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Problem 8

Solve the cubic equation

$$\epsilon^2 x^3 - x^2 + x - \epsilon = 0 \; ; \qquad \epsilon \ll 1 \, ,$$

by Newton's method.

(a) First solve it only to leading order and, for each root, indicate which terms balance each other and why the remaining terms may be neglected (i.e., indicate the order of each term for a given root).

(b) Obtain, recursively (iteratively), the next order correction for each of the three roots.