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# Professional Development Webinars

# Calculus: Getting It Straight – Differentiability as Local Linearity

**Fall 2018**

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# Moderator Bio

## Mike Houston

**T³ National Instructor**
**Riverside High School**
**Ellwood City, PA**

Mike is in his fourteenth year of teaching high school mathematics in Ellwood City, PA. While participating in a TI-Navigator™ Fast-Track in 2007, he learned how technology can effectively cultivate students' wide range of learning styles. During this time, Mike has served as a T³ National Instructor and a contributing author for MathForward™.

# Panelists' Bios

## Tom Dick

**T³ Senior Math Advisor**

**Corvallis, OR**

Tom Dick is a Professor and former Chair of the Math Department of Oregon State Univ. He has served on the Editorial Panels for the *Journal for Research in Mathematics Education* and the *Mathematics Teacher Educator*. He remains active in the College Board's Advanced Placement Calculus Program and has previously served as Chair of the AP* Calculus Test Development Committee.

## Dan Kennedy

**T³ Regional Instructor**

**Tucson, AZ**

Dan began teaching 30+ years ago teaching calculus in Mali, West Africa. For the past 20 years, he has taught all levels of math and various sciences to a diverse population of students in Tucson, AZ. In addition to his classroom responsibilities of physics and AP* Calculus, his school and district have given him the added responsibility of acting as a TTL (Teacher Technology Liaison).

# Agenda

- Welcome & Introductions
- Learning outcomes
- Getting it straight - the Idea of Local Linearity
  - Work of David Tall
- Understanding L'Hopital's rule through local linearity
- First (derivative) principles:
  - Difference quotients, approximating derivatives from a table of values
- Slope fields

# Expected Outcomes:

- **Explore** differentiability in terms of local linearity
- **Discuss** when the tangent line really is the *best* linear approximation
- **Explore** why L'Hopital's Rule makes sense through local linearity
- **Analyze** some applications of approximating derivatives
- **Examine** how slope fields make use of local linearity

# What is local linearity?

Differentiable functions have the property that “up close” their graphs look straight. In other words, a function that is differentiable at a point behaves approximately like a linear function on a small interval containing that point.

This manifests itself on a graphing calculator in a striking, yet simple way - the more we zoom in on a differentiable function, the straighter its graph appears.

David Tall called this profound property a “cognitive root” for the mathematical idea of differentiability, meaning that it is “an anchoring concept which the learner finds easy to comprehend, yet forms a basis on which a theory may be built.”

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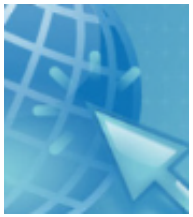

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# Thank you!

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