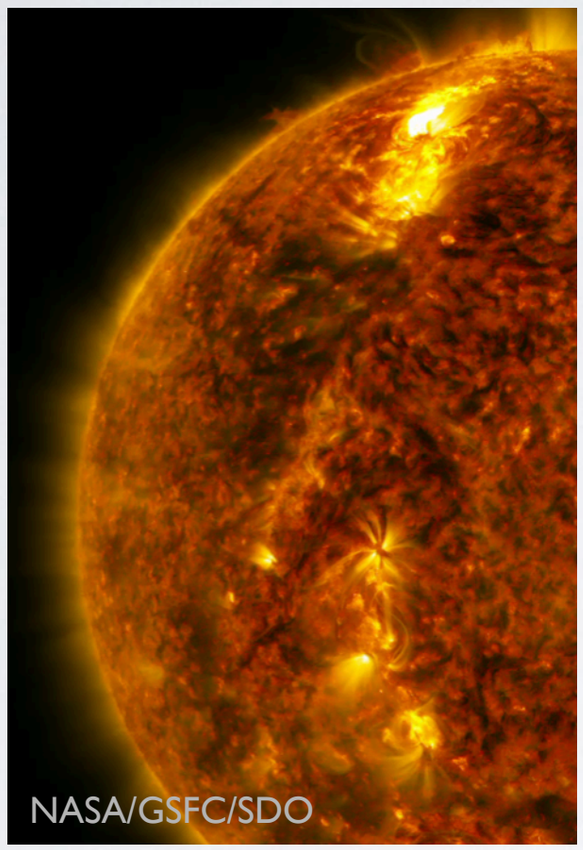
Week 2 - #1

Newtonian Mechanics — Single Particle (II)


NASA/GSFC/SDO


SpaceX Falcon 9 Rocket Launch

Today: Ch 2.5-2.7

Next Class: Ch 3.1-3.5

Ji-hoon Kim (Seoul National University)

Classical Mechanics I (Spring 2026): Quiz #2

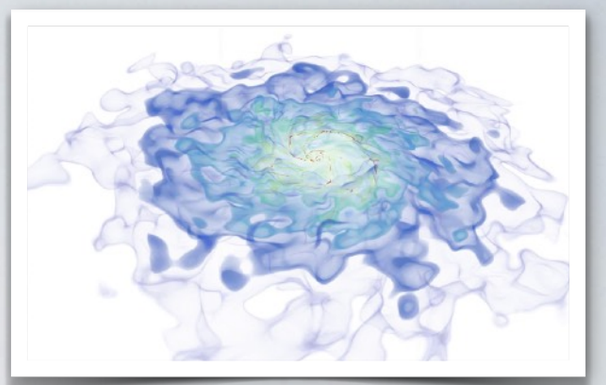
— [open book and open note, but no cellphone or laptop, drop it off as you leave the class] —

Please write down your name and student ID in the top right corner. (0.0 pt: no paper found with your name / 0.5 pt: paper found with your name and some answers / 1.0 pt: good answers)

1. Thornton & Marion, Problem 2-39
2. Thornton & Marion, Problem 2-43
3. What do you mean by “stability” or “being stable” in physics?

2-39. A boat with initial speed v_0 is launched on a lake. The boat is slowed by the water by a force $F = -\alpha e^{\beta v}$. **(a)** Find an expression for the speed $v(t)$. **(b)** Find the time and **(c)** distance for the boat to stop.

2-43. A particle is under the influence of a force $F = -kx + kx^3/\alpha^2$, where k and α are constants and k is positive. Determine $U(x)$ and discuss the motion. What happens when $E = (1/4)k\alpha^2$? ($U(x)$ is the potential energy.)

