Explanation of Radical Multiplication Problem

This problem is one of the more complicated radical multiplication problems given in section 10.4. The instructions are to multiply and then simplify. Remember a **term** is something we are adding or subtracting.

$$\left(\sqrt[3]{x}+5\right)\left(\sqrt[3]{x^2}-5\sqrt[3]{x}+25\right)$$

Need to multiply both terms in first set of parentheses with all terms in second set of parentheses. Feels a little like FOIL but there are three terms in the second set of parentheses.

$$=\sqrt[3]{x}\sqrt[3]{x^2}+5\sqrt[3]{x^2}-\sqrt[3]{x}*5\sqrt[3]{x}-5*5\sqrt[3]{x}+25\sqrt[3]{x}+5*25$$

Then we need to simplify each term one by one. Since most involve cube roots, we can combine those, via the radical rule $\sqrt[n]{a}\sqrt[n]{b}=\sqrt[n]{ab}$. So the first term turns from $\sqrt[3]{x}\sqrt[3]{x^2}$ into $\sqrt[3]{x^3}$. The 3rd term is simplified likewise. The 2nd and 5th terms are left alone for now. We also have to remember to write constants out in front of each term and multiply those as we go. I have double underlined each term to make this easier to understand.

$$=\sqrt[3]{x^3}+5\sqrt[3]{x^2}-5\sqrt[3]{x^2}-25\sqrt[3]{x}+25\sqrt[3]{x}+125$$

Notice the 2nd and 3rd terms cancel each other. Likewise, the 4th and 5th terms cancel each other. (They are pairs of opposites.)

$$=\sqrt[3]{x^3}+125$$

From there, we write $\sqrt[3]{x^3}$ as simply x and we are done.

$$=x+125$$