Number of Solutions to a Quadratic Equation

If a, b, and c are rational numbers and $-\frac{b}{2a}$ exists, then when the **discriminant** b^2-4ac is :

<table>
<tr>
<td>Zero $b^2-4ac=0$

One rational repeated solution,
namely $-\frac{b}{2a}$
(trinomial will factor)</td>
<td>Positive $b^2-4ac>0$
If b^2-4ac...
a. is a perfect square, two distinct rational solutions (will factor)
b. is not a perfect square, two distinct irrational solutions (won't factor) It is prime.</td>
<td>Negative $b^2-4ac<0$

Two distinct complex (nonreal or imaginary) solutions (won't factor) It is prime.</td>
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<tr>
<td>$4x^2-12x+9=0$

a = 4 b = -12 c = 9

$b^2-4ac=0$

$(-12)^2-4(4)(9)=144-144=0$
One rational solution: $\left\{\frac{3}{2}\right\}$</td>
<td>a. $-8q^2-2q+1=0$
$8q^2+2q-1=0$
a = 8 b = 2 c = -1
$b^2-4ac>0$
$(2)^2-4(8)(-1)=4+32=36$
36 > 0 and 36 is a perfect square
Two rational solutions: $\left\{-\frac{1}{2},\frac{1}{4}\right\}$
b. $3z^2-8z+2=0$
a = 3 b = -8 c = 2
$b^2-4ac>0$
$(-8)^2-4(3)(2)=64-24=40$
40 > 0, but 40 is not a perfect square
Two irrational solutions:
$\left\{\frac{4-\sqrt{10}}{3},\frac{4+\sqrt{10}}{3}\right\}$</td>
<td>$2y^2+1=2y$
$2y^2-2y+1=0$
a = 2 b = -2 c = 1
$b^2-4ac<0$

$(-2)^2-4(2)(1)=4-8=-4$

Two complex solutions:
$\left\{\frac{1+i}{2},\frac{1-i}{2}\right\}$</td>
</tr>
</table>

NOTE: the discriminate is the part UNDER the radical sign. It is just b^2-4ac.

TRY:

What is b^2-4ac? How many solutions and of what type will there be to these equations?

Equation	a	b	c	b^2-4ac ?	1 or 2 rational/irrational/complex?
$x^2+6x+9=0$	1	6	9	0	1 real solution
$x^2+10x+25=0$					
$-x^2+3x-4=0$	1	-3	4		Two complex solutions
$x^2+4x-12=0$					
$2x^2+3x+5=0$					
$3x^2+5x-1=0$					
$12-7x+x^2=0$	1	-7	12		