PreCalculus 11 Date _____

Unit 3: Quadratic Equations
3.3 Solving Quadratic Equations by Completing the Square

Recall from 4.2 – Square Root Property (for quadratics with no degree 1 term)

ex. solve $2x^2 - 1 = 17$

$2x^2 = 18$

$x^2 = 9$

$x = \pm\sqrt{9}$

$x = \pm 3$

Extend to binomial square: **ex.** solve $(x-1)^2 - 49 = 0$

$(x-1)^2 = 49$

$x - 1 = \pm\sqrt{49}$

$x - 1 = \pm 7$

$+1 \quad +1$

$x = 7 + 1$ or $x = -7 + 1$

$x = 8, -6$

If there is no square we can introduce one by <u>completing the square</u>.

<u>Case I: $a = 1$</u>

ex. Solve by completing the square. Give answers in exact form and as decimals ~~rounded to nearest~~ tenth if needed.

$x^2 - 21 = -10x$

$x^2 + 10x - 21 = 0$

$x^2 + 10x + 25 = 21 + 25$

$(10/2)^2$

$(x+5)^2 = 46$

$x + 5 = \pm\sqrt{46}$

$x = -5 \pm \sqrt{46}$

~~$\pm\sqrt{46} - 5$~~

Exact solutions

$x = -5 + \sqrt{46}$ $x = -5 - \sqrt{46}$

$x = 1.8$ or $x = -11.8$

$q^2 - 4q = 14$

$q^2 - 4q + 4 = 14 + 4$

$(q-2)^2 = 18$

$q - 2 = \pm\sqrt{18}$

$q - 2 = \pm 3\sqrt{2}$

$q = 2 \pm 3\sqrt{2}$

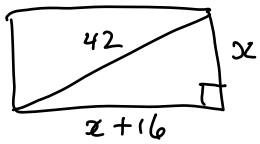
$q = 2 + 3\sqrt{2}$ $q = 2 - 3\sqrt{2}$

$= 6.2$ $= -2.2$

$\sqrt{18} = \sqrt{9}\sqrt{2}$

$= 3\sqrt{2}$

ex. A wide-screen television has a diagonal measure of 42 in. The width of the screen is 16 in. more than the height. Determine the dimensions of the screen, to the nearest tenth of an inch.



Pythagoras

$x^2 + (x+16)^2 = 42^2$

$x^2 + x^2 + 32x + 256 = 1764$

$\frac{2x^2 + 32x}{2} = \frac{1508}{2}$

$x^2 + 16x + 64 = 754 + 64$

$(x+8)^2 = 818$

$x + 8 = \pm\sqrt{818}$

$x = -8 \pm \sqrt{818}$

$-8 + \sqrt{818}$ $-8 - \sqrt{818}$

$= 20.6$ $= -36.6$

The screen is 20.6 in by 36.6 in

Case II: $a \neq 1$

ex. Solve by completing the square. Give answers in exact form and as decimals rounded to nearest hundredth if needed.

$4b^2 - 40b = -25$

$\frac{4b^2 - 40b}{4} = \frac{-25}{4}$

$b^2 - 10b + 25 = -25/4 + 100/4$

$(b-5)^2 = 75/4$

$b - 5 = \pm\sqrt{75/4}$

$b = 5 \pm \frac{5\sqrt{3}}{2}$

$b = 9.33$ or 0.67

$-2x^2 - 3x + 7 = 0$

$\frac{-2x^2 - 3x}{-2} = \frac{-7}{-2}$

$x^2 + \frac{3}{2}x + 9/16 = 7 + 9/16$

$(x + 3/4)^2 = 65/16$

$x + 3/4 = \pm\sqrt{65/16}$

$x = -\frac{3}{4} \pm \frac{\sqrt{65}}{4}$

$x = \frac{(-3 \pm \sqrt{65})}{4}$

$x = 1.27$ or -2.77

ex. A defender kicks a soccer ball away from her own goal. The path of the kicked soccer ball can be approximated by the quadratic function $h(x) = -0.06x^2 + 3.168x - 35.34$, where *x* is the horizontal distance travelled, in metres, from the goal line and *h* is the height, in metres.

a) How far is the soccer ball from the goal line when it is kicked? Express your answer to the nearest tenth of a metre.

$h(x) = 0$

$-0.06x^2 + 3.168x - 35.34 = 0$

$\frac{-0.06x^2 + 3.168x}{-0.06} = \frac{35.34}{-0.06}$

$x^2 - 52.8x + 696.96 = -589 + 696.96$

$(x - 26.4)^2 = 107.96$

$x - 26.4 = \pm\sqrt{107.96}$

$x = 26.4 \pm \sqrt{107.96}$

$x = 36.8 \quad x = 16.0$

16.0m from the goal line

b) How far does the soccer ball travel before it hits the ground?

$36.8 - 16.0$

20.8m

Practice: pg. 241/ #5acdf, 6, 7abe, 8, 10, 11 – 13, 15, 21