Solve for x:

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

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

Method 1: Factoring

$x^2+6x+5=0$ (Simple Trinomial)

$(x+1)(x+5)=0$ $\quad 1 \times 5 = 5$, $1+5=6$

$x+1=0$ | $x+5=0$

$\boxed{x=-1}$ $\boxed{x=-5}$

Method 2: Completing the Square

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

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

$$x^2+6x+9=-5+9 \qquad 6 \times \tfrac{1}{2} = (3)^2 = 9$$

$$(x+3)^2 = 4 \quad \leftarrow \text{square root both sides}$$

$$x+3 = \pm 2$$

$$x=-3\pm 2$$

$x=-3-2$ | $x=-3+2$

$\boxed{x=-5}$ $\boxed{x=-1}$

Method 3: (Quadratic Formula) $\quad x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$

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

$a=1$

$b=6$

$c=5$

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

$$x=\frac{-6\pm\sqrt{36-20}}{2}$$

$$x=\frac{-6\pm\sqrt{16}}{2}$$

$$x=\frac{-6\pm 4}{2}$$

$x=\dfrac{-6-4}{2}$ $\qquad$ $x=\dfrac{-6+4}{2}$

$x=\dfrac{-10}{2}$ $\qquad$ $x=\dfrac{-2}{2}$

$\boxed{x=-5}$ $\qquad$ $\boxed{x=-1}$

Math 11

IMAGINARY NUMBERS

Recall the solution to example 5 on the previous page:

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

You will notice that we have a negative number under the square root sign, and we know that there is no ***real*** solution to the square root of a negative value. Therefore, we must now discuss a special type of number that will enable us to solve this problem.

While it is true that $\sqrt{-16}$ does not have a solution that is a ***real*** number, $\sqrt{-16}$ most definitely is a valid mathematical number. The fact is that it happens to belong to another set of numbers called ***imaginary*** or ***complex numbers***.

Imaginary or ***complex numbers*** can be represented by the expression:

a + **b*i***, where **a** and **b** are real numbers and $\boxed{i = \sqrt{-1}}$ or $\boxed{i^2 = -1}$

To use this definition of ***i***: $\sqrt{-25} = \sqrt{25i^2} = 5\boldsymbol{i}$

$$\sqrt{-100} = \sqrt{100i^2} = 10\boldsymbol{i}$$

$$\sqrt{-43} = \sqrt{43i^2} = \sqrt{43}\,\boldsymbol{i}$$

So if we look back at Example 5:

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

$$x = \frac{4 \pm \sqrt{16i^2}}{2}$$

$$x = \frac{4 \pm 4i}{2}$$

$$= 2 \pm 2i$$

So, one solution is $\mathbf{x = 2 + 2}\boldsymbol{i}$, and the other solution is $\mathbf{x = 2 - 2}\boldsymbol{i}$. We say that this equation has no real roots, but we still must find the complex roots.

Recall, that the graph of the corresponding quadratic function would not have any x-intercepts!

$$\sqrt{-64} = \sqrt{64i^2} = 8i$$

$$\sqrt{-49} = \sqrt{49i^2} = 7i$$

$$\sqrt{-25} = \sqrt{25i^2} = 5i$$

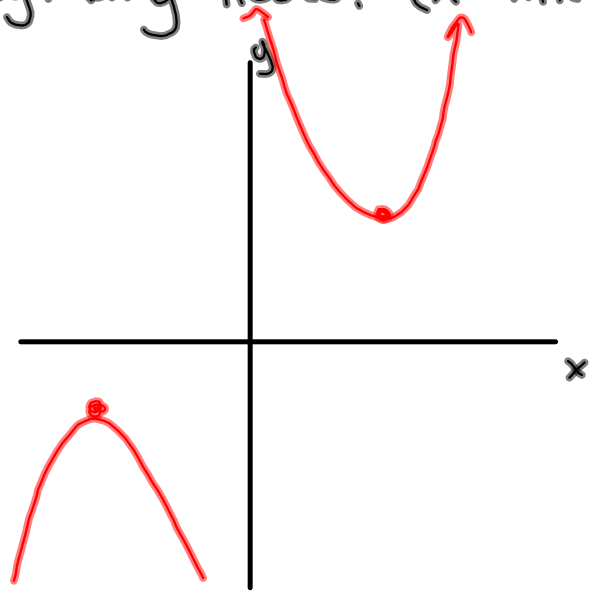
Simplify

$$\sqrt{-12} = \sqrt{12i^2} = i\sqrt{12}$$

$$= i\sqrt{4 \times 3}$$

$$= 2i\sqrt{3}$$

Imaginary Roots: (x-intercepts)



(3) $x^2 + 5x + 8 = 0$

$a = 1 \quad b = 5 \quad c = 8$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-5 \pm \sqrt{(5)^2 - 4(1)(8)}}{2(1)}$$

$$x = \frac{-5 \pm \sqrt{25 - 32}}{2}$$

$$x = \frac{-5 \pm \sqrt{-7}}{2}$$

$$x = \frac{-5 \pm \sqrt{7i^2}}{2}$$

$$x = \frac{-5 \pm i\sqrt{7}}{2}$$