

Bellwork

Factor each of the following:

1. $x^2 - 144$

$$(x - 12)(x + 12)$$

2. $4x^2 - 1600$

$$4(x^2 - 400)$$

$$4(x - 20)(x + 20)$$

3. $x^2 + 12x + 36$

$$(x + 6)(x + 6)$$

OR

$$(x + 6)^2$$

4. $5x^2 - 210x + 2205$

$$5(x^2 - 42x + 441)$$

$$5(x - 21)(x - 21)$$

OR

$$5(x - 21)^2$$

Factoring Trinomials: Special Cases

1. Difference of Squares
2. Perfect Square Trinomials

The following pages will discuss each of these in detail and will also provide multiple examples.

Difference of Squares

The property:

$$a^2 - b^2 = (a + b)(a - b)$$

Where....

a is the square root of the first term.

b is the square root of the second term.

Note: This will work also when the leading coefficient is not = 1. **As long as** the coefficient is a perfect square.

Examples

1. $x^2 - 144$

$$\sqrt{x^2} = x$$

$$\sqrt{144} = 12$$

So this means...
 $(x + 12)(x - 12)$

2. $x^2 - 625$

$$\sqrt{x^2} = x$$

$$\sqrt{625} = 25$$

So this means...
 $(x + 25)(x - 25)$

3. $x^2 - 1024$

$$\sqrt{x^2} = x$$

$$\sqrt{1024} = 32$$

So this means...
 $(x + 32)(x - 32)$

More Examples

$$4. 2x^2 - 242$$

Divide by 2...

$$\sqrt{x^2} = x$$

$$\sqrt{144} = 12$$

So this means:
 $2(x + 12)(x - 12)$

$$5. -3x^2 + 147$$

Divide by -3...

$$\sqrt{x^2} = x$$

$$\sqrt{49} = 7$$

So this means:
 $-3(x + 7)(x - 7)$

$$6. 5x^2 - 180$$

Divide by 5...

$$\sqrt{x^2} = x$$

$$\sqrt{36} = 6$$

So this means:
 $5(x + 6)(x - 6)$

Advanced Examples

7. $9x^2 - 4$

$$\sqrt{9x^2} = 3x$$

$$\sqrt{4} = 2$$

So this means:
 $(3x + 2)(3x - 2)$

8. $25x^2 - 121$

$$\sqrt{25x^2} = 5x$$

$$\sqrt{121} = 11$$

So this means:
 $(5x + 11)(5x - 11)$

9. $169x^2 - 81$

$$\sqrt{169x^2} = 13x$$

$$\sqrt{81} = 9$$

So this means:
 $(13x + 9)(13x - 9)$

Perfect Square Trinomials

The property:

$$\begin{aligned}a^2x^2 + (2ab)x + b^2 &= (ax + b)(ax + b) \\ &= (ax + b)^2\end{aligned}$$

OR

$$\begin{aligned}a^2x^2 - (2ab)x + b^2 &= (ax - b)(ax - b) \\ &= (ax - b)^2\end{aligned}$$

Where:

a is the square root of the leading coefficient.

b is the square root of the constant.

Examples

$$1. x^2 + 40x + 400$$

$$\sqrt{1} = 1$$

$$\sqrt{400} = 20$$

Check $(2ab)x$:

$$2(1)(20)x \\ 40x$$

So this means...

$$(x + 20)(x + 20) \\ (x + 20)^2$$

$$2. x^2 - 36x + 324$$

$$\sqrt{1} = 1$$

$$\sqrt{324} = 18$$

Check $(2ab)x$:

$$2(1)(18)x \\ 36x$$

So this means...

$$(x - 18)(x - 18) \\ (x - 18)^2$$

More Examples

3. $3x^2 + 114x + 1083$

Divide by 3...

$$3(x^2 + 38x + 361)$$

$$\sqrt{1} = 1$$

$$\sqrt{361} = 19$$

Check $(2ab)x$:

$$\begin{array}{r} 2(1)(19)x \\ 38x \end{array}$$

So this means:

$$\begin{array}{r} 3(x + 19)(x + 19) \\ 3(x + 19)^2 \end{array}$$

4. $4x^2 - 120x + 900$

Divide by 4...

$$4(x^2 - 30x + 225)$$

$$\sqrt{1} = 1$$

$$\sqrt{225} = 15$$

Check $(2ab)x$:

$$\begin{array}{r} 2(1)(15)x \\ 30x \end{array}$$

So this means:

$$\begin{array}{r} 4(x - 15)(x - 15) \\ 4(x - 15)^2 \end{array}$$