	$x$	$2$
$3x$	$3x^2$	$6x$
$1$	$1x$	$2$

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

e)  $8x^2 - 5x - 3$

	$x$	$-1$
$8x$	$8x^2$	$-8x$
$3$	$3x$	$-3$

$$(x-1)(8x+3)$$

Example: Factor  $15x^2 - 65x + 20$  completely.

$$\begin{aligned} &= 5(3x^2 - 13x + 4) \\ &= 5(3x^2 - 1x - 12x + 4) \\ &= 5(x(3x-1) - 4(3x-1)) \\ &= 5(x-4)(3x-1) \end{aligned}$$