

Factoring

2 - Factoring Trinomials by Splitting the Middle Term

Split middle term and factor by grouping.

$$\begin{aligned} \#1) \quad & 3p^2 - 2p - 5 \\ & = 3p^2 + 3p - 5p - 5 \\ & = (3p^2 + 3p) + (-5p - 5) \\ & = 3p(p+1) - 5(p+1) \\ & = (p+1)(3p-5) \end{aligned}$$

mult	Add
$(3p^2)(-5)$	$-2p$
$(p)(-15p)$	$-14p$
$(3p)(-5p)$	$-2p$

$$\begin{aligned} \#2) \quad & 2x^2 + 3x - 9 \\ & = 2x^2 - 3x + 6x - 9 \\ & = (2x^2 - 3x) + (6x - 9) \\ & = x(2x - 3) + 3(2x - 3) \\ & = (2x - 3)(x + 3) \end{aligned}$$

mult	Add
$2x^2(-9)$	$3x$
$(-x)(18x)$	$17x$
$(-7x)(9x)$	$7x$
$(-3x)(6x)$	$3x$

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

mult	Add
$(3x^2)(4)$	$-8x$
$(-x)(-12x)$	$-13x$
$(-2x)(-6x)$	$-8x$

$$\begin{aligned} \#4) \quad & 5x^2 + 19x + 12 \\ & = 5x^2 + 4x + 15x + 12 \\ & = (5x^2 + 4x) + (15x + 12) \\ & = x(5x + 4) + 3(5x + 4) \\ & = (5x + 4)(x + 3) \end{aligned}$$

mult	Add
$5x^2(12)$	$19x$
$(x)(60x)$	$61x$
$(2x)(30x)$	$32x$
$(3x)(20x)$	$23x$
$(4x)(15x)$	$19x$

$$\begin{aligned} \#5) \quad & 2x^2 + 11x + 5 \\ & = 2x^2 + x + 10x + 5 \\ & = (2x^2 + x) + (10x + 5) \\ & = x(2x + 1) + 5(2x + 1) \\ & = (2x + 1)(x + 5) \end{aligned}$$

mult	Add
$(2x^2)(5)$	$11x$
$(x)(10x)$	$11x$

$$\begin{aligned} \#6) \quad & 2x^2 + 5x + 2 \\ & = 2x^2 + x + 4x + 2 \\ & = (2x^2 + x) + (4x + 2) \\ & = x(2x + 1) + 2(2x + 1) \\ & = (2x + 1)(x + 2) \end{aligned}$$

mult	Add
$(2x^2)(2)$	$5x$
$(x)(4x)$	$5x$

$$\begin{aligned} \#7) \quad & 7x^2 + 53x + 28 \\ & = 7x^2 + 4x + 49x + 28 \\ & = x(7x + 4) + 7(7x + 4) \\ & = (7x + 4)(x + 7) \end{aligned}$$

mult	Add
$(7x^2)(28)$	$53x$
$(x)(196x)$	$197x$
$(2x)(98x)$	$100x$
$(4x)(49x)$	$53x$

$$\begin{aligned} \#8) \quad & 9x^2 + 66x + 21 \\ & \text{GCF} = 3 \\ & = 3[3x^2 + 22x + 7] \\ & = 3[3x^2 + x + 21x + 7] \\ & = 3[(3x^2 + x) + (21x + 7)] \\ & = 3[x(3x + 1) + 7(3x + 1)] \\ & = 3(3x + 1)(x + 7) \end{aligned}$$

mult	Add
$(3x^2)(7)$	$22x$
$(x)(21x)$	$22x$

$$\begin{aligned} \#9) \quad & 15x^2 - 27x - 6 \\ & \text{GCF} = 3 \\ & = 3[5x^2 - 9x - 2] \\ & = 3[5x^2 + x - 10x - 2] \\ & = 3[(5x^2 + x) + (-10x - 2)] \\ & = 3[x(5x + 1) - 2(5x + 1)] \\ & = 3(5x + 1)(x - 2) \end{aligned}$$

mult	Add
$(5x^2)(-2)$	$-9x$
$(x)(-10x)$	$-9x$

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#10) $5x^2 - 18x + 9$

$$\begin{aligned}
 &= 5x^2 - 3x - 15x + 9 \\
 &= (5x^2 - 3x) + (-15x + 9) \\
 &= x(5x - 3) - 3(5x - 3) \\
 &= (5x - 3)(x - 3)
 \end{aligned}$$

mult	Add
$(5x^2)(9)$	$-18x$
$(-x)(-45x)$	$-45x$
$(-3x)(-15x)$	$-18x$

#11) $4x^2 - 15x - 25$

$$\begin{aligned}
 &= 4x^2 - 20x + 5x - 25 \\
 &= (4x^2 - 20x) + (5x - 25) \\
 &= 4x(x - 5) + 5(x - 5) \\
 &= (x - 5)(4x + 5)
 \end{aligned}$$

mult	Add
$(4x^2)(-25)$	$-15x$
$(x)(-100x)$	$-99x$
$(2x)(-50x)$	$-48x$
$(4x)(-25x)$	$-21x$
$(5x)(-20x)$	$-15x$

