# 15019455

*by* Fahad Chohan

**Submission date:** 03-Mar-2017 05:01PM (UTC+0000)
**Submission ID:** 68017234
**File name:** 15019455_2791227_696068956.ipynb (890K)
**Word count:** 0

15019455

GRADEMARK REPORT

FINAL GRADE

66/100

GENERAL COMMENTS

## Instructor

**LATE SUBMISSION - 10% penalty applied to raw grade of 76%.**
**http://www.ucl.ac.uk/srs/academic-manual/c4/failure/late-submission**

A good project with very nicely produced graphs. Some attention to detail in the physics, and much more care over the bracketing is needed.

Your introduction could have given more context - its a little abrupt. This is supposed to be like a formal report. However, your summary of the RK/secant method is very good. You should explain the initial value of phi as well as psi.

Your explanation of the details of RK method could be clearer: it might be easier with just one variable at first.

Your docstrings are generally good.

You don't need to recalculate psiN1 every time - you could set it to psiN2.

How have you chosen your energy guesses for n=1 ?

Rather than recalculate the RK solution every time you call the routine RungeKutta2d, you might store the solution once and re-use.

Using the analytical energies as input guesses for the secant method is not a general approach: how would you do this for an unknown system ?

You should explain why you have to scale some analytic solutions by -1 but not others.

The ground state for the QHO is actually n=0 (a very important point !). You should compare to the known eigenstates rather than describing the effect of the potential.

For all these extra potentials, your method to find the energy brackets is not general.

You can't say "as expected from previous knowledge" without giving some justification.

The step potential is well done.

## G/S ENERGY (15%) 10 / 10

Calculation of ground state energy

| | |
|---|---|
| 0.00 (0) | Not calculated |
| 1.00 (1) | . |
| 2.00 (2) | . |
| 3.00 (3) | . |
| 4.00 (4) | Major error in calculation that should have been spotted and corrected. |
| 5.00 (5) | . |
| 6.00 (6) | Minor error in calculation |
| 7.00 (7) | . |
| 8.00 (8) | . |
| 9.00 (9) | . |
| 10.00 (10) | Correctly calculated using Runge Kutta methods as used in previous sessions |

## G/S WAVEFN (5%) 10 / 10

Calculation of ground state wavefunction

| | |
|---|---|
| 0.00 (0) | Not calculated |
| 1.00 (1) | . |
| 2.00 (2) | . |
| 3.00 (3) | . |
| 4.00 (4) | Major error in calculation that should have been spotted and corrected. |
| 5.00 | . |

(5)

6.00 Minor error in calculation
(6)

7.00 .
(7)

8.00 .
(8)

9.00 .
(9)

10.00 Correctly calculated and normalised
(10)

G/SCOMPARISON (5%) 10 / 10

Comparison with analytical result

---

0.00 Not compared
(0)

1.00 .
(1)

2.00 .
(2)

3.00 .
(3)

4.00 Compared and found to be different, without explanation or commentary
(4)

5.00 .
(5)

6.00 .
(6)

7.00 .
(7)

8.00 .
(8)

9.00 .
(9)

10.00 Compared and verified
(10)

EXCITED STATE (10%) 7 / 10

Excited state wavefunctions and energies

---

0.00 Not calculated

| | |
|---|---|
| 0.00 (0) | |
| 1.00 (1) | . |
| 2.00 (2) | . |
| 3.00 (3) | . |
| 4.00 (4) | Major error in calculation or interpretation. |
| 5.00 (5) | . |
| 6.00 (6) | Minor error, eg valid wavefunctions but not those for n = 2, 3, 4, or minor omission |
| 7.00 (7) | . |
| 8.00 (8) | Correctly calculated, but uses known analytical values for E_n as guesses |
| 9.00 (9) | . |
| 10.00 (10) | Correctly calculated, and correctly interpreted, with an intelligent method used for initial guesses |

LARGE N STATE (2%) 7 / 10

Large n excited state

| | |
|---|---|
| 0.00 (0) | Not calculated |
| 1.00 (1) | . |
| 2.00 (2) | . |
| 3.00 (3) | . |
| 4.00 (4) | . |
| 5.00 (5) | Calculated but with errors or wrong interpretation |
| 6.00 (6) | . |
| 7.00 (7) | . |

| | |
|---|---|
| 8.00 (8) | . |
| 9.00 (9) | . |
| 10.00 (10) | At least one high-energy state calculated correctly and verified, with the value of n explicitly checked. |

HARMONIC POT (10%) 6 / 10

Harmonic embedded potential

| | |
|---|---|
| 0.00 (0) | Not calculated |
| 1.00 (1) | . |
| 2.00 (2) | . |
| 3.00 (3) | . |
| 4.00 (4) | Major error in calculation or interpretation. |
| 5.00 (5) | . |
| 6.00 (6) | Minor errors or omissions, or minor misunderstanding in the interpretation of the results |
| 7.00 (7) | . |
| 8.00 (8) | Correctly calculated for both ground state and low-lying excited states, compared qualitatively with analytical harmonic potential results. |
| 9.00 (9) | . |
| 10.00 (10) | Correctly calculated for both ground state and low-lying excited states, compared quantitatively with analytical harmonic potential results. |

