What is Calculus?

ID: 12727

Time Required
20 minutes

Activity Overview

Students will explore the major concepts of calculus. Students will answer self-check questions and investigate animations in this introduction and overview of calculus. Students will get the big picture of what calculus is about and its various applications.

Topic: Introduction and Overview of Calculus

- *Introduce concepts of limit, derivative and integral.*
- *Brief historical background of calculus and its application.*

Teacher Preparation and Notes

- *This activity is designed to be a student-centered activity to begin the year of calculus. It can also be used toward the end of the year in precalculus as a preview for what is to come next year. Teachers could also use the animations with their software and computer projection system to introduce the key concepts of calculus.*
- *On self-check questions, students can get immediate feedback by selecting* menu ***Check Answer*** *(or by pressing* ctrl *+ ▲). With TI-Nspire Teacher software, teachers can change self-check questions to exam mode so students cannot check their answer. On any question, click the Teacher Tool Palette and select Question Properties. Change the Document Type from Self-Check to Exam. Also, teachers should use the Teacher Software in TI-SmartView Emulator view so the answers do not show as they would if the left panel was in Document Tools.*
- ***To download the student TI-Nspire document (.tns file) and student worksheet, go to education.ti.com/exchange and enter "12727" in the keyword search box.***

Associated Materials

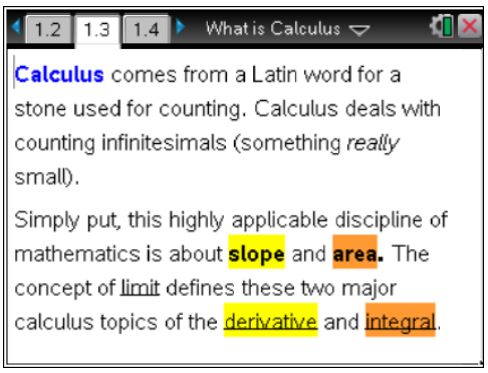
- *WhatIsCalculus_Student.doc*
- *WhatIsCalculus.tns*

Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *Local Linearity Discovery (TI-Nspire technology) — 10890*
- *The Open Box: An Exploration of Maximum Volume (TI-Nspire technology) — 12877*
- *Limits of Functions (TI-Nspire technology) — 16067*
- *Basic Limits (TI-Nspire technology) — 16069*

Part 1 – Introduction & Limits



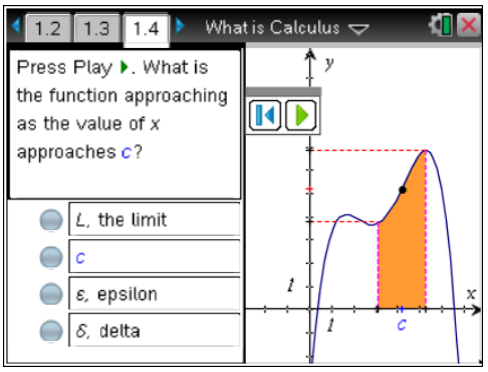
Students will read and answer questions in the TI-Nspire document to become introduced to the major concepts of calculus. The activity begins with an overview and then transitions to limits.

Student Solutions

1. Students may have heard a variety of things about calculus, some true and others not so much. This question can be helpful to identify and correct misconceptions.

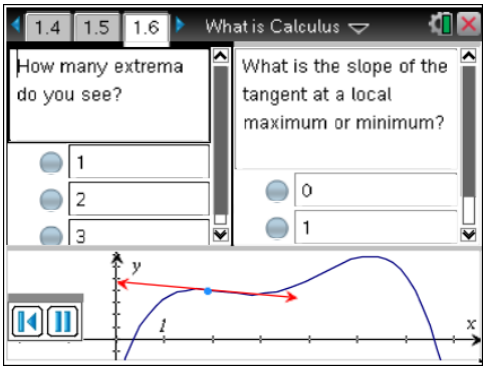
2. The three major concepts of calculus are the limit, the derivative, and the integral.

3. The value of $f(x)$ appears to be getting close to L. L is the limit of $f(x)$ as x approaches c.



On page 1.4, epsilon and delta are provided as choices. Students may think those are odd answer options since they are no mentioned anywhere. The more often students see or hear terminology, the easier it is to accept it and remember it later. Teachers can return to this animation later and add delta/epsilon labels. As the animation progresses, L will appear.