#12) $14x^2 - 35x + 49$

$$\begin{aligned}
 &= 4x^2 - 7x - 28x + 49 \\
 &= x(4x - 7) - 7(4x - 7) \\
 &= (4x - 7)(x - 7)
 \end{aligned}$$

mult	Add
$(4x^2)(49)$	$-35x$
$(-x)(-196x)$	$-197x$
$(-7x)(-98x)$	$-100x$
$(-4x)(-49x)$	$-53x$
$(-7x)(-28x)$	$-35x$

#13) $4x^2 - 17x + 4$

$$\begin{aligned}
 &= 4x^2 - x - 16x + 4 \\
 &= (4x^2 - x) + (-16x + 4) \\
 &= x(4x - 1) - 4(4x - 1) \\
 &= (4x - 1)(x - 4)
 \end{aligned}$$

mult	Add
$(4x^2)(4)$	$-17x$
$(-x)(-16x)$	$-17x$

#14) $6x^2 + 7x - 49$

$$\begin{aligned}
 &= 6x^2 - 14x + 21x - 49 \\
 &= (6x^2 - 14x) + (21x - 49) \\
 &= 2x(3x - 7) + 7(3x - 7) \\
 &= (3x - 7)(2x + 7)
 \end{aligned}$$

mult	Add
$(6x^2)(-49)$	$7x$
$(-x)(294x)$	$293x$
$(-2x)(147x)$	$145x$
$(-3x)(98x)$	$95x$
$(-6x)(49x)$	$47x$
$(-7x)(42x)$	$35x$
$(-14x)(21x)$	$7x$

#15) $6x^2 + 37x + 6$

$$\begin{aligned}
 &= 6x^2 + x + 36x + 6 \\
 &= (6x^2 + x) + (36x + 6) \\
 &= x(6x + 1) + 6(6x + 1) \\
 &= (6x + 1)(x + 6)
 \end{aligned}$$

mult	Add
$(6x^2)(6)$	$37x$
$(x)(36x)$	$37x$

#16) $-6x^2 - 25x - 25$

$$\begin{aligned}
 &= -1 [6x^2 + 25x + 25] \\
 &= -1 [6x^2 + 10x + 15x + 25] \\
 &= -1 [(6x^2 + 10x) + (15x + 25)] \\
 &= -1 [2x(3x + 5) + 5(3x + 5)] \\
 &= -1 (3x + 5)(2x + 5)
 \end{aligned}$$

mult	Add
$(6x^2)(25)$	$25x$
$(x)(150x)$	$151x$
$(2x)(75x)$	$77x$
$(3x)(50x)$	$53x$
$(5x)(30x)$	$35x$
$(6x)(25x)$	$31x$
$(10x)(15x)$	$25x$

#17) $6x^2 + 5x - 6$

$$\begin{aligned}
 &= 6x^2 - 4x + 9x - 6 \\
 &= (6x^2 - 4x) + (9x - 6) \\
 &= 2x(3x - 2) + 3(3x - 2) \\
 &= (3x - 2)(2x + 3)
 \end{aligned}$$

mult	Add
$(6x^2)(-6)$	$5x$
$(-x)(36x)$	$35x$
$(-2x)(18x)$	$16x$
$(-3x)(12x)$	$9x$
$(-4x)(9x)$	$5x$

#18) $16x^2 + 60x - 100$

GCF = 4

$$\begin{aligned}
 &= 4x^2 + 15x - 25 \\
 &= 4x^2 - 5x + 20x - 25 \\
 &= (4x^2 - 5x) + (20x - 25) \\
 &= x(4x - 5) + 5(4x - 5) \\
 &= (4x - 5)(x + 5)
 \end{aligned}$$

mult	Add
$(4x^2)(-25)$	$15x$
$(-x)(100x)$	$99x$
$(-2x)(50x)$	$48x$
$(-4x)(25x)$	$21x$
$(-5x)(20x)$	$15x$