GSE Algebra 1 **8.7 – C.T.S to Vertex form** Name: _____

Complete the square to solve for x. Warmup

$x^2 - 14x - 12 = 0$	$3x^2 - 12x + 1 = 0$	$x^2 + x - 10 = 0$

Now we are going to complete the square and leave it in vertex form.

** **Vertex form**: $y = a(x-h)^2 + k$ standard → vertex

$y = x^2 + 10x + 15$

$x^2 + 10x + 15 = 0$

$-15 \quad -15$

$x^2 + 10x + 25 = -15 + 25$

$\frac{10}{2}$

$(5)^2 = 25$

$(x+5)(x+5) = 10$

$(x+5)^2 = 10$

$-10 \quad -10$

$(x+5)^2 - 10 = 0$

Vertex: $(-5, -10)$ Max or Min: Min

$y = x^2 - 8x - 4$

$x^2 - 8x - 4 = 0$

$+4 \quad +4$

$x^2 - 8x + 16 = 4 + 16$

$\frac{-8}{2}$

$(-4)^2 = 16$

$(x-4)(x-4) = 20$

$(x-4)^2 = 20$

$-20 \quad -20$

$(x-4)^2 - 20 = 0$

Vertex: $(4, -20)$ Max or Min: Min

$y = 2x^2 + 12x + 17$

$2x^2 + 12x + 17 = 0$

$-17 \quad -17$

$2x^2 + 12x = -17$

$\frac{2x^2}{2} + \frac{12x}{2} = -17$

$2(x^2 + 6x + 9) = -17 + 2(9)$

$\frac{6}{2} = 3 \quad (3)^2 = 9$

$2(x+3)(x+3) = 1$

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

$-1 \quad -1$

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

Vertex: $(-3, -1)$ Min or Max: Min

$y = \frac{1}{2}x^2 - 6x + 11$

$\frac{1}{2}x^2 - 6x + 11 = 0$

$-11 \quad -11$

$\frac{1}{2}x^2 - 6x = -11$

$\frac{\frac{1}{2}x^2}{\frac{1}{2}} \quad \frac{-6x}{\frac{1}{2}}$

$\frac{1}{2}(x^2 - 12x + 36) = -11 + \frac{1}{2}(36)$

$\frac{-12}{2} = -6 \quad (-6)^2 = 36$

$\frac{1}{2}(x-6)^2 = 7$

$-7 \quad -7$

$\frac{1}{2}(x-6)^2 - 7 = 0$

Vertex: $(6, -7)$ Min or Max: Min

$y = -4x^2 - 64x - 156$

$-4x^2 - 64x - 156 = 0$

$+156 \quad +156$

$-4x^2 - 64x = 156$

$\frac{-4x^2}{-4} \quad \frac{-64x}{-4}$

$-4(x^2 + 16x + 64) = 156 + -4(64)$

$\frac{16}{2} = 8 \quad (8)^2 = 64$

$-4(x+8)^2 = -100$

$+100 \quad +100$

$-4(x+8)^2 + 100 = 0$

Vertex: $(-8, 100)$ Min or max: Max

$y = -x^2 + 4x - 10$

Vertex: _____ Min or Max: _____

$x^2 - 12x + 32 = 0$

$x^2 - 12x + 36 = -32 + 36$

$(-6)^2 = 36$

$(x-6)^2 = 4$

$-4 \quad -4$

$(x-6)^2 - 4 = 0$

Vertex: $(6, -4)$ Min or Max: Min

$y = -2x^2 - 12x + 8$

$-2x^2 - 12x + 8 = 0$

$-8 \quad -8$

$\frac{-2x^2}{-2} - \frac{12x}{-2} = \frac{-8}{-2}$

$-2(x^2 + 6x + 9) = -8 + -2(9)$

$(3)^2 = 9$

$-2(x+3)^2 = -26$

$+26 \quad +26$

$-2(x+3)^2 + 26 = 0$

Vertex: $(-3, 26)$ Min or Max: Max

Let's look at these **special cases** for complete the square.

$x^2 + 4x + 10 = 0$

$-10 \quad -10$

$x^2 + 4x + 4 = -10 + 4$

$(2)^2 = 4$

$(x+2)(x+2) = -6$

$\sqrt{(x+2)^2} = \sqrt{-6}$

No Solution

* Cannot take square root of a negative

$x^2 - 10x + 65 = 0$

$-65 \quad -65$

$2x^2 - 10x + 25 = -65 + 25$

$(-5)^2 = 25$

$2\sqrt{(x-5)^2} = \sqrt{-40}$

$1/5$

1 No Solution

$-3x^2 + 12x - 21 = 0$

$+21 \quad +21$

$\frac{-3x^2}{-3} + \frac{12x}{-3} = 21$

$-3(x^2 - 4x + 4) = 21 + -3(4)$

$(-2)^2 = 4$

$-3(x-2)^2 = 9$

$-3 \quad -3$

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

No Solution

HW TOP Vertex form, Vertex, Max/Min

① $y = x^2 - 4x + 10$

$x^2 - 4x + 10 = 0$

$-10 \quad -10$

$x^2 - 4x + \frac{4}{2} = -10 + 4$

$(-2)^2 = 4$

$(x-2)(x-2) = -6$

$(x-2)^2 = -6$

$+6 \quad +6$

$(x-2)^2 + 6 = 0$

Min Vertex $(2, 6)$

Middle complete the [] to solve

⑧ $\frac{9x^2}{9} - \frac{81x}{9} = 12$

$9(x^2 - 9x + 20.25) = 12 + 9(20.25)$

$\frac{9x^2 - 9x + 20.25}{2}$

$(-4.5)^2 = 20.25$

$\frac{9(x-4.5)^2}{9} = \frac{194.25}{9}$

$\sqrt{(x-4.5)^2} = \sqrt{\frac{259}{12}}$

$x - 4.5 = \pm\sqrt{\frac{259}{12}}$

$+4.5 \quad +4.5$

$x = 4.5 \pm \sqrt{\frac{259}{12}}$

Factor

$\frac{4x^2}{4} - \frac{16}{4}$

$4(x^2 - 4)$

$x \cdot x \quad 2 \cdot -2$

$4(x-2)(x+2)$

$4x^2 - 4x - 3$

-12

$-6 \cdot 2$

$2x \quad -3$

$2x$	$4x^2$	$-6x$
1	$2x$	-3

$(2x-3)(2x+1)$

$\frac{-6}{4} \quad \frac{2}{4}$

$-\frac{3}{2} \quad \frac{1}{2}$

$(2x-3)(2x+1)$