

Factor the following trinomials:

$$x^2 + 11x + 10$$

$x^2 + 1x + 10x + 10$

 $\Rightarrow (x+10)(x+1)$

Diagram for $x^2 + 11x + 10$:

 Top-left: 10 (labeled "mult.")

 Bottom-left: 10

 Bottom-right: 1 (labeled "add.")

 Blue arrows connect the top-left 10 to the bottom-right 1, and the bottom-left 10 to the top-right 10.

$$x^2 - 7x - 30$$

Diagram for $x^2 - 7x - 30$:

 Top-left: -30

 Bottom-left: 3

 Bottom-right: -10

 Bottom-left: -7

$$(x+3)(x-10)$$

$$x^2 - 19x + 48$$

48:

 1 x 48

 2 x 24

 3 x 16

 4 x 12

 6 x 8

Diagram for $x^2 - 19x + 48$:

 Top-left: 48

 Bottom-left: -16

 Bottom-right: -3

 Bottom-left: -19

$$(x-16)(x-3)$$

$$1) \underline{-4x^4 - 4}$$

$$\underline{-4(x^4 + 1)}$$

$$2) -9k + 9$$

$$9(-k + 1)$$

$$3) 3p^3 + 4p$$

$$p(3p^2 + 4)$$

$$4) 27x - 9x^2$$

$$9x(3 - x)$$

$$5) 4n^3 + 6n^2$$

$$\underline{2n^2(2n + 3)}$$

$$\frac{4n^3}{2n^2} = 2n$$

$$\frac{6n^2}{2n^2} = 3$$

$$6) -42k^5 + 30k^6$$

$$6k^5(-7 + 5k)$$

$$7) 45x^4 - 20x^3 + 30x^2$$
$$5x^2(9x^2 - 4x + 6)$$

$$8) -30x^3 + 27x - 21$$
$$3(-10x^3 + 9x - 7)$$

$$9) -35k^7 + 21k^4 + 28k^2$$
$$7k^2(-5k^5 + 3k^2 + 4)$$

$$10) -25m^9 + 20m^5 + 10m^4$$
$$5m^4(-5m^5 + 4m + 2)$$

$$11) -70m^4 + 90m^3 - 10m^2$$
$$10m^2(-7m^2 + 9m - 1)$$

$$12) 3x^6 + 12x^4 - 9x^3$$
$$3x^3(x^3 + 4x - 3)$$

13) $n^2 + 2n - 80$

$$(n - 8)(n + 10)$$

14) $n^2 - 12n + 20$

$$(n - 10)(n - 2)$$

15) $x^2 + 12x + 27$

$$(x + 9)(x + 3)$$

16) $x^2 - 2x - 3$

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

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

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

18) $p^2 - 2p - 80$

$$(p + 8)(p - 10)$$

$$19) \textcircled{n^2} + 7n + 12$$
$$(n + 4)(n + 3)$$

$$20) \textcircled{r^2} - 3r - 18$$
$$(r + 3)(r - 6)$$

$$21) \textcircled{m^2} - 10m + 9$$
$$(m - 9)(m - 1)$$

$$22) \textcircled{v^2} + 2v - 24$$
$$(v - 4)(v + 6)$$

E.Q.:

How do we factor quadratic expressions that are not trinomials with a leading coefficient of 1?

Trinomials with a leading coefficient not equal to 1

Sometimes, we can factor out the leading coefficient:

Examples:

2

10

12

Factor out the 2!

$$\underline{2}x^2 - \underline{10}x - \underline{12}$$

GCF: 2

$$2(x^2 - 5x - 6)$$

$$2(x-6)(x+1)$$

$$\begin{array}{r} -6 \\ -6 \quad +1 \\ -5 \end{array}$$

$$\begin{array}{l} 3: 1, 3 \\ 33: 1, 3, 11, 33 \\ 30: 1, 3, 10, 30 \end{array}$$

Factor out the 3!

$$3x^2 + 33x + 30$$

$$3(x^2 + 11x + 10)$$

$$3(x+10)(x+1)$$

Trinomials with a leading coefficient not equal to 1

Sometimes, we **can not** factor out the leading coefficient:

Examples:

$$6x^2 + 13x + 6$$

First, multiply the leading coefficient and the constant term

$$6 \text{ times } 6 = 36$$

Trinomials with a leading coefficient not equal to 1

Sometimes, we **can not** factor out the leading coefficient:

$$\cancel{(x+9)(x+4)} \star \quad 6x^2 + \cancel{13x} + 6 \quad \star$$

$$\begin{array}{c} 36 \\ \circlearrowleft \quad \circlearrowright \\ \underline{9} \quad \underline{4} \\ 13 \end{array}$$

