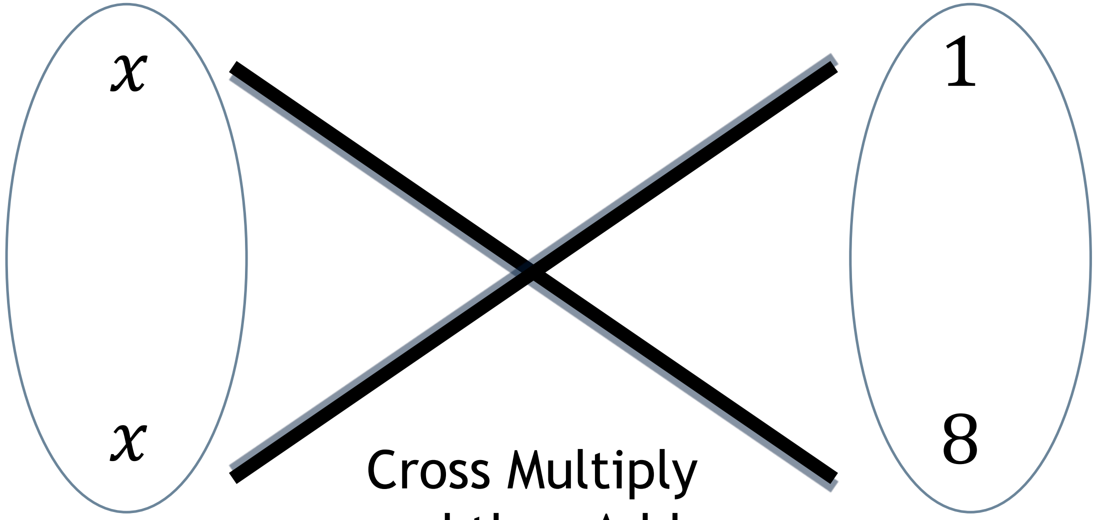
Factoring Trinomials Using Chelsea's X

Example 1: $x^2 + 9x + 8$

Chelsea's X

Variables →

$x \bullet x = x^2$, so put the x's on the left side.



← Factors

The factors of 8 that add to 9 are 1 and 8, so you put the factors on the right side.

Cross Multiply and then Add.

