# Factor the following trinomials:

$x^2 + 11x + 10$

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

$1 \cdot 10$
$2 \cdot 5$

$x^2 - 7x - 30$

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

$x^2 - 19x + 48$

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

$1 \cdot 48$
$2 \cdot 24$
$3 \cdot 16$
$4 \cdot 12$
$6 \cdot 8$

1) $n^2 + 14n + 40$

$(n+4)(n+10)$

$a = 1$

$ax^2+bx+c$

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

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

3) $n^2 + 8n + 15$

$(n+5)(n+3)$

4) $m^2 + 3m - 18$

$(m-3)(m+6)$

5) $m^2 - 5m - 6$

$(m+1)(m-6)$

6) $v^2 - 3v - 54$

$(v+6)(v-9)$

7) $m^2 + 5m - 50$

$(m + 10)(m - 5)$

8) $p^2 + 11p + 18$

$(p + 2)(p + 9)$

9) $v^2 - 6v - 16$

$(v - 8)(v + 2)$

10) $a^2 + 16a + 63$

$(a + 9)(a + 7)$

11) $p^2 - 16p + 60$

$(p - 6)(p - 10)$

12) $m^2 + 4m + 4$

$(m + 2)^2$

13) $a^2 + 12a + 35$

$(a + 5)(a + 7)$

14) $m^2 + 14m + 48$

$(m + 8)(m + 6)$

15) $b^2 + 8b + 7$

$(b + 1)(b + 7)$

16) $r^2 - 3r - 4$

$(r + 1)(r - 4)$

**E.Q.:**

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

Yesterday you factored simple quadratic trinomials with a leading coefficient of 1

$$x^2 - 7x - 30 = (x - 10)(x + 3)$$

Today we will look at our special products, and trinomials with leading coefficient not equal to 1.

$x^2 + 14x + 49$

$x^2 + 12x + 36$

# Special Products:

$x^2 + 20x + 100$

## Perfect Squares

$$a^2 + 2ab + b^2$$

$x^2 + 2 \cdot 5 \cdot x + 25$

$x^2 + 10x + 25$

## Difference of Squares

$$a^2 - b^2$$

$x^2 - 16$

$x^2 - 9$

$x^2 - 4$

$9x^2 - 25$

NOT

$x^2 - 8$

**Note:**

**Each of these can still be factored using the x-factor technique if the leading coefficient is 1**

$x^2 + 26x + 25$

$(x + 25)(x + 1)$

# Perfect Squares

$$a^2 + 2ab + b^2$$

When we multiply out a perfect square binomial, our product will always follow this pattern.

## Examples:

$$(x+2)^2 = (x+2)(x+2) = x^2 + 4x + 4$$


$$(x-3)^2 = (x-3)(x-3) = x^2 - 6x + 9$$

$$(2x-4)^2 = (2x-4)(2x-4) = 4x^2 - 16x + 16$$

$(2x-4)^2$

# Perfect Squares

$$a^2 + 2ab + b^2$$

To factor a perfect square, we simply need to recognize this pattern.

Example: $x^2 + 10x + 25$ $= (x+5)^2$

Is the 1st term a perfect square? X

Is the 3rd term a perfect square? 5

Is the 2nd term twice the product of those squares? $2 \cdot 5 \cdot x$
$10x$

# Perfect Squares

$$a^2 + 2ab + b^2$$

Example: $x^2 - 18x + 81$

$(x - 9)^2$

Is the 1st term a perfect square? X

Is the 3rd term a perfect square? 9

Is the 2nd term twice the product of those squares? $2 \cdot 9 \cdot x$

$18x$

# Perfect Squares

$$a^2 + 2ab + b^2$$

Example: $25x^2 + 20x + 4 = (5x + 2)^2$

Is the 1st term a perfect square? $5x$

Is the 3rd term a perfect square? $2$

Is the 2nd term twice the product of those squares? $2 \cdot 2 \cdot 5x$

$20x$

# Difference of Squares

$a^2 - b^2$

When we multiply out two binomials that represent a difference of squares, our product will always follow this pattern.

## Examples:


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

$(x-11)(x+11) = x^2 - 11^2 = x^2 - 121$

$(3x-4)(3x+4) = (3x)^2 - 4^2 = 9x^2 - 16$

# Difference of Squares

$a^2 - b^2$

To factor a perfect square, we simply need to recognize this pattern.

