Name: ______________________ Date: ______________ Hour: ___Alg 1___

Unit 7B Day 18: Determining the types of solutions in standard form

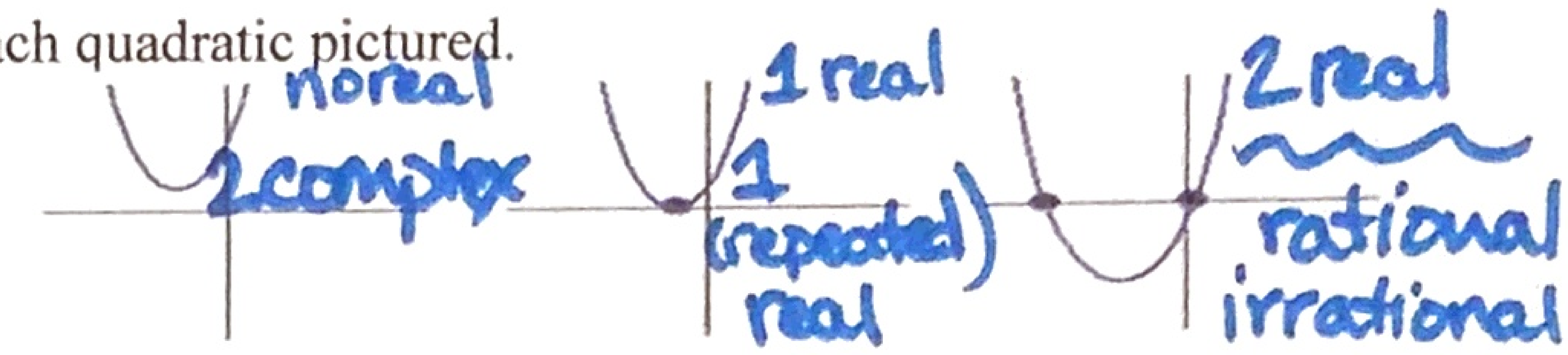
Focus Question: How do I know if a quadratic has two real, one real, or no real solutions?

A. Review

1. The fundamental theorem of algebra is that the degree of the equation is equal to the number of roots

2. What are all the synonyms for solutions to a quadratic? roots, zeros, x-int.

3. Give the number and type of solutions for each quadratic pictured.



4. Use the quadratic $f(x) = 4(x-3)^2 - 28$
   a) What form is it in? vertex
   b) Can you tell right away how many/what type of solutions it has? No
   c) What are the solutions? $0 = 4(x-3)^2 - 28$

$$+28 \qquad +28$$
$$\frac{28}{4} = \frac{4(x-3)^2}{4}$$
$$\sqrt{7} = \sqrt{(x-3)^2}$$
$$x - 3 = \pm\sqrt{7}$$
$$+3 \qquad +3$$
$$\boxed{x = 3 \pm \sqrt{7}}$$

   d) Make one change to the function that will cause this to have complex solutions.

$$f(x) = 4(x-3)^2 + 28 \qquad f(x) = -4(x-3)^2 - 28$$

   e) The number and type of solutions, when in vertex form, depend on which two parts of the function $f(x) = a(x-h)^2 + k$? k & a $\quad \frac{-k}{a}$

If $\frac{-k}{a}$ is > 0, then there are 2 real solutions. (rational, irrational)

If $\frac{-k}{a}$ is = 0, then there is 1 repeated real solution.

If $\frac{-k}{a}$ is < 0, then there are 2 complex solutions.

B. The Discriminant

When a quadratic is written in standard form, we use **the discriminant** to determine the number and type of solutions. The formula for the discriminant is $b^2 - 4ac$ (We will discuss where it comes from when we are able to complete the square.)

If $b^2 - 4ac$ is > 0, then there are 2 real solutions. (rational, irrational)

If $b^2 - 4ac$ is = 0, then there is 1 repeated real solution.

If $b^2 - 4ac$ is < 0, then there are 2 complex solutions.

For each quadratic below, find the discriminant and give the number and type of solutions.

1. $f(x) = 9x^2 - 5x + 2$

$a=9$
$b=\cancel{2}-5$
$c=2$

b^2-4ac
$(-5)^2-4(9)(2)$
$25-72$
-47
$-47<0$ $\boxed{\text{2 complex}}$

2. $g(p) = \frac{1}{3}p^2 - 7p - 9$

$a=\frac{1}{3}$
$b=-7$
$c=-9$

b^2-4ac
$(-7)^2-4(\frac{1}{3})(-9)$
$49+12$
61
$61>0$ $\boxed{\text{2 real}}$ irrational
61 is not a prft. sq.

3. $g(u) = 5u^2 + 2u - 3$

$a=5$
$b=2$
$c=-3$

b^2-4ac
$(2)^2-4(5)(-3)$
$4+60$
64
$64>0$ $\boxed{\text{2 real}}$ rational
64 is a prft sq.

4. $m(x) = 7x^2 + 9x - 4$

$a=7$
$b=9$
$c=-4$

b^2-4ac
$(9)^2-4(7)(-4)$
$81+112$
193
$193>0$ $\boxed{\text{2 real}}$ irrational
193 is not a pfct sq.

5. $h(t) = 3t^2 - 4t + 1$

$a=3$
$b=-4$
$c=1$

b^2-4ac
$(-4)^2-4(3)(1)$
$16-12$
4
$4>0$ $\boxed{\text{2 real}}$ rational
4 is prft. sq.

6. $d(s) = 6s^2 - 8s + 5$

$a=6$
$b=-8$
$c=5$

b^2-4ac
$(-8)^2-4(6)(5)$
$64-120$
-56
$-56<0$ $\boxed{\text{2 complex}}$