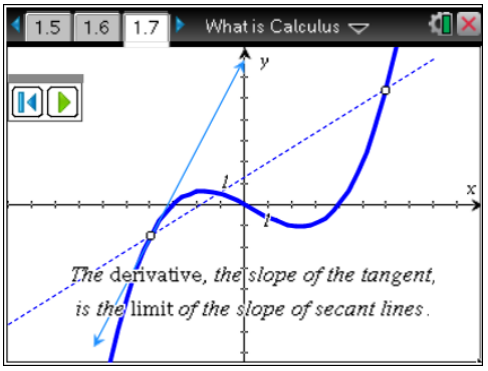
Part 2 – Derivatives & Optimization



Page 1.5 transitions to the concept of the derivative. Important calculus terminology is used, including extrema, maxima, minima, neighborhood, and local max and min. Students can answer self-check questions similar to those on the student worksheet.

On page 1.6, the point of tangency can be grabbed and moved to more closely investigate the slope and the maximum and minimum values. Press ctrl + ☜ or press and hold ☜ to grab a point.

Student Solutions



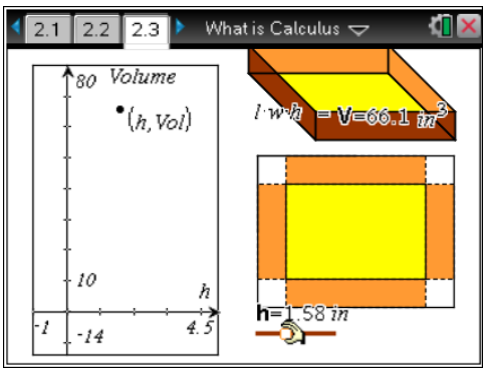
4. An extrema is a maximum or minimum value.

5. This 4th degree polynomial has 3 extrema.

6. The slope of the tangent at a max or min is zero.

7. The derivative, the slope of the tangent, is defined as the limit of the slope of secant lines.

8. a. The approximate maximum volume is 66.1 in^3 when the height *h* is 1.58 in.



Discussion Question

- *Can students determine what the original dimensions of the rectangle?* [8.5 in × 11 in]

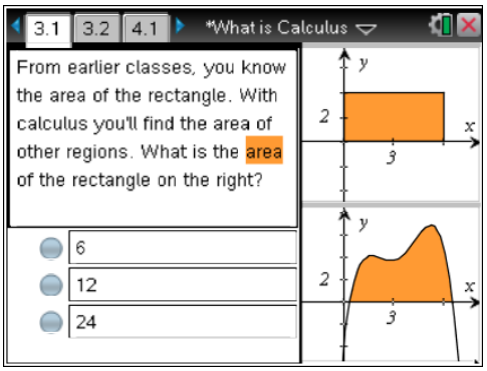
8. b. With calculus, the exact maximum can be found by finding the derivative and setting it equal to zero.

Part 3 – Integrals & History

Finally the area under the curve is introduced and applications to the Fundamental Theorem of Calculus are discussed.

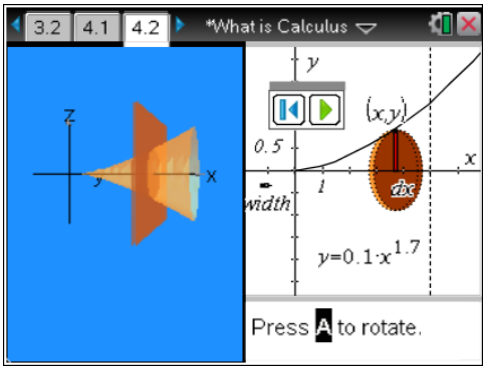
Student Solutions

9. The rectangle has an area of 24.



Discussion Question

- *How does this compare with the size of the definite integral?* [It is similar. The integral is actually about 27.]



10. The volume is found by rotating the function about *y* = 0, or the *x*-axis.

11. Newton and Leibniz independently co-discovered calculus.

12. Sample answer: Limit is what the function is close to when the *x*-value gets close to *c*. The derivative is the slope of the tangent and has to do with rate of change. The integral is the sum of infinitesimals and is related to the area of under the curve.