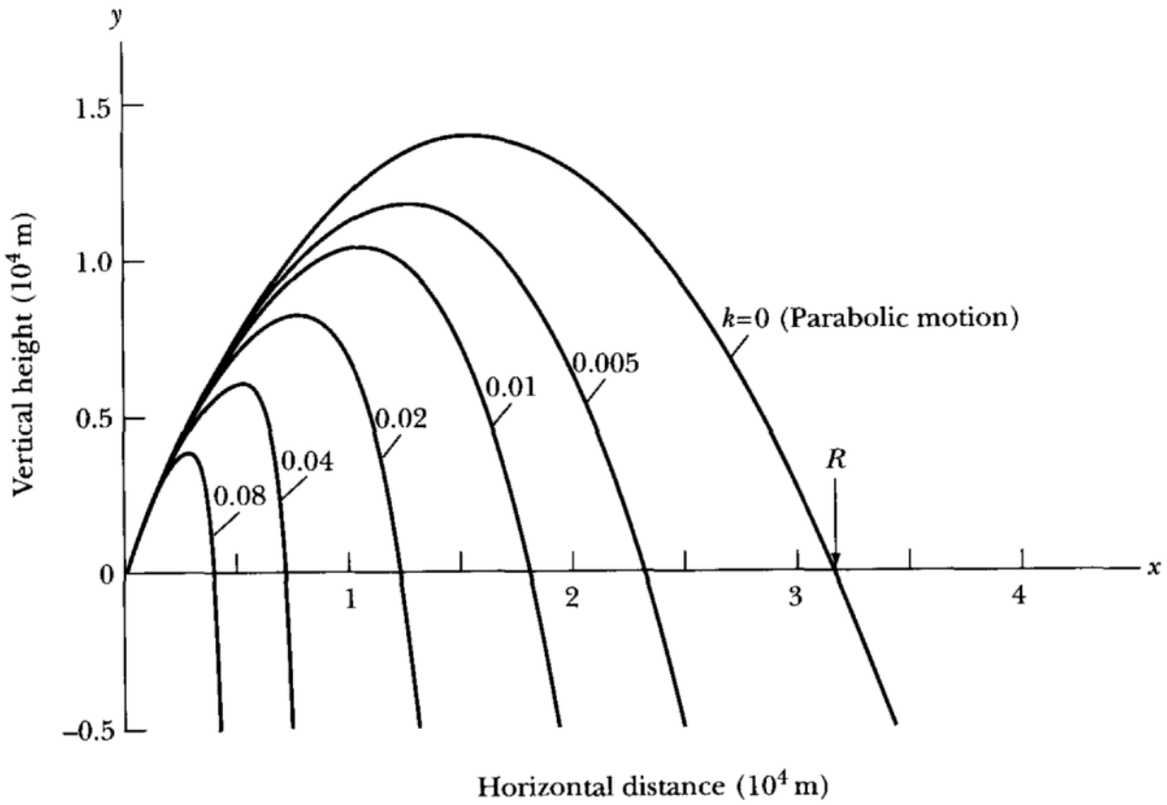


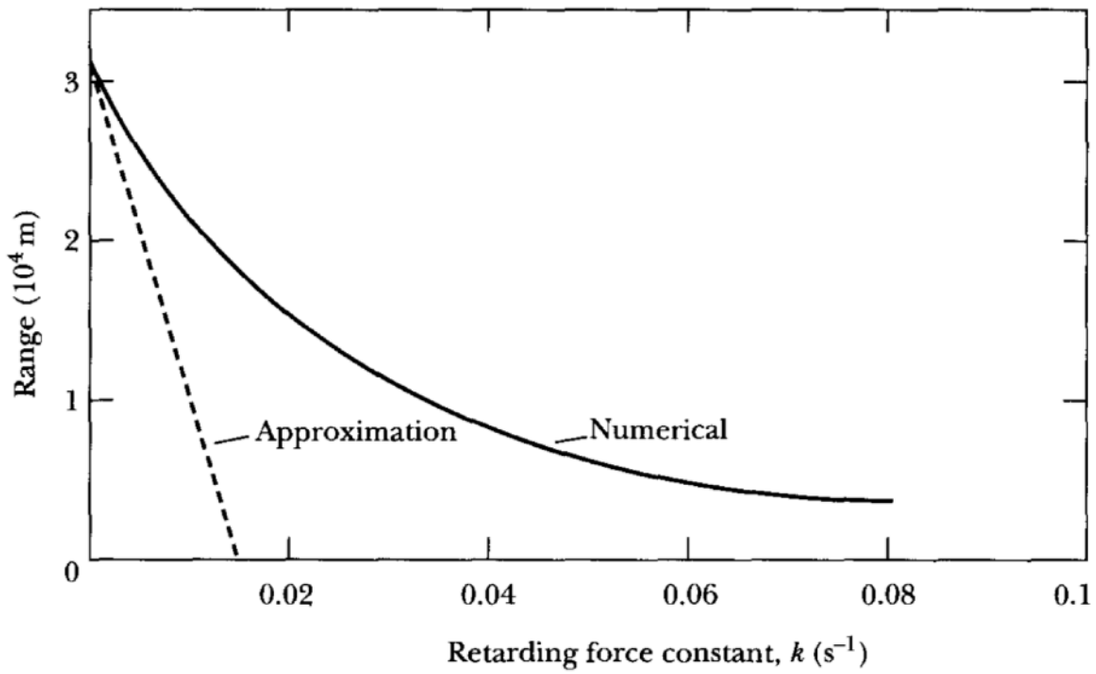
Using Computers As A Future Physicist or Astrophysicist

Numerical Problems

- Tools you may want to try for your numerical problems:

  Matlab, Mathematica, Mathcad, Wolfram Alpha, Python, etc.





Thornton & Marion Figs. 2-8, 2-9

Numerical Problems

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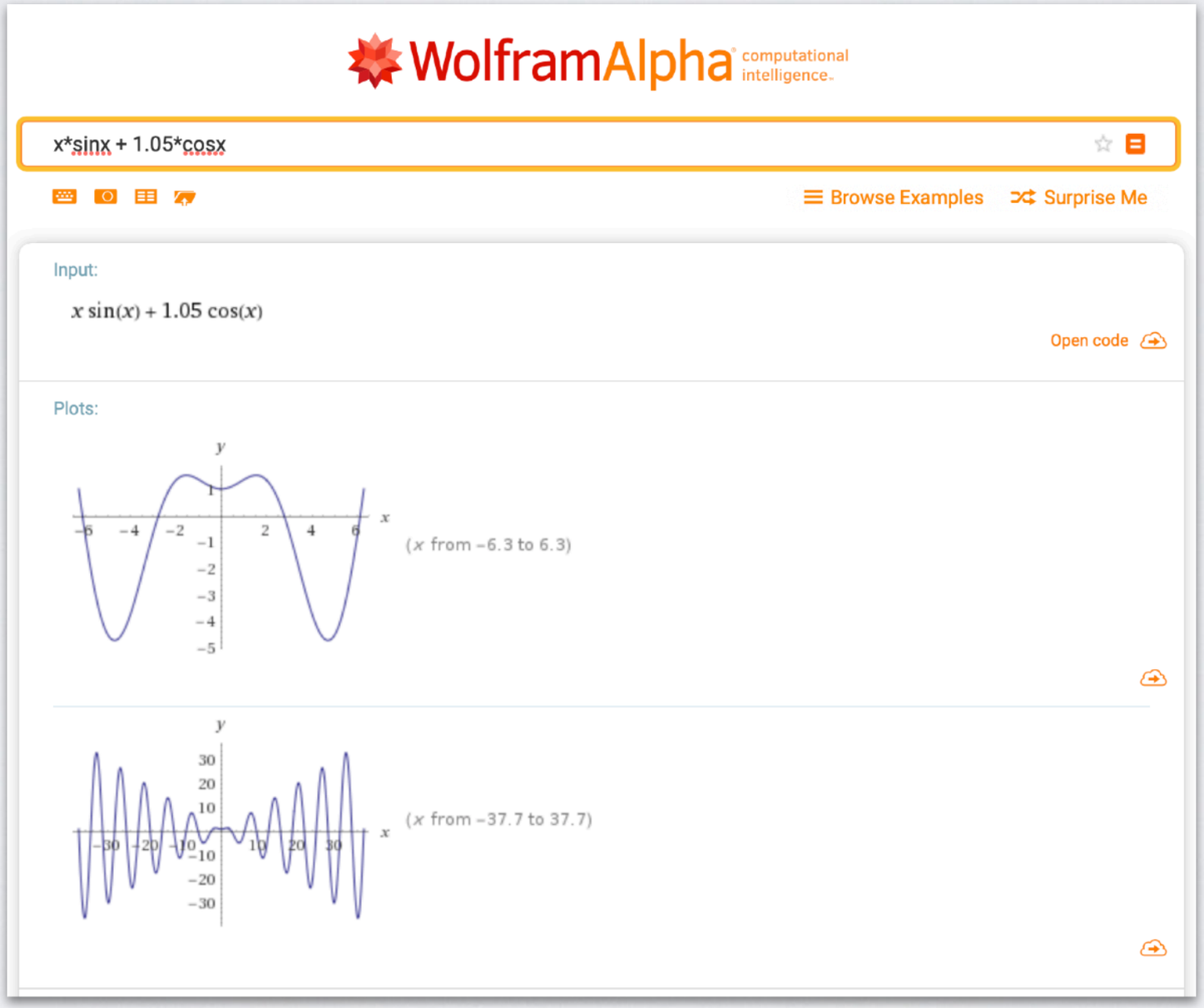