$8 \bullet x = 8x$

$1 \bullet x = x$

$8x + x = 9x$

Multiply up and down

$x \bullet x = x^2$

Multiply up and down

$1 \bullet 8 = 8$

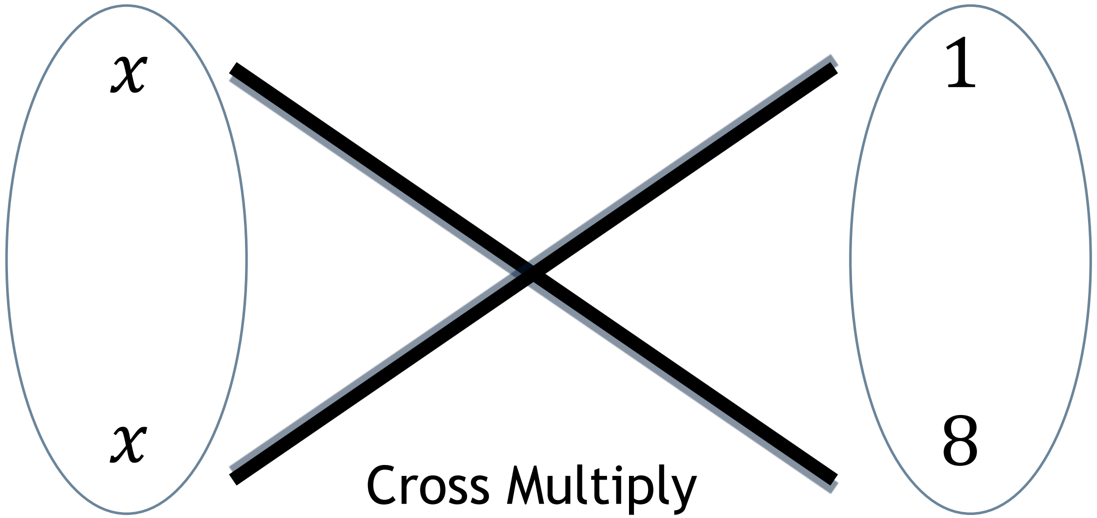
Factoring Trinomials Using Chelsea's X

Example 1: $x^2 + 9x + 8$ $= (x+8)(x+1)$

Chelsea's X

Variables →

$x \bullet x = x^2$, so put the x's on the left side.



← Factors

The factors of 8 that add to 9 are 1 and 8, so you put the factors on the right side.

Cross Multiply and then Add

$8 \bullet x = 8x$

$1 \bullet x = x$

$8x + x = 9x$

Multiply up and down

$x \bullet x = x^2$

Multiply up and down

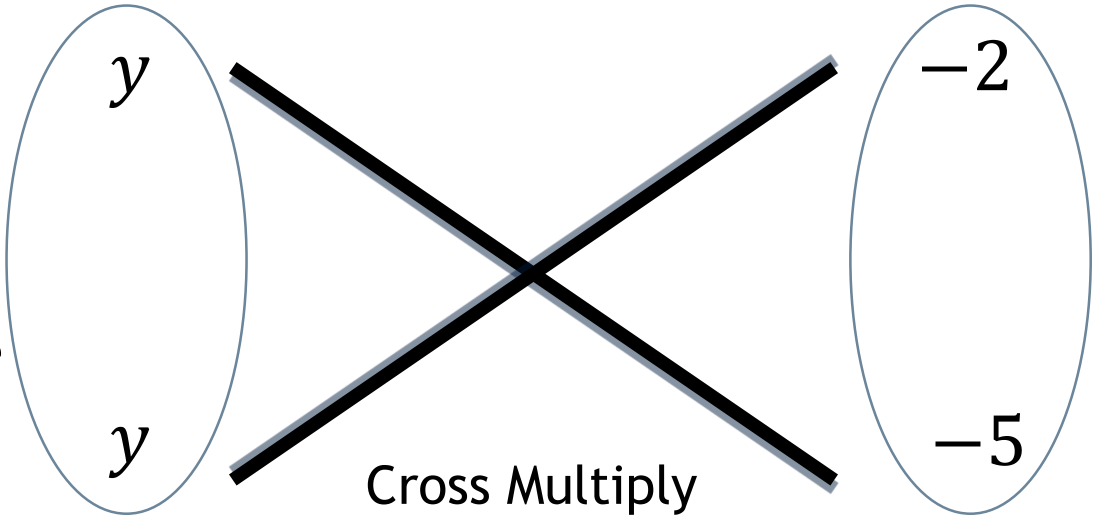
$1 \bullet 8 = 8$

Factoring Trinomials Using Chelsea's X

Example 2: $y^2 - 7y + 10$ $= (y-5)(y-2)$

Chelsea's X

Variables →



← Factors

$y \bullet y = y^2$, so put the y's on the left side.

The factors of 10 that add to -7 are -2 and -5, so you put the factors on the right side.

