

Challenging (physics) students

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"Where will we need this?" "How can we apply this?"

Understanding of mathematical methods

Relation between different mathematical concepts

Connections with everyday experience and physical questions Curious and creative mindset. Rigorous and consistent approach

Limits → Derivatives → Differential equations → Laplace transform → Complex numbers → Residues

- Why the sky is blue?
- Why grass is green?
- What color is the Sun? (Hint: it is not orange.)
- Why a rainbow happens? Estimate the diameter of the Sun.

Example: a mathematical pendulum

Describe the motion of a mathematical pendulum. Consider small angles and simplify the equations of motion. Make an experiment and compare its outcomes with the theoretical predictions.

Theoretical part

- 1. What is a pendulum?
- 2. What are the physical assumptions used?
- 3. How to describe the pendulum's motion?
- 4. How to solve this equation?
- 5. How can we simplify it?
- 6. What parameters are required for the numerical analysis?
- 7. What outputs can we measure?

Experimental part

- 1. How to make a pendulum at home?
- 2. How to measure its length without a ruler?
- 3. How to count time?
- 4. How to improve the accuracy of these measurements?
- 5. What conclusions can we make?

Thank you!