Taylor Series Using A Computer

WolframAlpha computational intelligence

taylor expand e^x cosx

Extended Keyboard Upload Examples Random

Input interpretation:

series $e^x \cos(x)$

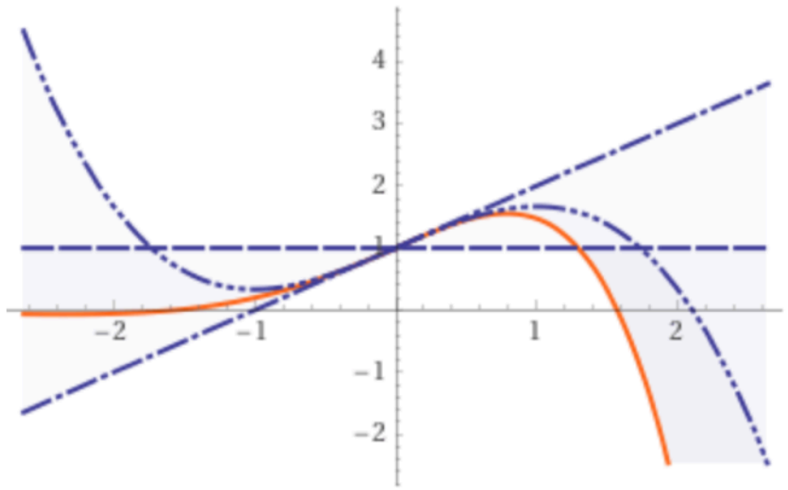
Series expansion at x = 0: Fewer terms More terms

$$1 + x - \frac{x^3}{3} - \frac{x^4}{6} - \frac{x^5}{30} + \frac{x^7}{630} + \frac{x^8}{2520} + \frac{x^9}{22\,680} - \frac{x^{11}}{1\,247\,400} + O(x^{12})$$

(Taylor series)

