QUANTITATIVE SPREADSHEET MODELING: SOLVES THE PROBLEMS OF STEM EDUCATION

SOLVING NON-UNIFORM ACCELERATION AND VELOCITY DEPENDENT FORCES IN ALGEBRA BASED PHYSICS WITH NUMERICAL METHODS

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WHAT I DO:

- Education: Lafayette College ('04), BS Chemical Engineering
- Cinnaminson High School (NJ)
  - Physics (AP C, AP 1, College Prep)
  - Chemistry / Physical Science / Engineering & Design
- Lindenwold High School (NJ)
- Camden County College (NJ)
  - Adjunct Professor, Physics for Non-Science Majors/Automotive Certification Program

WHAT I DID (2019-2020)

- Spreadsheet Lab Manual LLC (SLM)
  - President and Founder, Spreadsheet Model Innovator, Author, SLM Workshop Provider, Instructional Resource Vendor

WHY SPREADSHEETS?

- **Students NEED fluency for their future**
  - Colleges assume literacy
  - Business and Industry
    - Fluency – Necessary
    - Lack of Familiarity – Disqualifier
- VALUE ADDED to content modeling

WHY SPREADSHEETS?

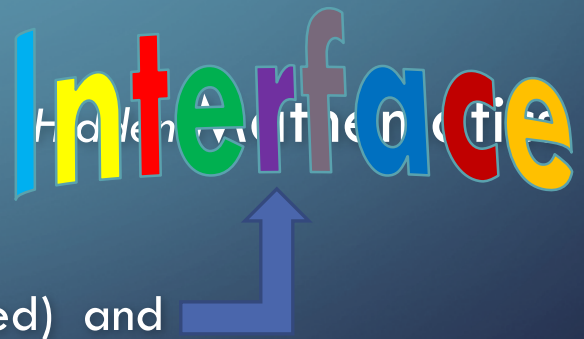
- 1,000,000,000 X more calculation power
  - Solve problems in ways previously never considered
- Blank Canvas: Programmable Computer Interface
- STEM Quantitative Analysis done more efficiently

  (just like everything else)
- Universally available, standardized, baseline familiarity
- Free Access is the New Normal for schools

WHY NOT ANOTHER PROGRAM?

Education/Task Specific Software

- **Adds Limitations and Cost**
  - **Not** a future **NEED**
  - Learning Hurdles = Lost Instructional Time
  - Less Versatile
  - License + Renewal Costs
  - Surrender Academic Freedom (preprogrammed) and



IDEAL ALGEBRAIC PHYSICS EQUATIONS ARE SINGLE STEPS IN NUMERICAL SOLUTIONS!

- $V_F = V_I + a_{inst}t$ Euler's Method, (Integrates Acceleration to get Velocity)
- $X_F = X_I + V_{inst}t$ Euler's Method, (Integrates Velocity to get position)

- $\Delta X = V_{ave}*t = (V_I + V_F)/2*t$ (Trapezoid Rule)
- $\Delta V = A_{ave}*t = (V_I + V_F)/2*t$ (Trapezoid Rule)

- $F_{drag} = dAV^2$ Velocity Dependent Force
- $F_{net} = ma$ Differential Equation

EXAMPLES:

- Terminal Velocity – Free Fall with Drag Force
- Comparing Trajectories – Projectile Motion with Drag Force

OTHER EXAMPLES: *SPREADSHEET LAB MANUAL©*

TO DOWNLOAD LIST OF ACTIVITIES AND DESCRIPTIONS [CLICK HERE]

- Vectors
- Rockets
- Gravitation
- Electrostatics
- Angular Motion in Cars
- Electric Currents
- Newton's Law of Cooling
- Buoyancy in Gases
- Gas Laws, Kinetic Theory
- Superposition of Waves

Spreadsheet Lab Manual LLC

NGSS aligned before NGSS was even written (2009)

- Infuse spreadsheet modeling into the entire high school STEM curriculum
  - Physics, Chemistry, Biology, Earth/Environmental, Algebra, Geometry, PreCalc/Trig, Prob/Stat
  - Classroom-ready instructional experiences that are highly differentiable and NGSS aligned
- Provide differentiated teacher workshops to teachers of all disciplines
  - Add future work skills to the content experience that give students an advantage
  - Enhance content with the computational power of the spreadsheet
- Funding Support Pending: NSF SBIR: Educational Applications

Get your students and colleagues a head start with this blossoming methodology before you have to get them caught up.

THANK YOU!!!