Lesson 11.1 Solving Quadratic Equations by Completing the Square DAY TWO NOTES B2A2 Date _____

OBJECTIVE 2: Completing the Square

First it is all about finding the perfect "c". Complete the square using $\square = \left(\frac{b}{2}\right)^2$

TASK 1: Use the formula for completing the square above to fill the □'s below.

a) $x^2 + 6x + \square$ $\square = 9$

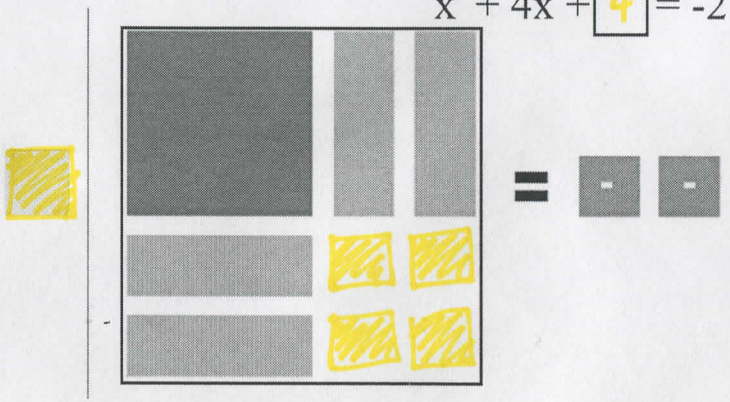
$\left(\frac{6}{2}\right)^2 = (3)^2 = 9$ $(x+3)^2$

b) $x^2 - 5x + \square$ $\square = \frac{25}{4}$

$\left(\frac{-5}{2}\right)^2 = \frac{25}{4}$ $(x - \frac{5}{2})^2$

How many yellows are needed to complete the square and balance the equation?

$x^2 + 4x + \boxed{4} = -2 + \boxed{4}$



STEPS:

1) If there is a "c" move it to the other side of the =.
2) Make sure "a" = 1, if not 1 then factor "a" out using GCF.
3) Divide the value of "b" by 2, square it, and add that value to both sides of the equation.
4) Write one side as a perfect square binomial and combine like terms on the other side, if necessary.
5) If "a" is not 1 then divide both sides by "a" to get the perfect square binomial alone.
6) Square root both sides of the equations, DO NOT FORGET the ± in front of the square root.
7) Now subtract by your "h" to get x alone.
8) Simplify if necessary.
9) Check if time allows.

Task 2: Solve using completing the square.

$\square = \left(\frac{2}{2}\right)^2$

a) $x^2 + 2x = 4$

$x^2 + 2x + \boxed{1} = 4 + \boxed{1}$

$(x+1)^2 = 5$

$x + 1 = \pm\sqrt{5}$

$\boxed{x = -1 \pm \sqrt{5}}$

$\square = \left(\frac{4}{2}\right)^2 = 4$

b) $x^2 + 4x = 3$

$x^2 + 4x + \boxed{4} = 3 + \boxed{4}$

$\sqrt{(x+2)^2} = \sqrt{7}$

$x + 2 = \pm\sqrt{7}$

$\boxed{x = -2 \pm \sqrt{7}}$

$\square = \left(\frac{14}{2}\right)^2$

c) $x^2 + 4x - 21 = 0$

$x^2 + 4x + \boxed{14} = 21 + \boxed{4}$

$\sqrt{(x+2)^2} = \sqrt{25}$

$x + 2 = \pm 5$

$x = -2 \pm 5$

$x = -2 + 5$ & $-2 - 5$

$\boxed{x = 3, -7}$

$\square = \left(\frac{4}{2}\right)^2 = (2)^2 = 4$

Task 3: Solve using completing the square.

a) $x^2 - 7x - 1 = 0$

$\square = \left(\frac{-7}{2}\right)^2 = \frac{49}{4}$

$x^2 - 7x + \frac{49}{4} = 1 + \frac{49}{4}$

$(x - \frac{7}{2})^2 = \frac{4}{4} + \frac{49}{4}$

$\sqrt{(x - \frac{7}{2})^2} = \sqrt{\frac{53}{4}}$

$x - \frac{7}{2} = \pm \frac{\sqrt{53}}{2}$

$x = \frac{7}{2} \pm \frac{\sqrt{53}}{2}$

b) $2x^2 - 8x + 3 = 0$

$2(x^2 - 4x + 4) = -3 + 2(4)$

$\frac{2(x-2)^2}{2} = \frac{5}{2}$

$\sqrt{(x-2)^2} = \sqrt{\frac{5}{2}}$

$x - 2 = \pm \sqrt{\frac{5}{2}}$

$x = 2 \pm \sqrt{\frac{5}{2}}$

c) $x^2 - 3x + 1 = 0$

$\square = \left(\frac{-3}{2}\right)^2 = \frac{9}{4}$

$x^2 - 3x + \frac{9}{4} = -1 + \frac{9}{4}$

$(x - \frac{3}{2})^2 = \frac{-4}{4} + \frac{9}{4}$

$\sqrt{(x - \frac{3}{2})^2} = \sqrt{\frac{5}{4}}$

$x - \frac{3}{2} = \pm \frac{\sqrt{5}}{2}$

$x = \frac{3}{2} \pm \frac{\sqrt{5}}{2}$ OR $\frac{3 \pm \sqrt{5}}{2}$

Task 4: Solve using completing the square.

a) $3x^2 - 12x + 1 = 0$

$\left(\frac{-4}{2}\right)^2 = (-2)^2 = 4$

$3(x^2 - 4x + 4) = -1 + 3(4)$

$3(x-2)^2 = 11$

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

$x - 2 = \pm \sqrt{\frac{11}{3}}$

$x = 2 \pm \sqrt{\frac{11}{3}}$

b) $3x^2 - 9x + 8 = 0$

$\left(\frac{-3}{2}\right)^2 = \left(\frac{9}{4}\right)$

$3(x^2 - 3x + \frac{9}{4}) = -8 + 3(\frac{9}{4})$

$3(x - \frac{3}{2})^2 = \frac{-32}{4} + \frac{27}{4}$

$\frac{1}{3} \cdot 3(x - \frac{3}{2})^2 = \frac{-5}{4} \cdot \frac{1}{3}$

$\sqrt{(x - \frac{3}{2})^2} = \sqrt{\frac{-5}{12}}$

$x = \frac{3}{2} \pm \frac{i\sqrt{5}}{2\sqrt{3}}$

c) $2x^2 - 5x + 7 = 0$

$\square = \left(\frac{-5}{2 \cdot 2}\right)^2 = \left(\frac{-5}{4}\right)^2 = \frac{25}{16}$

$2(x^2 - \frac{5}{2}x + \frac{25}{16}) = -7 + 2(\frac{25}{16})$

$2(x - \frac{5}{4})^2 = -7 + \frac{50}{16}$

$2(x - \frac{5}{4})^2 = \frac{-112}{16} + \frac{50}{16}$

$2(x - \frac{5}{4})^2 = \frac{-62}{16}$

$(x - \frac{5}{4})^2 = \frac{-62}{32}$

$x - \frac{5}{4} = \pm \sqrt{\frac{-62}{32}}$

$x = \frac{5}{4} \pm \frac{i\sqrt{62}}{4\sqrt{2}}$

Reminders to myself about the Completing the Square:

- don't forget the $\pm$
- don't forget perfect squares: 0, 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169
- don't forget $a = 1$
- don't forget $\square = \left(\frac{b}{2}\right)^2$
- factoring is always $(x + (\frac{b}{2}))^2$

Still need help with: