Secondary 2H Solving Quadratics Day 4 In Class Name _____

Solving using Quadratic Formula - NO CALCULATOR!

1) Given the standard form of a quadratic equation, $(ax^2 + bx + c = 0)$, derive the quadratic formula by completing the square.

$ax^2 + bx + c = 0$

$\frac{ax^2}{a} + \frac{bx}{a} + \frac{c}{a} = \frac{0}{a} = 0$

$x^2 + \frac{bx}{a} \quad \frac{c}{a} = 0$

$\frac{\frac{b}{a}}{2} = \frac{b}{2a}$

	x	$+\frac{b}{2a}$
x	x^2	$\frac{b}{2a}x$
$+\frac{b}{2a}$	$\frac{b}{2a}x$	$\frac{b^2}{4a^2}$

$-\frac{b^2+4ac}{4a^2}$

$\left(x + \frac{b}{2a}\right)^2 + \frac{-b^2+4ac}{4a^2} = 0$

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

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

$-\frac{b}{2a} \quad -\frac{b}{2a}$

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

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

$\frac{b^2}{4a^2} + \quad = \frac{c}{a}$

$\frac{b^2}{4a^2} + \frac{-b^2+4ac}{4a^2} = \frac{4ac}{4a^2}$

2) There is one more method we can use to solve quadratic equations. It is used when the equation is in Standard form, meaning $ax^2 + bx + c = 0$. It's called the quadratic Formula, and you need to memorize it!

The quadratic formula is:

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

3) A part of the quadratic equation that just includes what is under the ~~denominator~~ radical $b^2 - 4ac$ is called the discriminant. And can tell us about our solutions.

If the discriminant is a positive perfect square our solutions will be rational and real. $\sqrt{16} = \pm 4$

If the discriminant is a positive non-perfect square our solutions will be Irrat. & real. $\sqrt{17}$

If the discriminant is a negative perfect square our solutions will be rational & Imag. $\sqrt{-25} = 5i$

If the discriminant is a negative non-perfect square our solutions will be Irrati & Imag $\sqrt{-37}$

4) Use this formula to solve the following equation:

$x^2 + 4x - 9 = 0$

Identify the following:

a= 1 b = 4 c = -9

Now plug it in:

$$x = \frac{-4 \pm \sqrt{4^2+4(1)(+9)}}{2(1)}$$

$$= \frac{-4 \pm \sqrt{16+36}}{2}$$

$$= \frac{-4 \pm \sqrt{52}}{2} = \frac{-4 \pm 2\sqrt{13}}{\div 2} = \frac{-4}{2} \pm \frac{2\sqrt{13}}{2}$$

$\sqrt{52}$ → $2 \cdot 26$ → $2 \cdot 2 \cdot 13$ → $2\sqrt{13}$

$\frac{4+6}{\div 2}$ → $\frac{4}{2} + \frac{6}{2}$

And solve for x:

$$= -2 \pm \sqrt{13}$$

$x: -2+\sqrt{13}$ or $-2-\sqrt{13}$

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

Solve each equation from standard form. Then classify each equation's solution(s) as either rational real (QR), irrational real (IR) , rational imaginary (Qi) or irrational imaginary (Ii).

5) $2k^2 - k - 1 = 0$

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

$x = \frac{1 \pm \sqrt{1+8}}{4}$

$x = \frac{1 \pm \sqrt{9}}{4}$

$x = \frac{1 \pm 3}{4}$ $\quad \frac{1+3}{4} = 1 \quad \frac{1-3}{4} = -\frac{1}{2}$

$x = -\frac{1}{2}, 1$

6) $m^2 - 2m - 3 = 0$

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

$x = \frac{2 \pm \sqrt{4+12}}{2}$

$= \frac{2 \pm \sqrt{16}}{2} = \frac{2 \pm 4}{2}$ $\quad \frac{2+4}{2} = \frac{6}{2} = 3 \quad \frac{2-4}{2} = \frac{-2}{2} = 1$

$x = 1, 3$

7) $2p^2 = -10$

$+10 \quad +10$

$2p^2 + 10 = 0$

$2p^2 + 0p + 10 = 0$

$\frac{-0 \pm \sqrt{0^2-4(2)(10)}}{2(2)}$ ← Calc Error

$\sqrt{-80}$: $80 = 2 \cdot 40 = 2 \cdot 2 \cdot 20 = 2 \cdot 2 \cdot 2 \cdot 10 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5$; $i \, 2 \cdot 2 \sqrt{5}$

$\frac{\pm\sqrt{-80}}{4} = \frac{\pm 4i\sqrt{5}}{4} = \pm i\sqrt{5}$

8) $n^2 = 10n - 7$

$n^2 - 10n + 7 = 0$

$x = \frac{-(-10) \pm \sqrt{(-10)^2-4(1)(7)}}{2(1)}$

$= \frac{10 \pm \sqrt{100-28}}{2}$

$= \frac{10 \pm \sqrt{72}}{2}$

$= \frac{10 \pm 6\sqrt{2}}{2} = 5 \pm 3\sqrt{2}$

$\sqrt{72}$: $72 = 2 \cdot 36 = 2 \cdot 2 \cdot 18 = 2 \cdot 2 \cdot 2 \cdot 9 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$; $2 \cdot 3 \cdot \sqrt{2}$, $6\sqrt{2}$

9) $2n^2 = -7n + 60$

$2n^2 + 7n - 60 = 0$

$\frac{-7 \pm \sqrt{(7)^2+4(2)(60)}}{2(2)}$

$\frac{-7 \pm \sqrt{49+8(60)}}{4}$

$\frac{-7 \pm \sqrt{49+480}}{4}$

$\frac{-7 \pm \sqrt{529}}{4}$ $\quad \frac{-7+23}{4} = \frac{16}{4} = 4 \quad \frac{-7-23}{4} = \frac{-30}{4} = -\frac{15}{4}$

10) $7n^2 + 3 = -3n$

$7n^2 + 3n + 3$

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

$x = \frac{-3 \pm \sqrt{9-84}}{14}$

$= \frac{-3 \pm \sqrt{-75}}{14} = \frac{-3 \pm 5i\sqrt{3}}{14}$

11) Go back and find the discriminant for #5 _____, #7 _____,

#8 _____, and #10 _____.