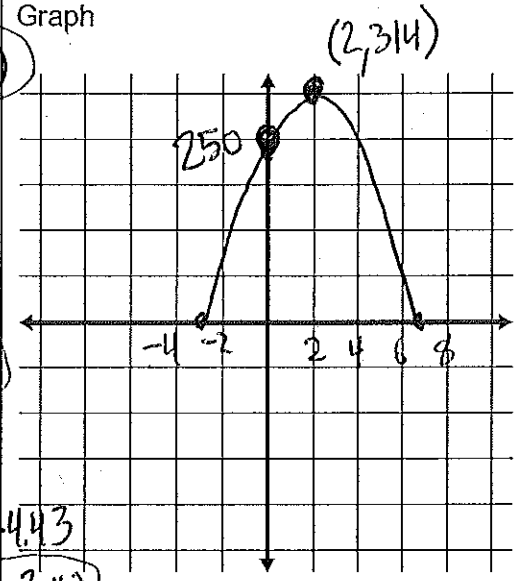
Completing the Square and the Quadratic Formula

Name:_____ Period:_____

Note: You will turn this page in for a quiz grade. Make sure you write down everything I do and that you complete the other problems. imaurer.weebly.com

Ex: Use completing the square to create a complete graph of $y = -16x^2 + 64x + 250$

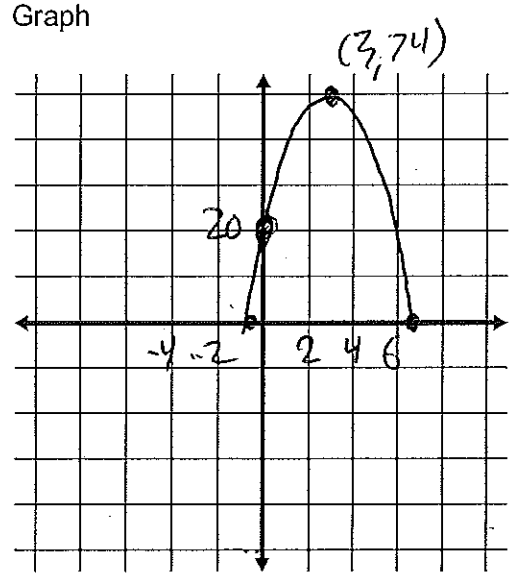
Complete the Square	Graph Features	Graph
$-16x^2+64x+250$	y-int: (0, 250)	
$-16(x^2-4x)+250$		
$\frac{-4}{2}=-2$, CTS $(-2)^2=4$, $0-4=-4$		
$-16((x-2)^2-4)+250$		
$-16(x-2)^2+64+250$	V: (2, 314)	
$0=-16(x-2)^2+314$	$19.625=(x-2)^2$	
-314 -314	$x-2=4.43$ or $x-2=-4.43$	
$\frac{-314}{-16}=\frac{-16(x-2)^2}{-16}$	$x=6.43$ or $x=-2.43$	

x - 2

	x^2	$-2x$
x		
-2	$-2x$	4

Your turn: Use completing the square to create a complete graph of $y = -6x^2 + 36x + 20$

$-6(x^2-6x)+20$

Complete the Square	Graph Features	Graph
$-6(x^2-6x)+20$	y-int: (0, 20)	
CTS $-6((x-3)^2-9)+20$		
$-6(x-3)^2+54+20$	V: (3, 74)	
$0=-6(x-3)^2+74$	$\pm\sqrt{12.3}=x-3$	
-74 -74	$3.5=x-3$	
$\frac{-74}{-6}=\frac{-6(x-3)^2}{-6}$	$6.5=+3$	
$12.3=(x-3)^2$	$-3.5=x-3$	
	$-.5=x$	

x - 3

	x^2	$-3x$
x		
-3	$-3x$	9

-9

Mathematicians work very hard to figure out easier ways to solve problems. Completing the square takes time, is kind of hard, and is easy to make mistakes on. Is there a way we can solve the problem once and for all? Is there a formula we can use?

We will derive the quadratic formula side-by-side with an example. Please focus on how the letters move around in the formula EXACTLY how the numbers do in the example.

Example $3x^2-24x-64$	Formula ax^2+bx+c
$3(x^2-8x)-64$	$a(x^2+\frac{b}{a}x)+c$
$\frac{-8}{2}=-4,\ (-4)^2=16,\ 0-16=-16$	$\frac{b/a}{2}=\frac{b}{2a},\ (\frac{b}{2a})^2=\frac{b^2}{4a^2},\ 0-\frac{b^2}{4a^2}=-\frac{b^2}{4a^2}$
$3((x-4)^2-16)-64$	$a((x+\frac{b}{2a})^2-\frac{b^2}{4a^2})+c$
$3(x-4)^2-48-64$	
$\boxed{3(x-4)^2-112=0}$	$\boxed{a(x+\frac{b}{2a})^2-\frac{b^2}{4a}+c=0}$
$+112\quad+112$	$-c\quad+\frac{b^2}{4a}-c$
$V:(4,-112)$	$V:(-\frac{b}{2a},-\frac{b^2}{4a}+c)$
$\frac{3(x-4)^2}{3}=\frac{112}{3}$	$a(x+\frac{b}{2a})^2=\frac{b^2}{4a}-c\cdot 4a$
$(x-4)^2=37.3$	$\frac{a(x+\frac{b}{2a})^2}{a}=\frac{\frac{b^2-4ac}{4a}}{a}$
$x-4=\pm\sqrt{37.3}$	$(x+\frac{b}{2a})^2=\frac{b^2-4ac}{4a^2}$
$x-4=6.1$	$x+\frac{b}{2a}=\pm\sqrt{\frac{b^2-4ac}{4a^2}}$
$x=10.1$	
$x-4=-6.1$	
$x=-2.1$	

Ex: Solve $y = 3x^2 - 5x - 123 = 0$ using the quadratic formula

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

Your turn: Solve $y = 7x^2+15x-3 = 0$ with the quadratic formula

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