Exponential Motion!

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http://merg.umassd.edu
http://simcalc.umassd.edu
Democratizing Access

- Mathematical alienation
- Motivation repressed via opaque classroom objectives
- Curriculum restrictions
- Classroom participation is an expectation rather than a phenomenological artifact of productive learning
SimCalc MathWorlds

- Dynamic interactive representations that are linked, e.g. edit a position function and automatically see velocity graphs update
- Graphically and algebraically editable functions
- Import motion data and re-animate (CBR & CBL2)
- SimCalc is analyzing the mathematics of variation
- Simulations are at the heart of SimCalc - *executable representations* (Moreno, 2001)
Making Activities About Something
Discussion

- What is Exponential Change?
Discussion

- What about an exponential change, is exponential?
Discussion

- What kinds of exponential phenomena are out there?
Exponential Phenomena?

- Projectile Motion
- Splitting Atoms
- Accumulation at Constant Rate
- Friction vs. Force
- Population Growth
Exponential Phenomena?

- Gravity acting on a ball?
- How many atoms split?
- What is constant rate?
- Static and kinetic?
- How do we model population?
SimCalc MathWorlds!

- SimCalc MathWorlds for Computer
- SimCalc MathWorlds for Calculator
  - 73
  - 83/84 Families
  - Voyage 200
- SimCalc Connected MathWorlds
Activity Time

- Piecewise Approximation
- Growth
- Interest Model
The Exponential Function

\[ y = e^{mx} \]
The Exponential Function

- What do we see?
  - In the plot
- What does $m$ mean?
  - Compared to what we did?
From Here to There

\[ y = e^{mx} \]

\[ y = 1.5^x \]
Natural Log and $e$

$$y = 1.5^x$$

$$y = e^{\ln(1.5) \cdot x}$$
And Now Compare

- How does our exponential compare with what we’re seeing here on the screen?
- How can we tell?
  - What can we do with the software to help us figure this out?
Understanding Exponential Functions

- What Account has more money?
- What Account will get more money?
- What Account would you pick?
Understanding Exponential Functions

- What are the properties of Exponential Functions and Curves?
Growth?

- How do we define growth?

\[ f(x) = e^{mx} \]

- How do we define decay?
A New Activity

- Our friend Zeno wants to visit his friend Onez. Onez is 100 meters away from Zeno. Every minute Zeno walks half as far as he did the last minute. When will Zeno reach Onez?
- What will his motion look like?
The New Activity

- What’s another name for how to define this function?
  - Recursion!
Exponential Decay

- Radioactive Half-life
- Cooling
- Atmospheric Pressure vs. Altitude
Thank You!

- Thank you for attending our workshop here at NCTM in Atlanta, Georgia!