Math in Video Games

By Cloudy Heaven Games

What I Do and Why It's Fun!

- I am an independent video game developer!
  - Mostly casual games, but have some big plans…
- Also tutor and teach programming and game development
  - Lots of writing and presenting
- Best part?
  - Using my imagination to develop fun ideas
  - Satisfaction of writing code that brings ideas to life
  - Going to game conventions and events
  - Helping students by using their favorite games
  - Talking and writing about MY favorite games!

Educational Path

- High school
  - Programming and AP Computer Science
  - Lots of science and math courses (including physics, trigonometry, calculus)
  - History and English (!!!)
- College
  - Computer Science and East Asian Studies
    - Japanese language and culture!
    - More math and programming!
  - Game and Simulation Programming
    - Game art and sound
    - Game design (game mechanics, level design, difficulty balancing)

Career Path

- Serious Games Internship
  - Ballistics demo
    - Lots of parabolas/curves (physics, algebra, precalculus)
    - Similar to Angry Birds, but was an isometric, angled top-down view
    - Calculus in Angry Birds or Projectile Motion in 4 Minutes or Less
- Software Developer and Tester
  - Online courses: arithmetic to calculate passing test scores
  - Fetching information from databases: Set theory and Venn diagrams
    - Example of a Venn Diagram
  - All aspects of programming: Boolean algebra and logic

Career Path: My Own Games!

- Continued working on games while working full time
- Released my first game in 2014
- Example game: Brain Bouncer
  - Gameplay video

Brain Bouncer

- Angles (geometry and trigonometry)
- Object position (x and y coordinates)
- Object motion
  - Adding/subtracting x and y values
  - Velocity (vectors, time, speed)
- Collision detections
  - Point and shape intersections
- Scoring
  - Number of bounces
  - Number of stars

What About Other Games?

- 3D Games (*Elder Scrolls, Fallout, Call of Duty,* etc)
  - Camera position and object movement use linear algebra and matrices (3D coordinate systems)
- Platformer Games (*Super Mario Brothers, Sonic the Hedgehog*)
  - Surface types use different amounts of friction (ice is more slippery, oil or sand can be sticky, water impedes movement)
  - Jumps and falls use gravity
  - Walking up slopes and inclines
- Role-playing Games (*Elder Scrolls*, *Final Fantasy, Fire Emblem*)
  - Character stats
  - Attack and defense power
  - Probability of enemy encounters and random item drops
  - Level-based attacks (only attack characters with levels that are a multiple of 3, for example)

Conclusion

- Games need math!!!
- Any questions?