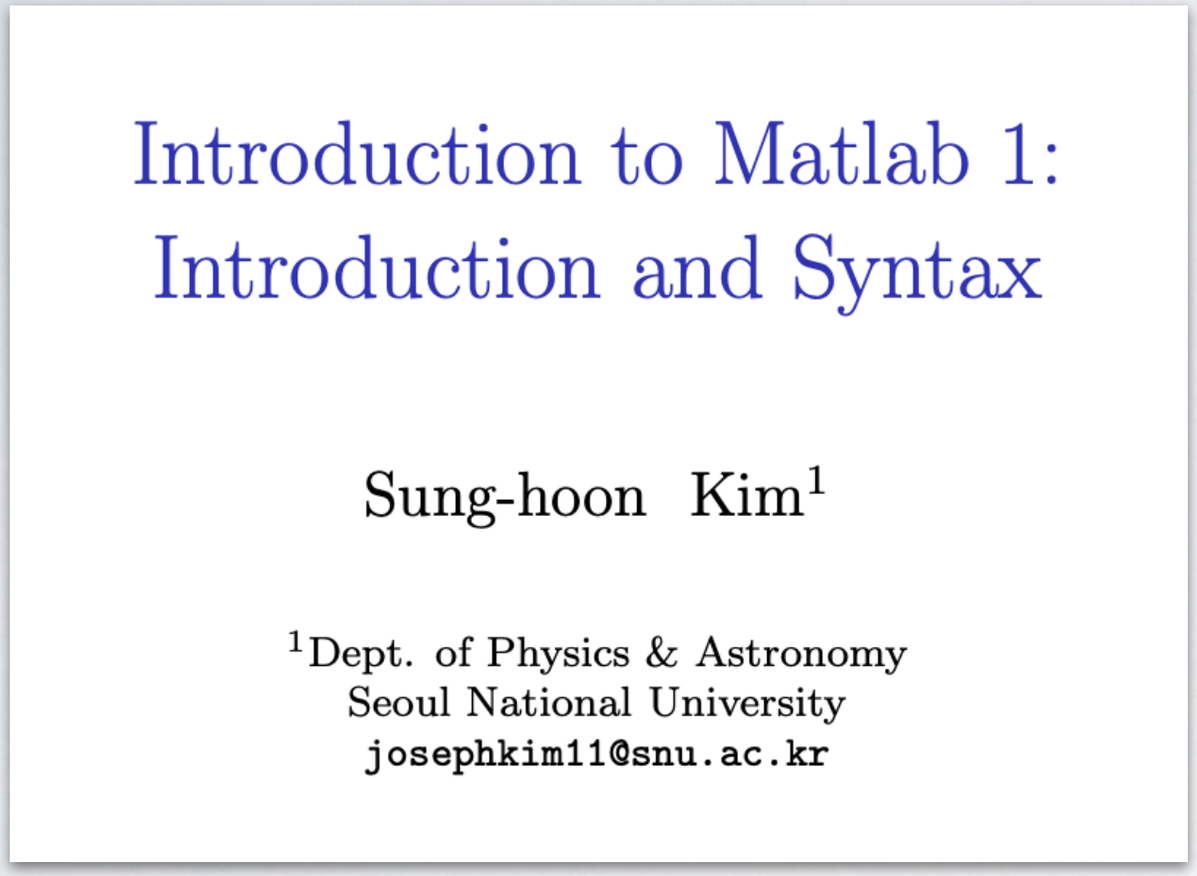
(converges everywhere)

Approximations about x = 0 up to order 3:



(order *n* approximation shown with *n* dots)

Exercise Classes



Introduction to Matlab 1:
Introduction and Syntax

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- Topics (subject to change):

1. Introduction and Syntax: installation, interface, variables, data types, operations
2. Graphics: 2D plot, 3D plot
3. Programming: functions, flow control
4. Mathematics & Tips: linear algebra, ODE

- The slides "MATLAB for Classical Mechanics" covered in the first 4 weeks of the exercise classes in Classical Mechanics 1 (2020) have been posted on ETL for you to review.