Cross Multiply and then Add

$$-5 \bullet y = -5y$$
$$-2 \bullet y = -2y$$
$$-5y + (-2y) = -7y$$

Multiply up and down

$$y \bullet y = y^2$$

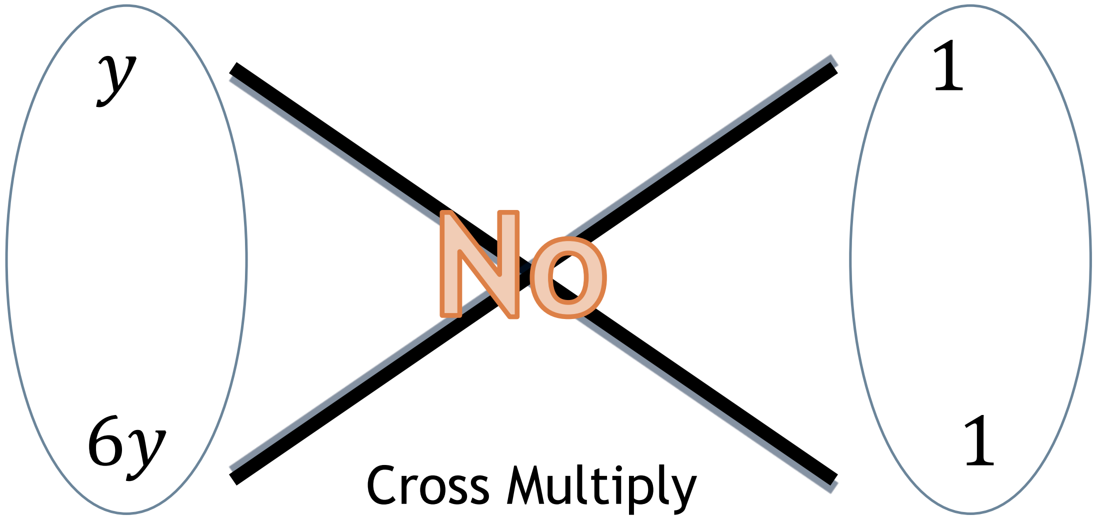
Multiply up and down

$$(-2)(-5) = 10$$

Factoring Trinomials Using Chelsea's X

Example 3: $6y^2 - 5y + 1$

Chelsea's X



Variables →

$y \bullet 6y = 6y^2$

$2y \bullet 3y = 6y^2$

← Factors

The factors of 1 are 1 and 1, and -1 and -1.

Cross Multiply and then Add

$1 \bullet y = y$

$1 \bullet 6y = 6y$

$y + 6y = 7y$

Multiply up and down

$y \bullet 6y = 6y^2$

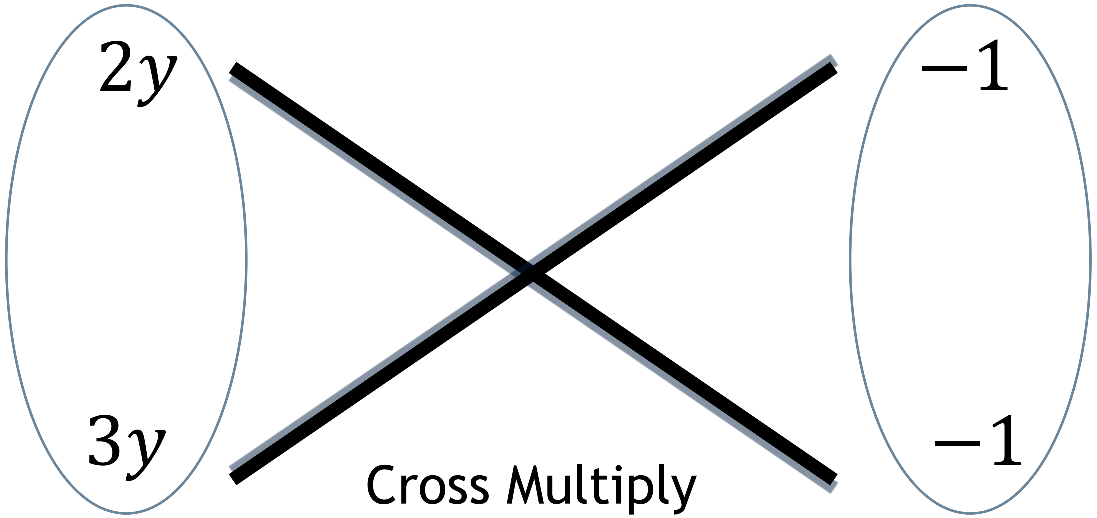
Multiply up and down

$(1)(1) = 1$

Factoring Trinomials Using Chelsea's X

Example 3: $6y^2 - 5y + 1 = (2y - 1)(3y - 1)$

Chelsea's X



Variables →

~~$y \bullet 6y = 6y^2$~~

$2y \bullet 3y = 6y^2$

← Factors

The factors of 1 are 1 and 1, and -1 and -1.

