4.6 Discriminant and Complex Numbers

From yesterday

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

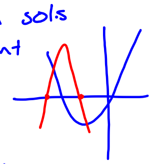
The value of the discriminant tells us two things

1. No. of real solutions to a quadratic
2. No. of x-intercepts

$b^2-4ac>0$ 2 real sols, 2 x-int

$b^2-4ac=0$ 1 real sol, 1 x-int

$b^2-4ac<0$ No real sols, No x-int

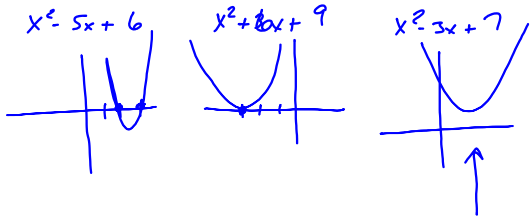


$ax^2+bx+c=0$ $y=ax^2+bx+c$

b^2-4ac

$x^2-5x+6=y$	$y=x^2+6x+9$	$y=x^2-3x+7$
$5^2-4(1)(6)$	$6^2-(4)(1)(9)$	$(-3)^2-4(1)(7)$
$25-24$	$36-36$	$9-28$
1	0	-19
2 real sol	1 real sol	0 real sol
2 x-ints	1 x-int	0 x-ints
2, 3	-3	

x^2-5x+6 x^2+6x+9 x^2-3x+7



Then we get a complex solution

we cannot take the squareroot of a negative number

$$\sqrt{-36}=\sqrt{36\cdot(-1)}=\sqrt{36}\cdot\sqrt{-1}=6\cdot\sqrt{-1}$$

We create a substitute for $\sqrt{-1}$ to solve problems

$$\sqrt{-1}=i$$

$\sqrt{-1} = i$

$\sqrt{-1}\cdot\sqrt{-1} = i^2 = -1$

$\sqrt{-1}\cdot\sqrt{-1}\cdot\sqrt{-1} = i^3 = -i$

$\sqrt{-1}\cdot\sqrt{-1}\cdot\sqrt{-1}\cdot\sqrt{-1} = i^4 = 1$

$\sqrt{2^2}$

i^n repeats every 4

$i, -1, -i, 1, i, -1, -i, 1$

Complex Numbers
two parts

Real Imaginary

$a \pm bi$

Operations
+/- like terms

$(3+2i)+(7-i)$

$(3+7)+(2i+(-i))$

$10+i$

$(5+2i)-(3-4i)$

$(5-3)+(2i-(-4i))$

$2+6i$

X FOIL

$(2+4i)(3+i)$

$6+2i+12i+4i^2$ $\quad i^2=-1$

$6+2i+12i-4$

$2+14i$

Solve leaving answer in complex form

$x^2-3x+4=0$ $\quad a \pm bi$

$\frac{3 \pm \sqrt{9-16}}{2}$

$\frac{3 \pm \sqrt{-7}}{2} = \frac{3 \pm 2.65i}{2}$

$= \frac{3}{2} \pm \frac{2.65}{2}i = 1.5 \pm 1.325i$