

Grouping: 4 terms

a. $12n^3 + 30n^2 - 72n - 180$

$$6 \left(\frac{2n^3 + 5n^2}{n^2} \mid \frac{-72n - 180}{-6 \quad -6} \right)$$

$$\downarrow$$

$$6 [n^2(2n+5) - 6(2n+5)]$$

$$\rightarrow 6(2n+5)(n^2-6)$$

b. $64x^3 + 40x^2 - 48x - 30$

$$2 \left(\frac{32x^3 + 20x^2}{4x^2} \mid \frac{-24x - 15}{-3 \quad -3} \right)$$

$$\downarrow$$

$$2 [4x^2(8x+5) - 3(8x+5)]$$

$$\rightarrow 2(4x^2-3)(8x+5)$$

Try it!

1. $24n^3 - 16n^2 + 6n - 4$

$$2 \left(\frac{12n^3 - 8n^2}{4n^2} \mid \frac{3n - 2}{1 \quad 1} \right)$$

$$\downarrow$$

$$4n^2(3n-2) + 1(3n-2)$$

$$\rightarrow 2(4n^2+1)(3n-2)$$

a = 1 (after you take out the GCF)

a. $2k^2 + 4k - 96$

$$2 \left(\frac{k^2 + 2k - 48}{k} \right)$$

$$\downarrow$$

$$k(k+8) - 6(k+8)$$

$$\rightarrow 2(k-6)(k+8)$$

$$\begin{array}{r} \cancel{-48} \\ 8 \times \cancel{-6} \\ \hline 2 \end{array}$$

b. $4m^2 - 44m + 120$

$$4 \left(\frac{m^2 - 11m + 30}{m} \right)$$

$$\downarrow$$

$$m(m-5) - 6(m-5)$$

$$\rightarrow 4(m-5)(m-6)$$

$$\begin{array}{r} \cancel{30} \\ -5 \times \cancel{-6} \\ \hline -11 \end{array}$$

c. $3v^2 - 6v - 24$

$$3 \left(\frac{v^2 - 2v - 8}{v} \right)$$

$$\downarrow$$

$$v(v-4) + 2(v-4)$$

$$\rightarrow 3(v-4)(v+2)$$

$$\begin{array}{r} \cancel{-8} \\ -4 \times \cancel{2} \\ \hline -2 \end{array}$$

d. $2v^2 + 18v + 16$

$$2 \left(\frac{v^2 + 9v + 8}{v} \right)$$

$$\downarrow$$

$$v(v+8) + 1(v+8)$$

$$\rightarrow 2(v+1)(v+8)$$

$$\begin{array}{r} \cancel{8} \\ 8 \times \cancel{1} \\ \hline 9 \end{array}$$

Practice

$$1. \frac{3x^2 + 39x + 108}{3 \quad 3 \quad 3}$$

$$\begin{array}{r} 36 \\ 9 \times 4 \\ \hline 13 \end{array}$$

$$3(x^2 + 13x + 36)$$

$$\frac{x^2 + 9x}{x} + \frac{4x + 36}{4 \quad 4}$$

$$x(x+9) + 4(x+9)$$

$$\boxed{3(x+4)(x+9)}$$

$$5. \frac{-2x^2 + 18x - 40}{-2 \quad -2 \quad -2}$$

$$\begin{array}{r} 20 \\ -5 \times -4 \\ \hline -9 \end{array}$$

$$-2(x^2 - 9x + 20)$$

$$\frac{x^2 - 4x}{x} + \frac{-5x + 20}{-5 \quad -5}$$

$$x(x-4) - 5(x-4)$$

$$\boxed{-2(x-4)(x-5)}$$

$$2. \frac{5x^2 + 35x + 60}{5 \quad 5 \quad 5}$$

$$\begin{array}{r} 12 \\ 3 \times 4 \\ \hline 7 \end{array}$$

$$5(x^2 + 7x + 12)$$

$$\frac{x^2 + 3x}{x} + \frac{4x + 12}{4 \quad 4}$$

$$x(x+3) + 4(x+3)$$

$$\boxed{5(x+4)(x+3)}$$

$$6. \frac{-3x^2 + 33x - 54}{-3 \quad -3 \quad -3}$$

$$\begin{array}{r} 18 \\ -2 \times -9 \\ \hline -11 \end{array}$$

$$-3(x^2 - 11x + 18)$$

$$\frac{x^2 - 2x}{x} + \frac{-9x + 18}{-9 \quad -9}$$

$$x(x-2) - 9(x-2)$$

$$\boxed{-3(x-9)(x-2)}$$

$$3. \frac{4x^2 - 8x - 140}{4 \quad 4 \quad 4}$$

$$\begin{array}{r} -35 \\ -7 \times 5 \\ \hline -2 \end{array}$$

$$4(x^2 - 2x - 35)$$

$$\frac{x^2 - 7x}{x} + \frac{5x - 35}{5 \quad 5}$$

$$x(x-7) + 5(x-7)$$

$$\boxed{4(x-7)(x+5)}$$

$$7. \frac{4x^2 + 8x - 12}{4 \quad 4 \quad 4}$$

$$\begin{array}{r} -3 \\ 3 \times -1 \\ \hline 2 \end{array}$$

$$4(x^2 + 2x - 3)$$

$$\frac{x^2 + 3x}{x} + \frac{-1x - 3}{-1 \quad -1}$$

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

$$\boxed{4(x-1)(x+3)}$$

$$4. \frac{7x^2 - 35x + 28}{7 \quad 7 \quad 7}$$

$$\begin{array}{r} 4 \\ -4 \times -1 \\ \hline -5 \end{array}$$

$$7(x^2 - 5x + 4)$$

$$\frac{x^2 - 4x}{x} + \frac{-1x + 4}{-1 \quad -1}$$

$$x(x-4) - 1(x-4)$$

$$\boxed{7(x-1)(x-4)}$$

$$8. \frac{2x^2 + 10x - 48}{2 \quad 2 \quad 2}$$

$$\begin{array}{r} -24 \\ -3 \times 8 \\ \hline 5 \end{array}$$

$$2(x^2 + 5x - 24)$$

$$(x^2 - 3x) + 8x - 24$$

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

$$\boxed{2(x+8)(x-3)}$$