Cross Multiply and then Add

$-1 \bullet 2y = -2y$

$-1 \bullet 3y = -3y$

$-2y - 3y = -5y$

Multiply up and down

$2y \bullet 3y = 6y^2$

Multiply up and down

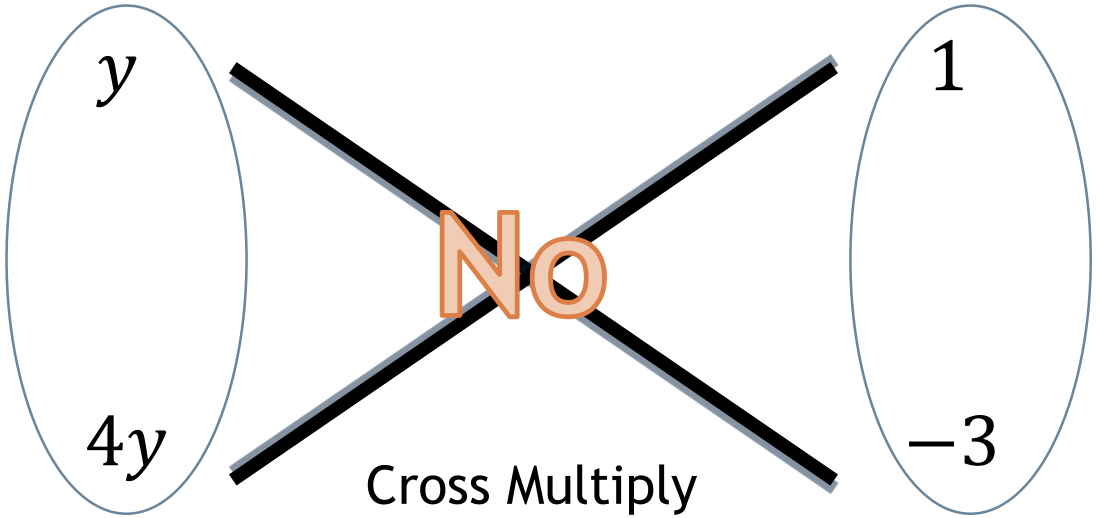
$(-1)(-1) = 1$

Factoring Trinomials Using Chelsea's X

Example 4: $4y^2 - 4y - 3$

Chelsea's X

Variables →



← Factors

$y \bullet 4y = 4y^2$

$2y \bullet 2y = 4y^2$

The factors of -3 are 1 and -3, and -1 and 3.

Cross Multiply and then Add

$1 \bullet 4y = 4y$

$-3 \bullet y = -3y$

$4y - 3y = y$

Multiply up and down

$y \bullet 4y = 4y^2$

Multiply up and down

$(1)(-3) = -3$

Factoring Trinomials Using Chelsea's X

Example 4: $4y^2 - 4y - 3$ $= (2y - 1)(3y - 1)$

Chelsea's X

Variables →

~~$y \bullet 4y = 4y^2$~~

$2y \bullet 2y = 4y^2$

$2y$ | 1

$2y$ | -3

← Factors

The factors of -3 are 1 and -3, and -1 and 3.

