THE QUADRATIC FORMULA

SECTION 4-7

Mr. Gallo
Algebra 2

THE QUADRATIC FORMULA

Standard Form: $y = ax^2 + bx + c$

If $ax^2 + bx + c = 0$ and $a \neq 0$, then:

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

*When you cannot factor to find the values of **x**, use the quadratic formula.*

Solve the following equations using the Quadratic Formula:

$3x^2+11x-4=0$ $\quad x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$ $\quad 3x^2-4x+1=0$

$a=3 \quad b=11 \quad c=-4$

$$x=\frac{-11\pm\sqrt{11^2-4(3)(-4)}}{2(3)}$$

$$x=\frac{-11\pm\sqrt{169}}{6}=\frac{-11\pm13}{6}$$

$$x=\frac{-11+13}{6}=\frac{2}{6}=\frac{1}{3}$$

$$x=\frac{-11-13}{6}=\frac{-24}{6}=-4$$

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

$$x=\frac{-(-4)\pm\sqrt{(-4)^2-4(3)(1)}}{2(3)}$$

$$x=\frac{4\pm\sqrt{16-12}}{6}=\frac{4\pm2}{6}$$

$$x=\frac{4+2}{6}=1$$

$$x=\frac{4-2}{6}=\frac{2}{6}=\frac{1}{3}$$

EXAMPLE

- Accounting for a driver's reaction time, the minimal distance d in feet it takes for a certain car to stop is approximated by the formula

$$d=.042s^2+1.1s+4$$

where s is the speed in miles per hour. If a car took 200 feet to stop, about how fast was it traveling?

$d=200$

$200=0.042s^2+1.1s+4$

$0=0.042s^2+1.1s-196$

$a=0.042 \quad b=1.1 \quad c=-196$

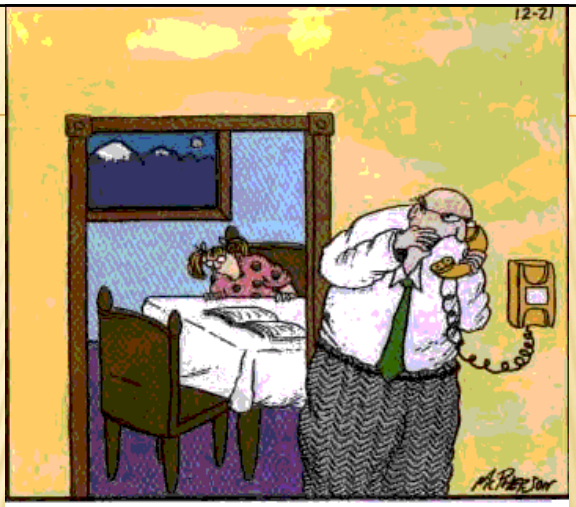
$$x=\frac{-1.1\pm\sqrt{1.1^2-4(.042)(-196)}}{2(.042)}$$

$$x=\frac{-1.1\pm\sqrt{1.21+32.98}}{0.084}=\frac{-1.1\pm\sqrt{34.19}}{0.084}$$

$$x=\frac{-1.1+\sqrt{34.19}}{0.084}=56.51$$

~~$x=\dfrac{-1.1-\sqrt{34.19}}{0.084}=-82.7$~~

The car was traveling about 57 mph.



"Uh, yeah, Homework Help Line? I need to have you explain the Quadratic Equation in roughly the amount of time it takes to get a cup of coffee."

HOMEWORK: P. 245 #11-23 ODD, 41-57 ODD

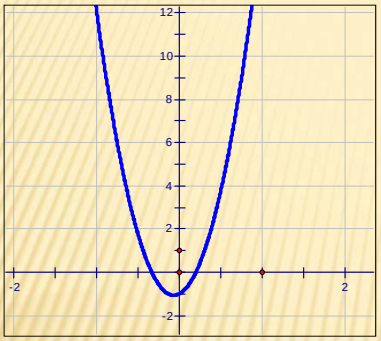
THE QUADRATIC FORMULA

- If $ax^2 + bx + c = 0$ and $a \neq 0$, then

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

- Discriminant:
  - Solutions to quadratic (and other) equations are sometimes called ____Roots____.
  - $b^2 - 4ac$ is called the ____Discriminant____ of the quadratic equation. It determines the number of ____Real____ solutions to the equation.