## Example:

$x^2 - 100$

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

Is the 1st term a perfect square? X

Is the 2nd term a perfect square? 10

Are those terms being subtracted? Yes

# Difference of Squares

$$a^2 - b^2$$

1, 4, 9, 16, 25, 36, 49, 64, 81,
100, 121, 144, 169, 196, 225

Example: $x^2 - 1$ $(x+1)(x-1)$

Is the 1st term a perfect square? X

Is the 2nd term a perfect square? 1

Are those terms being subtracted? Yes

# Difference of Squares

$$a^2 - b^2$$

Sum of squares

$x^2 + 9 \neq (x+3)(x+3)$

$x^2 + 6x + 9$

## Example:

$16x^2 - 25 = (4x+5)(4x-5)$

Is the 1st term a perfect square? $4x$

Is the 2nd term a perfect square? 5

Are those terms being subtracted? Yes

# Trinomials with a leading coefficient not equal to 1

Sometimes, we can factor out the leading coefficient:

## Examples:

Factor out the 2!

$2x^2 - 10x - 12$

$2(1x^2 - 5x - 6)$

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


Factor out the 3!

$3x^2 + 33x + 30$

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

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

$a(x-r_1)(x-r_2)$

F. O. I. L.

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

(2x 6)(3x 1) (2x 3)(3x 2)

(2x 1)(3x 6) (3x 2)(2x 3)

(6x 3)(x 2)

(x 6) (x 2)(6x 3)

(6x 1)(x 6)

(6x 6)(x 1)

# Trinomials with a leading coefficient not equal to 1

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

Examples: $6x^2 + 13x + 6$

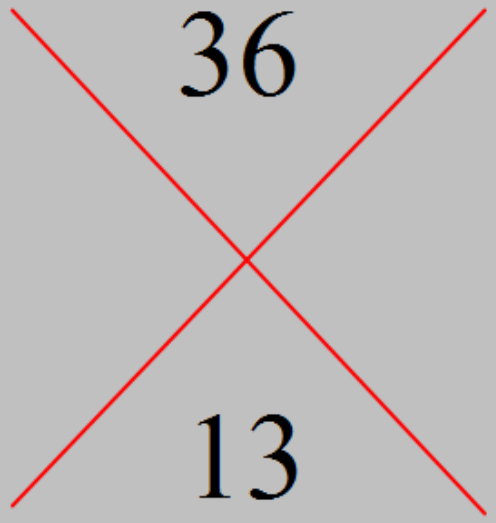
First, multiply the leading coefficient and the constant term