Cross Multiply and then Add

$1 \bullet 2y = 2y$

$-3 \bullet 2y = -6y$

$2y - 6y = -4y$

Multiply up and down

$2y \bullet 2y = 4y^2$

Multiply up and down

$(1)(-3) = -3$

Factoring Trinomials Using Chelsea's X

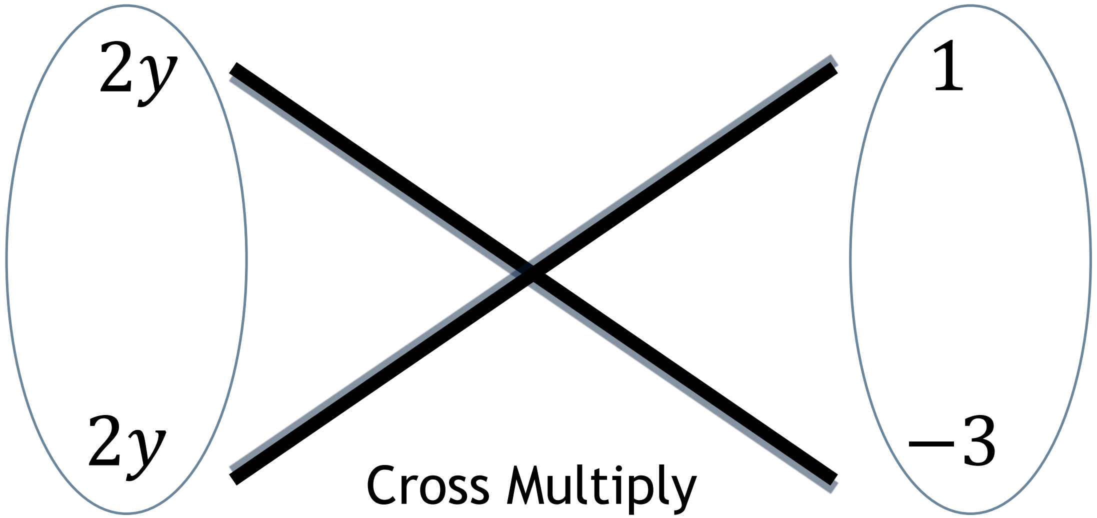
Example 4: $4y^2 - 4y - 3$ $= (2y - 1)(3y - 1)$

Chelsea's X

Variables →

~~$y \bullet 4y = 4y^2$~~

$2y \bullet 2y = 4y^2$



← Factors

The factors of -3 are 1 and -3, and -1 and 3.

Cross Multiply and then Add

$1 \bullet 2y = 2y$

$-3 \bullet 2y = -6y$

$2y - 6y = -4y$

Multiply up and down

$2y \bullet 2y = 4y^2$

Multiply up and down

$(1)(-3) = -3$

A **prime polynomial** is a polynomial that cannot be factored as a product of polynomials with integer coefficients.

Example 1: $p^2 + 4p - 2$

The terms of $p^2 + 4p - 2$ have no common factors. There are no integer factors of -2 whose sum is 4. So, this polynomial is already factored completely.

Example 2: $x^2 + 4$

The terms of $x^2 + 4$ have no common factors. You might think that this polynomial could be factored as $(x + 2)(x + 2)$, but you would be wrong. Because if you were to multiply the two binomial factors, you would get $x^2 + 4x + 4$. So, this polynomial is already factored completely.

A factorable polynomial with integer coefficients is said to be **factored completely** when no more factors can be found and it is written as the product of prime factors.

Factor each polynomial completely.

a. $3x^3 - 18x^2 + 24x$

$= 3x(x^2 - 6x + 8)$

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

b. $7x^4 - 28x^2$

$= 7x^2(x^2 - 4)$

$= 7x^2(x^2 - 2^2)$

$= 7x^2(x + 2)(x - 2)$

Solving an Equation by Factoring Completely

$$2x^3 + 8x^2 = 10x$$

$$2x^3 + 8x^2 - 10x = 0$$

$$2x(x^2 + 4x - 5) = 0$$

$$2x(x + 5)(x - 1) = 0$$

$$2x = 0 \quad or \quad x + 5 = 0 \quad or \quad x - 1 = 0$$

$$x = 0 \quad or \quad x = -5 \quad or \quad x = 1$$

The solutions are $x = -5$, $x = 0$, and $x = 1$.