Title: Dangerous Curves: How I Learned To Stop Worrying and Love the Calculus

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Abstract: Based on her book, The Calculus Diaries, join, Jennifer Ouellette as she shows how calculus can be applied to everything from gas mileage, diet, the rides at Disneyland, surfing in Hawaii, shooting craps in Vegas and warding off zombies. Even the mathematically challenged, can-and-should learn the fundamentals of the universal language.
DANGEROUS CURVES

How I Learned To Stop Worrying and Love the Calculus
This was me:
Math is All Around Us

Calculus = change and motion
Math Can Reveal Hidden Truths

EG: Objects fall at same rate, regardless of mass

\[ g = \frac{GM}{r^2} \]
Archimedes and Problem of Curves
Vdara Hotel a Giant Death Ray

South side of property

The solar reflection covers an approximate 10 foot by 15 foot area, which moves as the Earth rotates.
Roman Contribution to Math
While Rome Fiddled, Arab World Flourished in Art, Math, Science

Ibn Al-Khwarizmi invents algebra
A Match Made in Heaven

Fermat and Descartes merge geometry, algebra
Of Curves and Calculus

Curves are geometry in motion! EG: Apple falling from a tree = parabola!
Planets Have Elliptical Orbits
Curves = “Faces” of Functions

\[ f(x) = ae^{-x^2} \]
What is a function?

Every possible point on a curve taken together forms the function

Greater than sum of its parts: predictive model!
Math Can Model Our World
Tower of Terror = Parabola!

Plot change in position as a function of time = a parabola.
This is the “position function: $h(t) = -16t^2 + 200$.

But what if we want to know how fast we’re moving at any given point? We need a “velocity function”! We can take a derivative to find it: $v = at$. 

![Image of Hollywood Tower Hotel and a parabola graph]
Fun with Space Mountain

Double integral of acceleration = position

BEHOLD THE POWER OF THE FUNCTION
Calculus in the Real World

Vectors and Mad Teacup Ride at Disneyland
Calculus in the Real World

Comparison shopping = multivariable optimization problem (eg, house hunting)
Calculus in the Real World

Wave dynamics = sine waves/Fourier transform
Calculus in the Real World

St. Louis Arch = catenary curve

\[ f(x) = \cosh x = \frac{e^x + e^{-x}}{2} \]

\[ y = 693.8597 - 68.72 \cosh (0.018335x) \]
Calculus in the Real World

Cooling cup of coffee, rate at which wet clothing dries = exponential decay
Calculus in the Real World

Exercise = integrating rate of calories burned to get total calories expended
Oh Yeah: About Those Zombies:
Doing the Math:

\[ S \rightarrow \alpha \text{ humans born each time period} \]
\[ S \rightarrow \beta \text{ humans become zombies each time period} \]
\[ S \rightarrow \delta \text{ humans die each time period} \]
\[ Z \rightarrow \alpha \text{ zombies become dead each time period} \]
\[ R \rightarrow \beta \text{ zombies each time period} \]
“Time To Nut Up or Shut Up!”
CAVEAT: People Don’t Act Rationally

“Corrupted Blood” outbreak/World of Warcraft
“Ancora Imparo”

YOU MESS WITH
CALCULUS,
YOU MESS WITH
ME
No, Really... Why Should I Care About Math?
Shameless Self-Promotion

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