FINITE SQUARE (10%) 7 / 10

Embedded finite square well

| | |
|---|---|
| 0.00 (0) | Not calculated |
| 1.00 (1) | . |
| 2.00 (2) | . |

| | |
|---|---|
| 3.00 (3) | . |
| 4.00 (4) | Major error in calculation or interpretation. |
| 5.00 (5) | . |
| 6.00 (6) | Minor errors or omissions, or minor misunderstanding in the interpretation of the results |
| 7.00 (7) | . |
| 8.00 (8) | Correctly calculated for both ground state and low-lying excited states, compared qualitatively with analytical finite square results. |
| 9.00 (9) | . |
| 10.00 (10) | Correctly calculated for both ground state and low-lying excited states, compared quantitatively with “textbook” finite square well results. |

OTHER POT (5%) 7 / 10

Other potential(s)

| | |
|---|---|
| 0.00 (0) | Not calculated |
| 1.00 (1) | . |
| 2.00 (2) | . |
| 3.00 (3) | Major error in calculation or interpretation. |
| 4.00 (4) | . |
| 5.00 (5) | Poor choice, or minor calculation / interpretation errors. |
| 6.00 (6) | . |
| 7.00 (7) | Generally sensible choice, correctly calculated and interpreted. |
| 8.00 (8) | . |
| 9.00 (9) | . |
| 10.00 | Excellent choice, correctly calculated, with a relevant, in-depth interpretation. |

(10)

## UNITS (3%) 9 / 10

| | |
|---|---|
| 0.00 (0) | No units present! |
| 1.00 (1) | . |
| 2.00 (2) | . |
| 3.00 (3) | . |
| 4.00 (4) | Most units missing /wrong |
| 5.00 (5) | . |
| 6.00 (6) | . |
| 7.00 (7) | Some units missing or wrong. |
| 8.00 (8) | . |
| 9.00 (9) | . |
| 10.00 (10) | Units are present and correct throughout in both text cells and code comments |

## PLOTS (10%) 8 / 10

| | |
|---|---|
| 0.00 (0) | No plots produced by the submitted code. |
| 1.00 (1) | . |
| 2.00 (2) | . |
| 3.00 (3) | Inadequate plots - for example, frequent missing axis labels or titles. |
| 4.00 (4) | . |
| 5.00 (5) | Most but not all requirements of the plots met - for example, occasional missing legends, or errors in the axis labels/title |

| | |
|---|---|
| 6.00 (6) | . |
| 7.00 (7) | All plot requirements met: nearly everything is clearly plotted and correctly and appropriately labelled. |
| 8.00 (8) | . |
| 9.00 (9) | . |
| 10.00 (10) | Exemplary plots throughout, aesthetically perfect, publication quality. |

CODE STYLE (5%) 7 / 10

(weighted at 5%)

| | |
|---|---|
| 0.00 (0) | Code would require significant correction before it can be run. |
| 1.00 (1) | n/a |
| 2.00 (2) | . |
| 3.00 (3) | Code has errors (requiring the marker to correct it before it can be run) - for example an undefined variable or code cells wrongly ordered. |
| 4.00 (4) | . |
| 5.00 (5) | The code runs with no errors, but is somewhat inefficient or poorly structured, or has a poor choice of variable names |
| 6.00 (6) | . |
| 7.00 (7) | Code is clear, follows best practice guidelines, with a good effort made to ensure appropriate variable names and efficiency of calculation. Runs without errors or warnings. |
| 8.00 (8) | . |
| 9.00 (9) | . |
| 10.00 (10) | Code is exceptionally clear, efficient, well-structured and follows best practice throughout. |

# COMMENTING (5%) 6 / 10

Quality of the commenting in the code cells

| | |
|---|---|
| 0.00 | No comments are included |

| | |
|---|---|
| (0) | |
| 1.00 (1) | n/a |
| 2.00 (2) | . |
| 3.00 (3) | Significant lack of useful comments in the submitted code. |
| 4.00 (4) | . |
| 5.00 (5) | Code is undercommented, unnecessarily verbose, or so unnecessarily overcommented that readability is affected. Nonetheless, the comments remain decipherable and are of some use. |
| 6.00 (6) | . |
| 7.00 (7) | Code is clearly and appropriately commented where needed. Complicated parts of code have a higher level of commenting than simpler parts. |
| 8.00 (8) | . |
| 9.00 (9) | . |
| 10.00 (10) | Exceptional level of commenting throughout the code. Clear, concise and readable throughout. |

TEXT CELLS (15%) 6 / 10

(weighted at 15%)

| | |
|---|---|
| 0.00 (0) | Text cells have not been included |
| 1.00 (1) | . |
| 2.00 (2) | . |
| 3.00 (3) | Not enough text cells included to create a self-contained document, or poor quality, for example grammatical/linguistic errors severely affecting the readability of the commentary. |
| 4.00 (4) | . |
| 5.00 (5) | Acceptable commentary, but needs expansion. |
| 6.00 (6) | . |

| | |
|---|---|
| 7.00<br>(7) | Good commentary resulting in a clear, self-contained document. Text cells consist of complete, well-structured and grammatical paragraphs. It is clear what the student is calculating, how they are going about it, and why they are doing it. A clear understanding of the physics of the problem is demonstrated. |
| 8.00<br>(8) | . |
| 9.00<br>(9) | . |
| 10.00<br>(10) | Exceptional quality of the text commentary, resulting in an exemplary, self-contained document. Results are fully discussed, showing an excellent understanding of the physics. |