6 times 6 = 36

# Trinomials with a leading coefficient not equal to 1

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

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

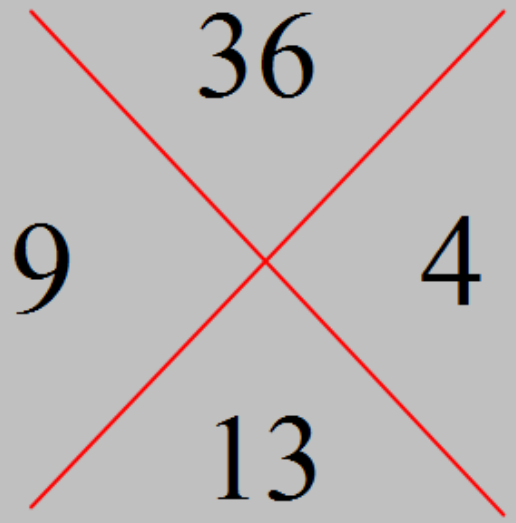



Second, set up your x-factor with this product on the top

# Trinomials with a leading coefficient not equal to 1

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

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




Third, rewrite the middle term using these two numbers

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

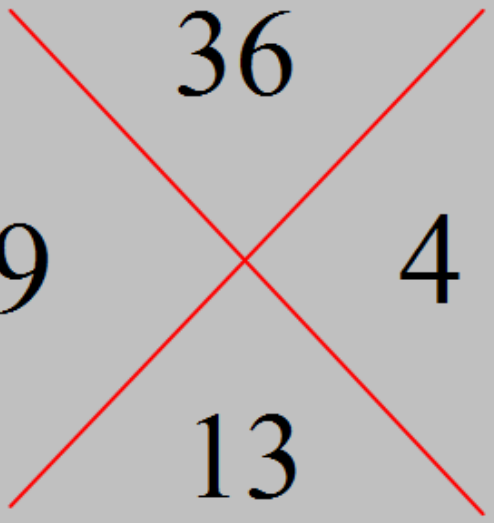
$3x(2x+3) + 2(2x+3)$

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

# Trinomials with a leading coefficient not equal to 1

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

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

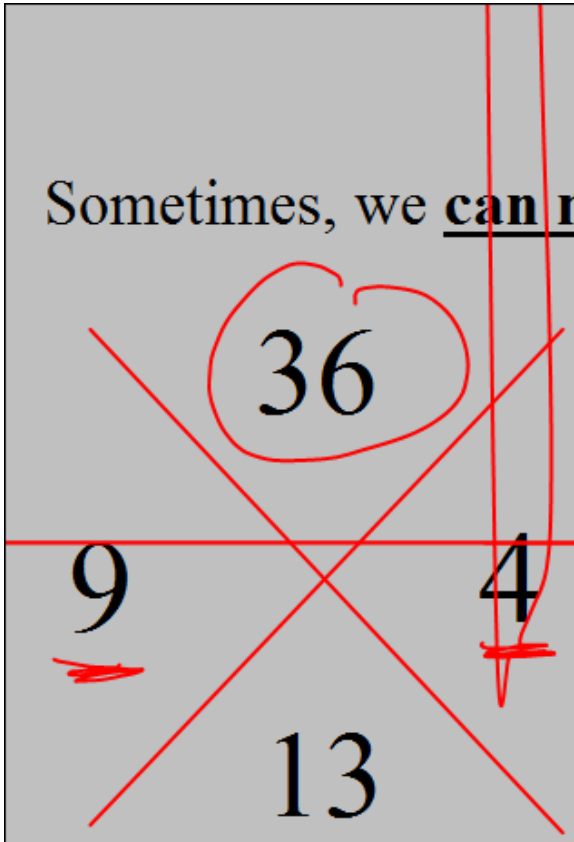



Now we factor the first pair and the second pair separately

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

# 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

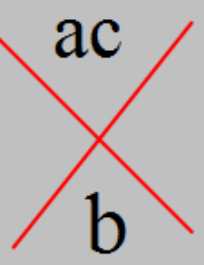
$$(3x + 2)(2x + 3)$$

# Factoring by grouping

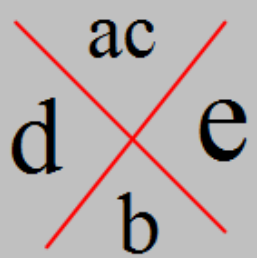
$$ax^2 + bx + c$$

1. Multiply a and c **ac**

2. Set up the x-factor with ac on top and b on bottom




3. Find the two numbers that multiply to get ac and add to get b




4. Rewrite your middle term using these numbers

$$ax^2 + dx + ex + c$$

5. Factor the 1st two terms and the 2nd two terms separately

6. Write answer in factored form

# Factoring by grouping

Examples:

$$10x^2 + 33x - 7$$

a · c

−70

35 · −2

33

F O I L

$10x^2 + 35x \quad -2x - 7$

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

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

1 · 70
2 · 35
5 · 14
7 · 10
~~10~~ 33

# Factoring by grouping

Examples:

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

(1) $4 \cdot -3$

$-12$

$1 \cdot 12$

$2 \cdot 6$

$3 \cdot 4$

$-6 \cdot 2 = -12$

$-6 + 2 = -4$

$4x^2 + 2x - 6x - 3$

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

$\frac{-6x}{2x} = -3$

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

$4x^2 - 6x + 2x - 3$

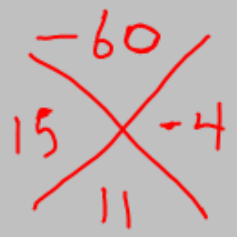
$2x(2x-3) + 1(2x-3)$

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

# Factoring by grouping

Examples:

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




$6x^2 + 15x \{ -4x - 10$

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

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

# Factoring by grouping

Examples:

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

# HW #3 Factoring Quadratics