Name____________________

Derivation of the Quadratic Formula

General form of a quadratic equation: $ax^2 + bx + c = 0, \quad \forall a,b,c \in \Re, \quad a \neq 0$

	Algebraic Representations	Directions
Step 1:	$x^2 + \frac{b}{a}x + \frac{c}{a} = 0, \quad a \neq 0$	
Step 2:	$x^2 + \frac{b}{a}x = -\frac{c}{a}$	
Step 3:	$x^2 + \frac{b}{a}x + \left(\frac{b}{2a}\right)^2 = -\frac{c}{a} + \left(\frac{b}{2a}\right)^2$	
Step 4:	$\left(x + \frac{b}{2a}\right)^2 = -\frac{c}{a} + \left(\frac{b}{2a}\right)^2$	
Step 5:	$\left(x + \frac{b}{2a}\right)^2 = -\frac{c}{a} + \frac{b^2}{4a^2}$	
Step 6:	$\left(x + \frac{b}{2a}\right)^2 = -\frac{c}{a} \bullet \frac{4a}{4a} + \frac{b^2}{4a^2}$	
Step 7:	$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}$	
Step 8:	$\sqrt{\left(x + \frac{b}{2a}\right)^2} = \pm\sqrt{\frac{b^2 - 4ac}{4a^2}}$	
Step 9:	$\left(x + \frac{b}{2a}\right) = \pm\sqrt{\frac{b^2 - 4ac}{4a^2}}$	
Step 10:	$x + \frac{b}{2a} = \pm\frac{\sqrt{b^2 - 4ac}}{\sqrt{4a^2}}$	
Step 11:	$x + \frac{b}{2a} = \pm\frac{\sqrt{b^2 - 4ac}}{2a}$	
Step 12:	$x = -\frac{b}{2a} \pm \frac{\sqrt{b^2 - 4ac}}{2a}$	
Step 13:	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	

The steps below are in mixed order. Your task is to arrange them in the correct order.

1) Cut out the 13 steps below.
2) Use the algebraic expressions on the first page to help arrange the steps in the correct order.
3) Paste them in the correct order in the 2nd column.

Simplify $\sqrt{4a^2}$ on the right side of the equation.
Subtract $\frac{b}{2a}$ from both sides of the equation.
Divide the general form of a quadratic equation by *a*.
Factor the **<u>trinomial</u>** on the left side of the equation.
Combine the fractions on the right side of the equation.
Use the property $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ on the right side of the equation.
Combine the fractions to obtain the **<u>Quadratic Formula</u>.**
Subtract the **constant** $\frac{c}{a}$ from both sides of the equation.
Multiply out $\left(\frac{b}{2a}\right)^2$ on the right side of the equation.
Take half of the coefficient of the **<u>linear term</u>**, square it, and add it to both sides of the equation.
Simplify $\sqrt{\left(x+\frac{b}{2a}\right)^2}$ on the left side of the equation.
Multiply $-\frac{c}{a}$ by an equivalent form of one to obtain common denominators.
Take the square root of both sides of the equation.

Algebra 1 Name___________________

Derivation of the Quadratic Formula

General form of a quadratic equation: $ax^2 + bx + c = 0, \quad \forall a,b,c \in \Re, \quad a \neq 0$

	Directions	Algebraic Representations
Step 1:	Divide the general form of a quadratic equation by *a*.	
Step 2:	Subtract the **constant** $\frac{c}{a}$ from both sides of the equation.	
Step 3:	Take half of the coefficient of the **linear term**, square it, and add it to both sides of the equation.	
Step 4:	Factor the **trinomial** on the left side of the equation.	
Step 5:	Multiply out $\left(\frac{b}{2a}\right)^2$ on the right side of the equation.	
Step 6:	Multiply $-\frac{c}{a}$ by an equivalent form of one to obtain common denominators.	
Step 7:	Combine the fractions on the right side of the equation.	
Step 8:	Take the square root of both sides of the equation.	
Step 9:	Simplify $\sqrt{\left(x + \frac{b}{2a}\right)^2}$ on the left side of the equation.	
Step 10:	Use the property $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ on the right side of the equation.	
Step 11:	Simplify $\sqrt{4a^2}$ on the right side of the equation.	
Step 12:	Subtract $\frac{b}{2a}$ from both sides of the equation.	
Step 13:	Combine the fractions to obtain the **Quadratic Formula**.	

The steps below are in mixed order. Your task is to arrange them in the correct order.

1) Cut out the 13 steps below.
2) Use the written directions on the first page to help arrange the steps in the correct order.
3) Paste them in the correct order in the 2nd column.

