Solution of a Cubic Equation by Successive Approximation.

What is the solubility of $PbCl_2$ in 0.10 M NaCl?

$PbCl_2$	=	Pb^{2+}	+	$2Cl^-$
--		0		0.10
--		+x		+2x
--		x		0.10 + 2x

$(0.10 + 2x)^2\ x = 1.7e\text{-}5$

Assume that $2x = 0$,

We have $x = 1.7e\text{-}3$

Plug back into original eqn.

$[0.10 + 2(1.7e\text{-}3)]^2 1.7e\text{-}3 = 1.8e\text{-}5 \neq 1.7e\text{-}5$

Won't really consider this possibility in Chem 253 but consider:

***So back to the cubic equation.

To simplify consider that solve for x:

$x = 1.7e\text{-}5/(0.10 + 2x)^2$

now let $2x = 0$

$x_1 = 1.7e\text{-}5/(0.10 + 2(0))^2 = 1.7e\text{-}3$ 1^{st} iteration
plug x_1 back into 2x

$x_2 = 1.7e\text{-}5/(0.10 + 2(1.7e\text{-}3))^2 = 1.59e\text{-}3$ 2^{nd} iteration

$x_3 = 1.7e\text{-}5/(0.10 + 2(1.59e\text{-}3))^2 = 1.60e\text{-}3$ 3^{rd} iteration

so we can get x from the cubic eqn from Newton's "Method of Successive Approximation"

$2x = 0$ fails as $K_{sp} > 1e\text{-}6$ semi-soluble salts