Second, set up your x-factor with this product on the top

$$6x^2 + \underline{9x + 4x} + 6$$

Trinomials with a leading coefficient not equal to 1

Sometimes, we can not factor out the leading coefficient:

$$6x^2 + 13x + 6$$

$$\begin{array}{ccc} & 36 & \\ \diagdown & & \diagup \\ 9 & & 4 \\ \diagup & & \diagdown \\ & 13 & \end{array}$$

Third, rewrite the middle term using these two numbers

$$6x^2 + 9x + 4x + 6$$

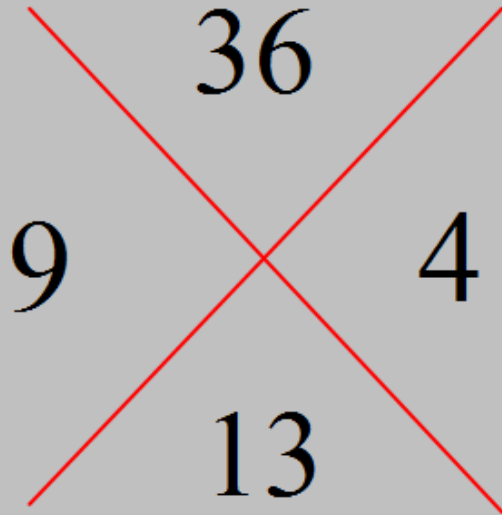
$$3x(2x + 3) + 2(2x + 3)$$

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

Trinomials with a leading coefficient not equal to 1

Sometimes, we can not factor out the leading coefficient:

$$6x^2 + 13x + 6$$

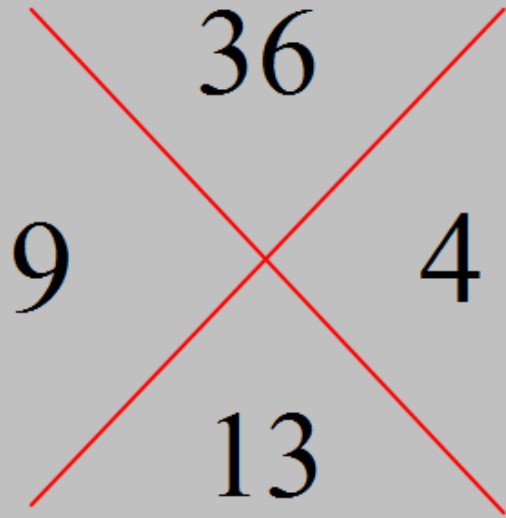


Now we factor the first pair and the second pair separately using the GCF:

$$6x^2 + 9x + 4x + 6$$

Trinomials with a leading coefficient not equal to 1

Sometimes, we **can not** factor out the leading coefficient:



$$6x^2 + 13x + 6$$

$$6x^2 + 9x + 4x + 6$$

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

Finally, we write our factored form

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

Factoring by grouping

Examples:

$$10x^2 + \del{33}x - 7$$

$$10 \cdot -7 = -70$$

$$\begin{array}{l}
 10x^2 + 35x \\
 \underline{5x(2x+7)}
 \end{array}
 \left.
 \begin{array}{l}
 -2x - 7 \\
 \underline{-1(2x+7)}
 \end{array}
 \right\}$$

$$\begin{array}{ccc}
 & -70 & \\
 & \diagdown & \diagup \\
 35 & & -2 \\
 & \diagup & \diagdown \\
 & 33 &
 \end{array}$$

$$(2x+7)(5x-1)$$

Factoring by grouping

Examples:

$$4x^2 - 4x - 3$$

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

Factoring by grouping

Examples:

$$6x^2 + 11x - 10$$

$$6x - 10$$

$$-60$$

$$\begin{array}{r} 15 \\ \times \\ -4 \\ \hline 11 \end{array}$$

$$6x^2 + 15x \quad \left\{ \quad -4x - 10\right.$$

$$3x(2x+5) \quad \left\{ \quad -2(2x+5)\right.$$

$$(3x-2)(2x+5)$$

Factoring by grouping

Examples:

$$40x^2 + x - 6$$

HW #3 Factoring Quadratics