

Factoring trinomials (product-sum with grouping)

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

How do you know
to make $11x = 8x + 3x$?

↳ multiply first and last number

$$2 \cdot (12) = 24$$

↳ the middle numbers must
have the same product

$$\begin{array}{r}
 24 \\
 \hline
 1, 24 \\
 2, 12 \\
 \boxed{3, 8} \quad 3+8=11 \\
 4, 6
 \end{array}$$

↳ factor by grouping

$$\begin{aligned}
 & 3x^2 + 10x + 8 \\
 &= 3x^2 + 6x + 4x + 8 \\
 &= 3x(x+2) + 4(x+2) \\
 &= (x+2)(3x+4)
 \end{aligned}$$

$$\begin{array}{r}
 3(8) = 24 \\
 \hline
 1, 24 \\
 2, 12 \\
 3, 8 \\
 \boxed{4, 6} \quad 4+6=10
 \end{array}$$

$$2x^2 - 5x - 12$$

$$= 2x^2 - 8x + 3x - 12$$

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

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

$$2(-12) = -24$$

$$1, -24$$

$$2, -12$$

$$\boxed{3, -8} \quad 3-8 = -5$$

$$4, -6$$

$$3x^2 + 14x - 5$$

$$= 3x^2 - 1x + 15x - 5$$

$$= x(3x-1) + 5(3x-1)$$

$$= (3x-1)(x+5)$$

$$3(-5) = -15$$

$$\boxed{-1, 15} \quad -1+15 = 14$$

$$-3, 5$$