Left over from last time:

(4) Completing the square.

$(a-b)^2 = a^2 - 2ab + b^2$

$(a+b)^2 = a^2 + 2ab + b^2$

The square of a binomial

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$\sqrt[3]{108} = \sqrt[3]{2\cdot2\cdot3\cdot3\cdot3}$

$3\sqrt[3]{4}$

$$\begin{array}{r|l} 2 & 108 \\ 2 & 54 \\ 3 & 27 \\ 3 & 9 \\ & 3 \end{array}$$

3 is an odd index

$\sqrt[3]{-108} = -3\sqrt[3]{4}$

There's no absolute value involved.
The negative just comes straight out of the radical.

$\boxed{\sqrt{x^2} = |x|}$ Even-index roots

$\boxed{\sqrt[4]{x^4} = |x|}$ Now, your book also always says "Assume x is nonnegative" or "Assume x represents a nonnegative real number." That allows them to dodge the absolute value & make that ± deal something students think appears with every $\sqrt{}$. or principal (main) root.

$\sqrt[4]{81} = \sqrt[4]{3^4} = 3$

$$\begin{array}{r|l} 3 & 81 \\ 3 & 27 \\ 3 & 9 \\ & 3 \end{array}$$

$\sqrt[4]{81x^4} = 3|x|$

$\sqrt[3]{81x^4} = \sqrt[3]{3^4 x^4} = \sqrt[3]{3^3 3^1 x^3 x^1}$

$= 3x\sqrt[3]{3x}$

No absolute value concerns for odd-indexed roots

$\sqrt[4]{162x^6} = \sqrt[4]{2 \cdot 3^4 \cdot x^4 x^2}$

$= 3|x|\sqrt[4]{2x^2}$

$$\begin{array}{r|l} 2 & 162 \\ 3 & 81 \\ 3 & 27 \\ 3 & 9 \\ & 3 \end{array}$$

Now. If you $\boxed{\text{assume } x \geq 0}$, then

it's $3x\sqrt[4]{2x^2}$

Since $|x| = x$ when $x \geq 0$

RECALL $|x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{if } x < 0 \end{cases}$

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

$(a-b)^2 = a^2 - 2ab + b^2$ } MEMORIZE

$(a+b)^2 = a^2 + 2ab + b^2$

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

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

$= x^2 + 6x + 9$

$(x+7)^2 = x^2 + 14x + 49$

In §8.1, we want to go from $x^2 + 14x + 49$ to $\boxed{(x+7)^2 \text{ Binomial Squared}}$

Complete the square:

$x^2 + 14x + \underline{49}$

$\frac{14}{2} = 7 \rightsquigarrow 7^2 = 49$

$x^2 + \underline{8x} + \underline{\quad 16 \quad}$ Now factors into $(x+4)^2$

$\frac{8}{2} = 4 \rightarrow 4^2 = 16$

$x^2 - \underline{3x} + \underline{\left(\frac{3}{2}\right)^2} = \left(x - \frac{3}{2}\right)^2$

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

Check

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

$(a-b)^2 = a^2 - 2ab + b^2$

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$$(x+2)^2 = 11$$

Today is about getting to this point

$$\sqrt{(x+2)^2} = \sqrt{11}$$

$$|x+2| = \sqrt{11}$$

$$x+2 = \pm\sqrt{11}$$

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

Solve, by completing the square.

$$x^2+4x-7=0$$

WE ONLY KNOW HOW TO COMPLETE THE SQUARE WHEN THE COEFFICIENT OF x^2 is "1"

$$x^2+4x \quad = 7$$

$$\frac{4}{2} = 2 \rightarrow 2^2 = 4$$

$$x^2+4x+4 = 7+4$$

$$(x+2)^2 = 11$$

$$x+2 = \pm\sqrt{11}$$

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

short version for the rest

We did these last two steps in about 5 steps, but once you're practiced it's just 2 steps to the finish.

Solve $x^2-6x-7=0$ by Completing the square. (Factors: $(x-7)(x+1)$)

$$x^2-6x+3^2=7+9$$

$$\frac{6}{2}=3 \rightsquigarrow 3^2=9$$

$$(x-3)^2=16$$

$$x-3=\pm\sqrt{16}=\pm 4$$

$$x=3\pm 4$$

$$3+4=\boxed{7=x}$$

$$3-4=\boxed{-1=x}$$

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S8.1 #s 35 - 42 are good for this skill

Solve by completing the square

1. Get x^2+bx by itself on Left
2. $\frac{b}{2} \rightarrow \left(\frac{b}{2}\right)^2$ Add to both sides
3. write $\left(x+\frac{b}{2}\right)^2 = K$
   Solve by square root property.

$x^2+6x-4=0$

1. $x^2+6x = 4$
2. $x^2+6x+3^2 = 4+9$
3. $(x+3)^2 = 13$

   $x+3 = \pm\sqrt{13}$

   $x = -3\pm\sqrt{13}$

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