Lecture 18 Review

Numerov technique for ODE solution.

Sketched numerical solution of square well potential.
Newton-Raphson Beware

Software ain’t magic...

Potential pathologies using N-R root finding technique

\[ \frac{df(x)}{dx} = 0 \]

“S”-shaped curves

...nasty...

NR solution potentially sensitive to initial guess. **Beware.** (Graph, too.)
Basic algorithm.
Start w/ $\psi_0$ and $\psi_1$ specified.

Symmetric QM wells have $\psi$’s of definite parity.
Recall, $\psi(-x) = \psi(x)$, “even” parity
$\psi(-x) = -\psi(x)$, “odd” parity

$|\psi(x)|^2$ and $|\psi(-x)|^2$ have physical significance.
$\psi$ and $\psi'$ must be continuous.

numerov.cc lets you pick parity. (By selecting sign of $\psi_1$.)
numerov.cc as coded does not check for continuity of $\psi'$. 
Numerov Technique Lab Exercise

Modify `numerov.cc`

- Limit number of possible iterations to, say, 1000. Modification should tell you if you reached this limit.

- Alter potential from a square well to a V-shaped well.

Find energy eigenvalues and eigenstates (i.e., find permissible energy levels & corresponding wavefunctions.)
Summary

Newton-Raphson warnings.

numerov.cc discussion.

Solution of triangular well via numerov.cc

Don’t suffer in silence. Scream for help!!!