Name Key

8A; Algebra 1

Date__________

Period______

Discriminant

The **discriminant** is the name given to the expression that appears under the square root (radical) sign in the quadratic formula.

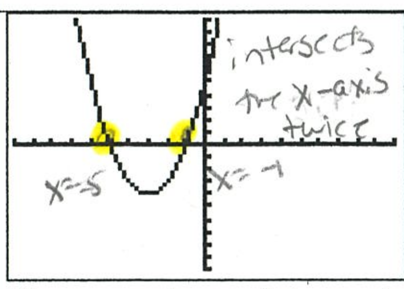
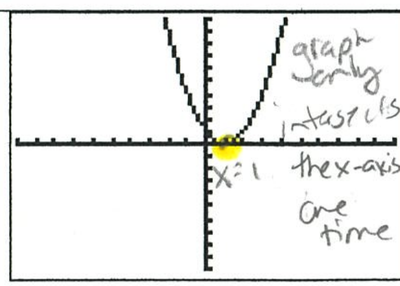
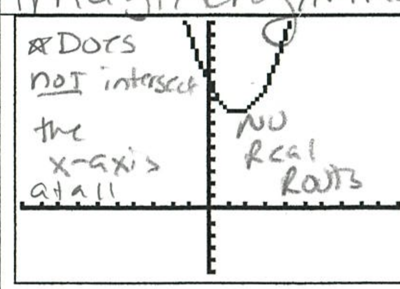
Quadratic Formula: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	**Discriminant** $b^2 - 4ac$ ✯ No √ sign

The discriminant tells you about the "nature" of the roots of a quadratic equation given that *a, b* and *c* are rational numbers. It quickly tells you the number of real (1) roots, or in other words, the number of *x*-intercepts (4), associated with a quadratic equation.

✯ Equations must be in standard form (=0 & DPO)

(2) Solutions

(3) zeros

Equation	$x^2 + 6x + 5 = 0$	$x^2 - 2x + 1 = 0$	$x^2 - 3x + 10 = 0$
Discriminant	a = 1, b = 6, c = 5 $b^2 - 4ac$ $(6)^2 - 4(1)(5)$ 36 - 20 16 The discriminant is **positive**	a = 1, b = -2, c = 1 $b^2 - 4ac$ $(-2)^2 - 4(1)(1)$ 4 - 4 0 The discriminant is **zero**	a = 1, b = -3, c = 10 $b^2 - 4ac$ $(-3)^2 - 4(1)(10)$ 9 - 40 -31 The discriminant is **negative**
Number of Solutions	Two real soutions	One real solution	No real solutions imaginary/Not Real
Graph of Roots	 **There are two *x*-intercepts.**	 **There is one *x*-intercept.**	 **There are no *x*-intercepts.**
Roots found using the Quadratic Equation (1) Rational = perfect squares (2) Irrational = NON-perfect squares	$x = \dfrac{-6 \pm \sqrt{6^2 - 4(1)(5)}}{2(1)}$ $x = \dfrac{-6 \pm \sqrt{16}}{2} = \dfrac{-6 \pm 4}{2}$ $x = -1; \quad x = -5$ perfect square = Rational **There are two real roots** (1) Rational: # under √ (or discriminant) is a perfect square (2) ~~Irrational~~: # under √ (or discriminant) is not a perfect square	$x = \dfrac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(1)}}{2(1)}$ $x = \dfrac{2 \pm \sqrt{0}}{2} = 1$ $x = 1; \quad x = 1$ perfect square = Rational **There is one real Rational root** ✯ Always Rational	$x = \dfrac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(10)}}{2(1)}$ $x = \dfrac{3 \pm \sqrt{-31}}{2}$ $x = \dfrac{3 + i\sqrt{31}}{2}; \quad x = \dfrac{3 - i\sqrt{31}}{2}$ **There are two complex roots.** imaginary/Not Real

Roots/zeros/x-intercepts Perfect square NON Perfect Square

So.....

If $b^2 - 4ac > 0$, the equation has two real solutions ** (Rational or Irrational)

If $b^2 - 4ac = 0$, the equation has one real solutions (Always Rational)

If $b^2 - 4ac < 0$, the equation has no real solutions AKA (2 complex/imaginary roots)

**If the discriminant is a perfect square, the two roots are rational numbers. If the discriminant is not a perfect square, the two roots are irrational numbers containing a radical.

1 How it's asked 3 AKA 2

Examples: Find the number of real solutions of each equation using the discriminant

Describe the nature of the roots

1) $3x^2 + 10x + 2 = 0$

$a=3$, $b=10$, $c=2$

b^2-4ac

$(10)^2-4(3)(2)$

$100-4(3)(2)$

$100-24$

$\boxed{76}$ → NON P.S.

2 real irrational roots/solutions

2) $2x^2 + 12x = -18$

$+18 \quad +18$

$2x^2+12x+18=0$

$a=2$, $b=12$, $c=18$

b^2-4ac

$(12)^2-4(2)(18)$

$144-4(2)(18)$

$144-144$

$\boxed{0}$ → P.S.

1 real rational Root/Solution

3) $x^2 + x + 1 = 0$

$a=1$, $b=1$, $c=1$

b^2-4ac

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

$1-4(1)(1)$

$1-4$

$\boxed{-3}$

2 complex/imaginary roots/solutions, NO Real Roots

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

$a=1$, $b=4$, $c=-5$

b^2-4ac

$(4)^2-4(1)(-5)$

$16-4(1)(-5)$

$16+20$

$\boxed{36}$ → perfect square!

2 real rational roots/solutions

5) $2x^2 - 2x + 3 = 0$

$a=2$, $b=-2$, $c=3$

b^2-4ac

$(-2)^2-4(2)(3)$

$4-4(2)(3)$

$4-24$

$\boxed{-20}$

2 complex/imaginary roots/solutions

NO Real Roots

6) $9x^2 - 7x + 1 = 0$

$a=9$, $b=-7$, $c=1$

b^2-4ac

$(-7)^2-4(9)(1)$

$49-4(9)(1)$

$49-36$

$\boxed{13}$ → NON-perfect square

2 real irrational roots/solutions