QUADRATIC EQUATIONS WITH COMPLEX SOLUTIONS

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

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

b^2-4ac = discriminant

$b^2-4ac>0$ two distinct real solutions

$b^2-4ac=0$ one real solution (repeated)

$b^2-4ac<0$ two complex solutions (conjugates of each other)

Example: $x^2+x+1=0$ $\quad a=1 \quad b=1 \quad c=1$

$$x=\frac{-1\pm\sqrt{1-4\cdot1\cdot1}}{2\cdot1}=\frac{-1\pm\sqrt{-3}}{2}=\frac{-1\pm\sqrt{3}\cdot\sqrt{-1}}{2}$$

$$=\frac{-1\pm\sqrt{3}\,i}{2}=-\frac{1}{2}\pm\frac{\sqrt{3}}{2}i=\begin{cases}-\frac{1}{2}-\frac{\sqrt{3}}{2}i\\ -\frac{1}{2}+\frac{\sqrt{3}}{2}i\end{cases}$$

Example: without solving the equations, determine whether they have two distinct real solutions, one repeated real solution or two complex solutions

	b^2-4ac	
1) $x^2+5x+6=0$	$25-4\cdot1\cdot6=25-24>0$	two real sol
2) $x^2+4x+4=0$	$16-4\cdot1\cdot4=0$	one real sol
3) $x^2+2x+4=0$	$4-4\cdot1\cdot4=-12<0$	two complex sol.