QUADRATIC FORMULA

If $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Remark: Notice that the equation must be set equal to zero first!

THE DISCRIMINANT

Definition: For the quadratic equation $ax^2 + bx + c = 0$, the discriminant is $b^2 - 4ac$.

If $b^2 - 4ac > 0$ and is a perfect square, then $ax^2 + bx + c = 0$ has two real and rational solutions.
(*to solve the equation we can use quadratic formula or algebrially*)

If $b^2 - 4ac > 0$ but is not a perfect square, then $ax^2 + bx + c = 0$ has two irrational solutions.
(*to solve the equation we need to use quadratic formula*)

If $b^2 - 4ac = 0$, then $ax^2 + bx + c = 0$ has one real and rational solution.
(*to solve the equation we can use quadratic formula or algebrially*)

If $b^2 - 4ac < 0$, then $ax^2 + bx + c = 0$ has no real solution but it has two complex solutions (involving the imaginary number).
(*to solve the equation we need to use quadratic formula*)

Directions: Solve each equation by factoring.

1. $x^2 + 9x = 0$

You try!

2 $4x^2 - 8x = 0$

3 $9x^2 - 25 = 0$

You try!

4 $81x^2 - 1 = 0$

5 $x^2 - 10x + 21 = 0$

Method − 2: Algebrically

$$x^2 - 10x + 21 = 0$$

6 $x^2 + 2x - 80 = 0$

Method -2: *Algebrically*

$$x^2 + 2x - 80 = 0$$

You try!

7 $x^2 + 9x + 20 = 0$

You try!

Method -2: *Algebrically*

$$x^2 + 9x + 20 = 0$$

You try!

8 $x^2 + 6x - 72 = 0$

You try!

$x^2 + 6x - 72 = 0$

9 $2x^2 + 21x + 10 = 0$

9 $2x^2 + 21x + 10 = 0$

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

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

11 $4x^2 - 12x + 9 = 0$ **You try!**

$4x^2 - 12x + 9 = 0$

You try!

12 $4x^2 + 5x - 3 = 0$

You try!

13 $3x^2 + 4x + 8 = 0$ **You try!**

Example:

A parallelogram has a base that is 4 units shorter than its height, h. If the height is increased by 5 units and the base is increased by 3 units, write the expression for the new area, A, of the parallelogram in square units.

$A.\ A = (h - 1)(h + 5)$

$B.\ A = (h + 3)(h + 4)$

C. $A = (h - 1)(h + 4)$

$D.\ A = (h + 3)(h + 5)$

Example:

Emily tossed a soccer ball straight up into the air. The height of the soccer ball at different times after it was thrown is shown in the table below.

Time(seconds)	Height(feet)
1	25
2	36
3	32
4	10

The height h(t) of the ball as a function of time can be described by:

$$\boldsymbol{h(t) = -10t^2 + 40t - 5}$$

At which of the following times was the ball located exactly at a height of 30 feet?

$A.\ 3.2\ seconds$ $B.\ 2.7\ seconds$ $C.\ 2.1\ second$ $D.\ 1.6\ seconds$

Difference of Squares

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

Difference and Sum of Cubes

Difference of Cubes:

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

Sum of cubes:

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

Examples: Difference of squares

1. $m^2 - n^2$
2. $x^2 - 49$
3. $36 - y^2$
4. $64x^2 - y^2$
5. $4x^2 - 9y^2$
6. $16m^2 - 49n^2$

Examples: Sum and Difference of cubes

1. $x^3 - 8$
2. $x^3 + 64$
3. $27 - 8y^3$
4. $64x^3 - 27$
5. $27x^3 - 125$
6. $64m^3 + 216$