Name_____ Class_____ Date_____

Lesson 10-7   Using the Discriminant

Lesson Objective	NAEP 2005 Strand: Algebra
▼ Find the number of solutions of a quadratic equation	Topic: Equations and Inequalities
	Local Standards: _____

Vocabulary and Key Concepts

Property of the Discriminant

For the quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$, you can use the value of the discriminant to determine the number of solutions.

If $b^2 - 4ac > 0$, there are [**two**] solutions.

If $b^2 - 4ac = 0$, there is [**One**] solution.

If $b^2 - 4ac < 0$, there are [**no**] solutions.

The discriminant is ___$b^2 - 4ac$ → under $\sqrt{}$___
_____

Example

❶ Using the Discriminant Find the number of solutions of $x^2 = -3x - 7$ using the discriminant.

+3x +7

$x^2 + 3x + 7 = 0$ Write in standard form.

$b^2 - 4ac = [3]^2 - 4([1])([7])$ Evaluate the discriminant. Substitute for a, b, and c.

$= 9 - [28]$ Use the order of operations.

$= [-19]$ Simplify.

Since $[-19] < 0$, the equation has [**no**] solution.

a = 1
b = 3
c = 7

Quick Check

1. Find the number of solutions for each equation.

   a. $x^2 = 2x - 3$ **b.** $3x^2 - 4x = 7$ **c.** $5x^2 + 8 = 2x$

a = 3
b = -4
c = -7

a.
a = 1
b = -2
c = 3
-2x + 3
$x^2 - 2x + 3 = 0$
$(-2)^2 - 4(1)(3)$
$4 \quad -12$
-8
[**NO solutions**]

b.
7 -7
$3x^2 - 4x - 7 = 0$
$(-4)^2 - 4(3)(-7)$
$16 + 84$
100
[**two solutions**]

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Example

❷ **Applying the Discriminant** A football is kicked from a starting height of 3 ft with an initial upward velocity of 40 ft/s. Will the football ever reach a height of 30 ft? Use the vertical motion formula $h = -16t^2 + vt + c$, where $h = 30$, $v = $ velocity, $c = $ starting height, and $t = $ time to land.

$h = -16t^2 + vt + c$ — Use the vertical motion formula.

$\boxed{30} = -16t^2 + \boxed{40}t + 3$ **-30** — Substitute $\boxed{30}$ for h, $\boxed{40}$ for v, and $\boxed{3}$ for c.

-30

$0 = -16t^2 + 40t - \boxed{27}$ — Write in standard form.

$b^2 - 4ac = (40)^2 - 4(\boxed{-16})(\boxed{-27})$ — Evaluate the discriminant.

$= \boxed{1,600} - 1,728$ — Use the order of operations.

$\rightarrow = \boxed{-128}$ — Simplify.

$a = -16$
$b = 40$
$c = -27$

The discriminant is $\boxed{\text{negative}}$. The football $\boxed{\text{won't}}$ reach a height of 30 ft.

Quick Check

2. A construction worker on the ground tosses an apple to a fellow worker who is 20 ft above the ground. The starting height of the apple is 5 ft with an initial upward velocity of 32 ft/s. Will the apple reach the worker? Use the vertical motion formula.

$h = -16t^2 + vt + c$

$20 = -16t^2 + 32t + 5$

$-20 \qquad\qquad -20$

$0 = -16t^2 + 32t - 15$

$32^2 - 4(-16)(-15)$

$1,024 - 960$

64

$a = -16$
$b = 32$
$c = -15$

two solutions

(yes)