

Factoring by Decomposition

Factor each completely.

1) $3x^2 - 16x + 20$

$$\begin{array}{l} \textcircled{\times} 60 \\ \textcircled{+} -16 \end{array}$$

$$\begin{array}{l} 1, 60 \\ 2, 30 \\ 3, 20 \\ 4, 15 \\ 5, 12 \\ -6, -10 \end{array}$$

$$= \underbrace{3x^2 - 6x}_{3x} - \underbrace{10x + 20}_{-10}$$

$$= 3x(x-2) - 10(x-2)$$

$$= (x-2)(3x-10)$$

$$\begin{aligned} \text{check: } &= 3x^2 - 10x - 6x + 20 \\ &= 3x^2 - 16x + 20 \end{aligned}$$

2) $5m^2 + 22m + 8$

$$\begin{array}{l} \textcircled{\times} 40 \\ \textcircled{+} 22 \end{array}$$

$$\begin{array}{l} 1, 40 \\ \textcircled{2, 20} \end{array}$$

$$= \underbrace{5m^2 + 20m}_{5m} + \underbrace{2m + 8}_{+2}$$

$$= 5m(m+4) + 2(m+4)$$

$$= (m+4)(5m+2)$$

$$\begin{aligned} \text{check: } &= 5m^2 + 2m + 20m + 8 \\ &= 5m^2 + 22m + 8 \end{aligned}$$

3) $4k^2 - 12k - 7$

$$\begin{array}{l} \textcircled{\times} -28 \\ \textcircled{+} -12 \end{array}$$

$$\begin{array}{l} 1, -28 \\ \textcircled{2, -14} \end{array}$$

$$= \underbrace{4k^2 + 2k}_{2k} - \underbrace{14k - 7}_{-7}$$

$$= 2k(2k+1) - 7(2k+1)$$

$$= (2k+1)(2k-7)$$

4) $8x^2 + 13x - 6$

$$\begin{array}{l} \textcircled{\times} -48 \\ \textcircled{+} 13 \end{array}$$

$$\begin{array}{l} -1, 48 \\ -2, 24 \\ -3, 16 \end{array}$$

$$= \underbrace{8x^2 + 16x}_{8x} - \underbrace{3x - 6}_{-3}$$

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

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

5) $11n^2 + 31n - 6$

$\otimes -66$ $-1, 66$
 $\oplus 31$ $-2, 33$

$$= \underbrace{11n^2 + 33n}_{11n} - \underbrace{2n - 6}_{-2}$$

$$= 11n(n+3) - 2(n+3)$$

$$= (n+3)(11n-2)$$

6) $16n^2 + 110n + 39$

$\otimes 624$ $1, 624$
 $\oplus 110$ $2, 312$
 $3, 208$
 $4, 156$

$$= \underbrace{16n^2 + 104n}_{8n} + \underbrace{6n + 39}_{+3}$$

$$= 8n(2n+13) + 3(2n+13)$$

$$= (2n+13)(8n+3)$$