$\left(x+\frac{b}{2a}\right)=\pm\sqrt{\frac{b^2-4ac}{4a^2}}$
$x^2+\frac{b}{a}x+\left(\frac{b}{2a}\right)^2=-\frac{c}{a}+\left(\frac{b}{2a}\right)^2$
$\sqrt{\left(x+\frac{b}{2a}\right)^2}=\pm\sqrt{\frac{b^2-4ac}{4a^2}}$
$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$
$\left(x+\frac{b}{2a}\right)^2=-\frac{c}{a}\bullet\frac{4a}{4a}+\frac{b^2}{4a^2}$
$x+\frac{b}{2a}=\pm\frac{\sqrt{b^2-4ac}}{2a}$
$x^2+\frac{b}{a}x+\frac{c}{a}=0, \quad a\neq 0$

$x=-\frac{b}{2a}\pm\frac{\sqrt{b^2-4ac}}{2a}$
$\left(x+\frac{b}{2a}\right)^2=-\frac{c}{a}+\left(\frac{b}{2a}\right)^2$
$x+\frac{b}{2a}=\pm\frac{\sqrt{b^2-4ac}}{\sqrt{4a^2}}$
$\left(x+\frac{b}{2a}\right)^2=-\frac{c}{a}+\frac{b^2}{4a^2}$
$x^2+\frac{b}{a}x=-\frac{c}{a}$
$\left(x+\frac{b}{2a}\right)^2=\frac{b^2-4ac}{4a^2}$

Algebra 1 Name___________________

Derivation of the Quadratic Formula

After today's lesson, you should know the quadratic formula and be familiar with its proof by completing the square. You should also be able to solve quadratic equations by using the quadratic formula. (CA 19.0, 20.0)

	Algebraic Representations	**Directions**
Step 1:	$x^2+\frac{b}{a}x+\frac{c}{a}=0, \quad a\neq 0$	Divide the general form of the quadratic equation by *a*.
Step 2:	$x^2+\frac{b}{a}x=-\frac{c}{a}$	Subtracted the **constant** $\frac{c}{a}$ from both sides of the equation.
Step 3:	$x^2+\frac{b}{a}x+\left(\frac{b}{2a}\right)^2=-\frac{c}{a}+\left(\frac{b}{2a}\right)^2$	Take half of the coefficient of the **<u>linear term</u>**, squared it, and added it to both sides of the equation.
Step 4:	$\left(x+\frac{b}{2a}\right)^2=-\frac{c}{a}+\left(\frac{b}{2a}\right)^2$	Factor the **<u>trinomial</u>** on the left side of the equation.
Step 5:	$\left(x+\frac{b}{2a}\right)^2=-\frac{c}{a}+\frac{b^2}{4a^2}$	Multiply out $\left(\frac{b}{2a}\right)^2$ on the right side of the equation.
Step 6:	$\left(x+\frac{b}{2a}\right)^2=-\frac{c}{a}\bullet\frac{4a}{4a}+\frac{b^2}{4a^2}$	Multiply $-\frac{c}{a}$ by 1 to obtain common denominators.
Step 7:	$\left(x+\frac{b}{2a}\right)^2=\frac{b^2-4ac}{4a^2}$	Combine the fractions in the right side of the equation.
Step 8:	$\sqrt{\left(x+\frac{b}{2a}\right)^2}=\pm\sqrt{\frac{b^2-4ac}{4a^2}}$	Take the square root of both sides of the equation.
Step 9:	$\left(x+\frac{b}{2a}\right)=\pm\sqrt{\frac{b^2-4ac}{4a^2}}$	Simplify $\sqrt{\left(x+\frac{b}{2a}\right)^2}$ on the left side of the equation.
Step 10:	$x+\frac{b}{2a}=\pm\frac{\sqrt{b^2-4ac}}{\sqrt{4a^2}}$	Use the property $\sqrt{\frac{a}{b}}=\frac{\sqrt{a}}{\sqrt{b}}$ on the right side of the equation.
Step 11:	$x+\frac{b}{2a}=\pm\frac{\sqrt{b^2-4ac}}{2a}$	Simplify $\sqrt{4a^2}$ on the right side of the equation.
Step 12:	$x=-\frac{b}{2a}\pm\frac{\sqrt{b^2-4ac}}{2a}$	Subtract $\frac{b}{2a}$ from both sides of the equation.
Step 13:	$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$	Combine the fractions to obtain the **<u>Quadratic Formula</u>.**