THE DISCRIMINANT



Graph $15x^2 + 2x - 1 = 0$

a = 15 b = 2 c = -1

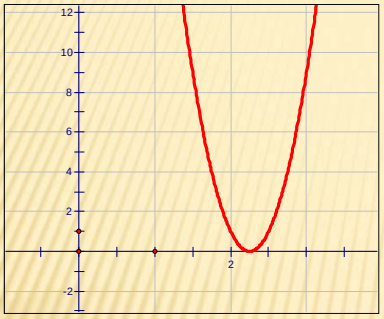
$b^2 - 4ac = 2^2 - 4(15)(-1)$

$= 4 + 60$

$= 64$

Value of $b^2 - 4ac$	Number of Real root(s)	Nature of Related Graph?
> 0	2 Real Roots	Touches *x*-axis at two points

THE DISCRIMINANT



Graph $16x^2 - 72x + 81 = 0$

a = 16 b = -72 c = 81

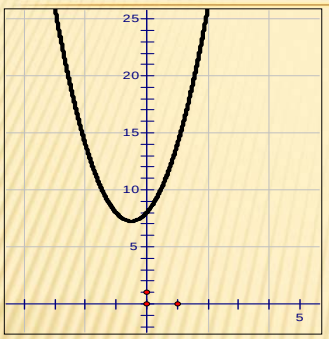
$b^2 - 4ac = (-72)^2 - 4(16)(81)$

$= 5184 - 5184$

$= 0$

Value of $b^2 - 4ac$	Number of Real root(s)	Nature of Related Graph?
$= 0$	1 Real Root at $x = -\frac{b}{2a}$	Touches *x*-axis at one point The Vertex.

THE DISCRIMINANT



Graph $3x^2 + 3x + 8 = 0$

a = 3 b = 3 c = 8

$b^2 - 4ac = 3^2 - 4(3)(8)$

$= 9 - 96$

$= -87$

Value of $b^2 - 4ac$	Number of Real root(s)	Nature of Related Graph?
< 0	No Real Roots	Never touches the *x*-axis

EXAMPLE 1:

- Determine the number of real roots of the following equations.

$16x^2 - 72x + 81$

a = 16

b = -72

c= 81

$b^2 - 4ac = (-72)^2 - 4(16)(81)$

$= 0$

Number of roots:

1 Real Root

$x^2 + 7x + 1 = 0$

a = 1

b = 7

c= 1

$b^2 - 4ac = 7^2 - 4(1)(1)$

$= 45$

Number of roots:

2 Real Roots

EXAMPLE 2:

- A ball is thrown from a height of 5 feet with a vertical velocity of 40 feet per second. Will this ball ever reach a height of 50 feet? Why or why not?

a. What is the equation representing this situation?

$$h = -16t^2 + 40t + 5$$

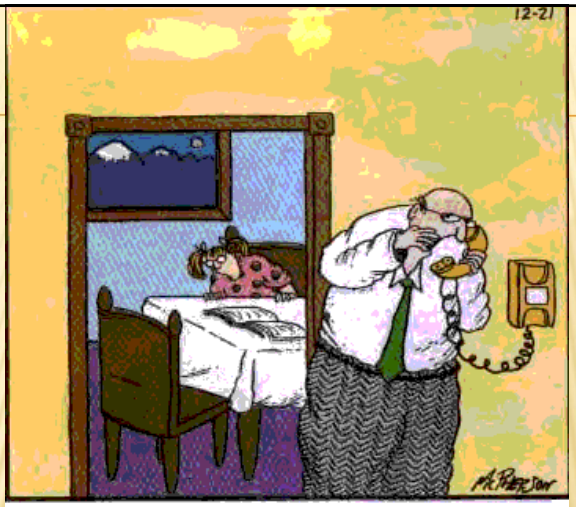
b. Let h = 50 and then write the equation in standard form?

$$50 = -16t^2 + 40t + 5 \qquad 0 = -16t^2 + 40t - 45$$

c. What is the discriminant?

$$b^2 - 4ac = 40^2 - 4(-16)(-45)$$

$$= -1280 < 0$$ No Real Number Solutions



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HOMEWORK: P. 245 #25-37 ODD, 38, 59-65 ODD