Algebra II

Section 5-3

COMPLETING THE SQUARE

The SQUARE ROOT Property

Factor perfect square problems, then take the ***square root***!

Example: $x^2 - 14x + 49 = 144$

when in doubt, factor it out!

$(x - 7)(x - 7) = 144$

$(x - 7)^2 = 144$

square root both sides

$\sqrt{(x-7)^2} = \sqrt{144}$

$x - 7 = \pm 12$

$x = 12 + 7$ and $x = -12 + 7$

$x = 19$ and $x = -5$

1) $x^2 - 6x + 9 = 32$

$(x - 3)(x - 3) = 32$

$(x - 3)^2 = 32$

$\sqrt{(x-3)^2} = \sqrt{32}$

$x - 3 = \pm 4\sqrt{2}$

$x = \pm 4\sqrt{2} + 3$

$\sqrt{32}$

$\sqrt{16} \bullet \sqrt{2}$

$4\sqrt{2}$

2) $4n^2 + 20n + 25 = 2$

$(2n + 5)(2n + 5) = 2$

$(2n + 5)^2 = 2$

$\sqrt{(2n+5)^2} = \sqrt{2}$

$2n + 5 = \pm\sqrt{2}$

$2n = \pm\sqrt{2} - 5$

$n = \dfrac{\pm\sqrt{2} - 5}{2}$

COMPLETING THE SQUARE

If the equation will not factor into a perfect square, you can "force" it to by inserting the correct number as the third term.

Example: $y^2 + 8y + 11 = 20$

eleven won't factor, so what number would?

$y^2 + 8y +$ **16** $= 9 +$ **16**

$(y + 4)(y + 4) = 25$

$(y + 4)^2 = 25$

square root both sides

$\sqrt{(y+4)^2} = \sqrt{25}$

$y + 4 = \pm 5$

$y = 5 - 4$ and $y = -5 - 4$

$y = 1$ and $y = -9$

$\sqrt{-20}$

$\sqrt{-1} \bullet \sqrt{4} \bullet \sqrt{5}$

$2i\sqrt{5}$

1) $x^2 - 10x + 45 = 0$

$x^2 - 10x$ **+ 25** $= -45$ **+ 25**

$(x - 5)(x - 5) = -20$

$(x - 5)^2 = -20$

$\sqrt{(x-5)^2} = \sqrt{-20}$

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

$x = \pm 2i\sqrt{5} + 5$

2) $3x^2 + 12x + 36 = 0$

Divide everything by 3

$x^2 + 4x + 12 = 0$

$x^2 + 4x$ **+ 4** $= -12$ **+ 4**

short cut to $(\ )^2$ if you wish

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

$\sqrt{(x+2)^2} = \sqrt{-8}$

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

$x = \pm 2i\sqrt{2} - 2$

3) $-2x^2 + 5x - 3 = 0$

Divide everything by -2

$x^2 - 5/2x + 3/2 = 0$

$x^2 - 5/2x$ **+ 25/16** $= -3/2$ **+ 25/16**

$(x - 5/4)^2 = 1/16$

$\sqrt{(x-5/4)^2} = \sqrt{1/16}$

$x - \dfrac{5}{4} = \pm\dfrac{1}{4}$

$x = \pm\dfrac{1}{4} + \dfrac{5}{4}$ so x = 1 and x = $\dfrac{3}{2}$