AA2 Week 11 Block Day Warm-up

Solve by the **quadratic formula.**

1. $x^2+5x+6=0$

$$x=\frac{-(5)\pm\sqrt{(5)^2-4(1)(6)}}{2(1)}$$

$$=\frac{-5\pm\sqrt{25-24}}{2}=\frac{-5\pm\sqrt{1}}{2}$$

$$=\frac{-5\pm1}{2}\quad \frac{-5+1}{2}=\frac{-4}{2}=-2 \qquad \frac{-5-1}{2}=\frac{-6}{2}=-3$$

2. $x^2+6x+9=0$

$$x=\frac{-(6)\pm\sqrt{(6)^2-4(1)(9)}}{2(1)}$$

$$=\frac{-6\pm\sqrt{36-36}}{2}=\frac{-6\pm\sqrt{0}}{2}$$

$$=\frac{-6\pm0}{2}\quad \frac{-6+0}{2}=\frac{-6}{2}=-3 \qquad \frac{-6-0}{2}=\frac{-6}{2}=-3$$

3. $x^2+7x-10=0$

$$x=\frac{-(7)\pm\sqrt{(7)^2-4(1)(-10)}}{2(1)}$$

$$=\frac{-7\pm\sqrt{49+40}}{2}=\frac{-7\pm\sqrt{89}}{2}$$

4. $x^2-3x+10=0$

$$x=\frac{-(-3)\pm\sqrt{(-3)^2-4(1)(10)}}{2(1)}$$

$$=\frac{3\pm\sqrt{9-40}}{2}=\frac{3\pm\sqrt{-31}}{2}=$$ non-real solution

Mathematicians invented a new kind of number to deal with situations like #4 on the warm-up.
Since the 1500's $\sqrt{-\#}$ called an imaginary number.
In late 1700's Leonard Euler introduced i = √-1

So we can simplify the following:

1. $\sqrt{-4}=\sqrt{-1}\cdot\sqrt{4}$
$i(2)=\boxed{2i}$

2. $\sqrt{-49}=\sqrt{-1}\cdot\sqrt{49}$
$i\cdot7=\boxed{7i}$

3. $\sqrt{-8}=\sqrt{-1}\cdot\sqrt{4}\cdot\sqrt{2}$
$=i\cdot2\sqrt{2}$
$\boxed{2i\sqrt{2}}$

And # 4 on the warmup could be completely solved using i.

$$4.\ x^2 - 3x + 10 = 0$$

$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(10)}}{2(1)}$$

$\sqrt{-1}\sqrt{31}$

$$= \frac{3 \pm \sqrt{9-40}}{2} = \frac{3 \pm \sqrt{-31}}{2} = \frac{3 \pm i\sqrt{31}}{2}$$

Solve using the quadratic formula. Give exact answers.

$$x^2 + 4x = -5$$

$$x^2 + 4x + 5 = 0$$

$$x = \frac{-4 \pm \sqrt{4^2 - 4(1)(5)}}{2(1)}$$

$$x = \frac{-4 \pm \sqrt{16-20}}{2}$$

$$= \frac{-4 \pm \sqrt{-4}}{2}$$

$\sqrt{-1}\sqrt{4}$

$$= \frac{-4 \pm 2i}{2} = \frac{+\cancel{2}(-2 \pm i)}{\cancel{2}}$$

$$x = \boxed{-2 \pm i}$$

# DISCRIMINANT

The discriminant is:

$$\boxed{b^2 - 4ac}$$

Advanced Algebra 2 - Discriminant Discovery Worksheet

$b^2 - 4ac$ Notice the warmup helps with 1st four

| Equation | Value of discriminant | Roots | Description of Roots ( Real, Rational, Irrational or Imaginary) | Number of Roots ( One double root, two, or two conjugates) |
|---|---|---|---|---|
| $x^2 + 5x + 6 = 0$ | 1 | -2,-3 | real, rational | two |
| $x^2 - 3x + 10 = 0$ | -31 | $\frac{3 \pm i\sqrt{31}}{2}$ | imaginary | two conjugates |
| $x^2 + 7x - 10 = 0$ | 89 | $\frac{-7 \pm \sqrt{89}}{2}$ | real, irrational | two |
| $x^2 + 6x + 9 = 0$ | 0 | -3 | real, rational | one double root |
| $3x^2 + 14x - 5 = 0$ | 256 | 1/3, -5 | real, rational | two |
| $x^2 - 14x + 34 = -15$ | 0 | 7 | real, rational | one double root |
| $(x+2)^2 = 5$ | 20 | $-2 \pm \sqrt{5}$ | real, irrational | two |
| $x^2 - 8x = -31$ | -60 | $4 \pm i\sqrt{15}$ | imaginary | two conjugates |
| $x^2 + 3x = -1$ | 5 | $\frac{-3 \pm \sqrt{5}}{2}$ | real, irrational | two |
| $(x - 7)^2 = -2$ | -8 | $7 \pm i\sqrt{2}$ | imaginary | two conjugates |

# How will I know how many REAL solutions exist?

2 REAL solutions? 1 REAL solution? 0 REAL solutions?

2 conjugates

**When Given**

$$ax^2 + bx + c = 0$$

( discriminant is a positive number )

**If** $b^2 - 4ac > 0$

then 2 REAL Solutions

-irrational discriminant is not perfect square
-rational-discriminate is a perfect square

( discriminant is zero )

**If** $b^2 - 4ac = 0$

then 1 REAL Solution ( double root ).

( discriminant is a negative number )

**If** $b^2 - 4ac < 0$

then 0 REAL Solutions or imaginary- 2 conjugates