Xtreme Calculus: Part I

ID: 11406

Time Required
10–15 minutes

Activity Overview

In this activity, students will explore relative maximums and minimums by dragging a tangent line to a curve and making observations about the slope of the tangent line.

Topic: Relative Extrema: Part I

- *Relative Minimum*
- *Relative Maximum*
- *Critical Numbers*

Teacher Preparation and Notes

- *Students will write their responses directly into the TI-Nspire handheld, or they can complete the accompanying student worksheet.*
- *Students should know that f'(x) refers to the slope of the tangent line to f at a given x-value.*
- *This activity uses the new question features. The teacher may check the answers by selecting the green check icon. The teacher may also clear the answers by selecting the pencil eraser icon.*
- *Notes for using the TI-Nspire™ Navigator™ System are included throughout the activity. The use of the Navigator System is not necessary for completion of this activity.*
- ***To download the student TI-Nspire document (.tns file) and student worksheet, go to education.ti.com/exchange and enter "11406" in the quick search box.***

Associated Materials

- *XtremeCalculusPart1.tns*
- *XtremeCalculusPart1_Soln.tns*
- *XtremeCalculusPart1_Student.doc*

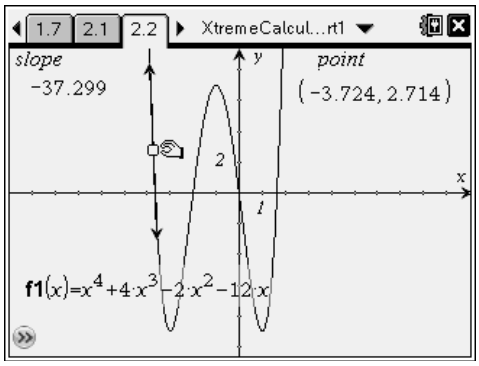
Suggested Related Activities

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

- *Derivative Trace (TI-Nspire Technology) — 8110*
- *Extrema (TI-Nspire Technology) — 9414*
- *Graphical Derivatives (TI-Nspire Technology) — 8499*

On pages 1.4–1.7, students will learn the definitions of the terms *relative maximum*, *relative minimum*, *relative extreme value*, and *critical numbers*. Students will need to know these definitions to successfully complete this activity.

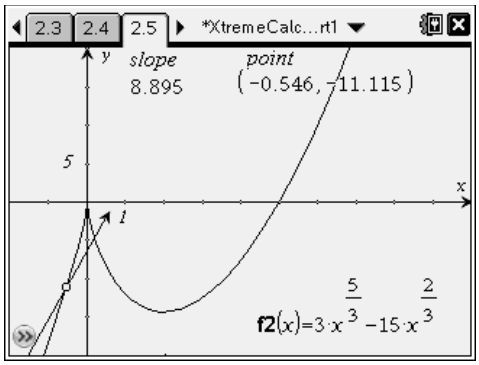
On page 2.2, students are asked to drag the tangent line along the given function, observe the slope of the tangent line, and determine the critical number(s) of the function. To drag the tangent line, move the cursor over the point of tangency until the point begins to flash. Press and hold the click key ( ) until the hand grabs the point. Then, use the NavPad to drag the tangent line along the function. Students should be able to determine the critical numbers of this function and whether there is a relative minimum or a relative maximum at each critical point.



TI-Nspire Navigator Opportunity: *Screen Capture*

See Note 1 at the end of this lesson.

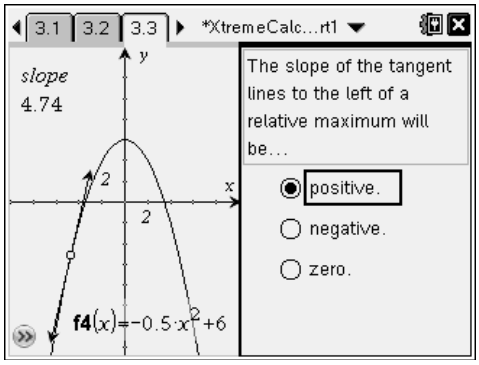
Students will repeat this process for two other functions. Students will determine that an extreme value does not occur at every critical number.



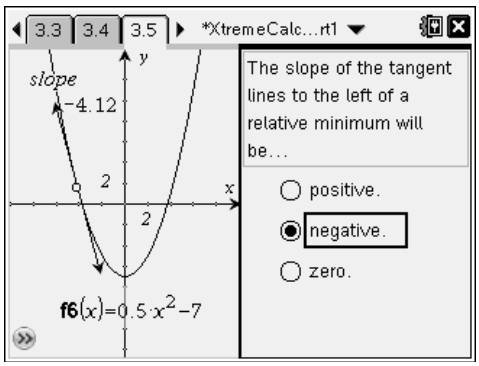
Student Solutions

1. $x = -3, -1, 1$
2. a relative extreme value
3. $x = 0, 2$
4. a relative extreme value
5. $x = 1$
6. a plateau
7. No

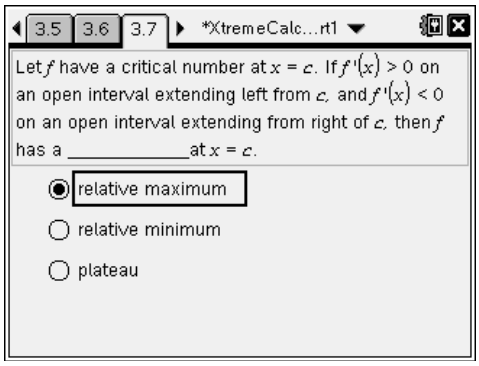
On page 3.3, students are asked to examine the correlation of the slope of the tangent line and the location of the point of tangency in reference to the relative maximum. Students should observe that the slope of the tangent line is positive when the point of tangency is to the left of the relative maximum and negative when the point of tangency is to the right of the relative maximum.



On page 3.5, students are asked to again examine the correlation of the slope and the location of the point of tangency, but this time, they are looking at a relative minimum. Students should observe that the slope of the tangent line is negative when the point of tangency is to the left of the relative minimum and positive when the point of tangency is to the right of the relative minimum.



Students are asked to sum up their observations by filling in a few fill-in-the-blank questions.



Student Solutions

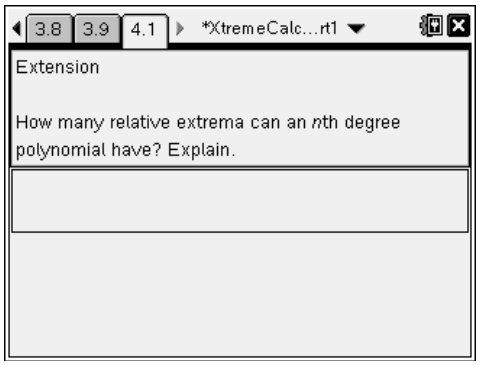
8. positive
9. negative
10. negative
11. positive
12. relative maximum
13. relative minimum
14. plateau

TI-Nspire Navigator Opportunity: *Quick Poll*

See Note 2 at the end of this lesson.

Extension

Students are asked how many extrema an *n*th degree polynomial can have. They are also asked to explain their answer.



Student Solution

15. $n - 1$. An nth degree polynomial can only change from increasing to decreasing or vice versa $n - 1$ number of times.

TI-Nspire Navigator Opportunities

Note 1
Problem 2, *Screen Capture*
This would be a good place to do a screen capture to verify students are able to drag the point. You may choose to use this to lead to a discussion of the critical point and the slope to the left and right of this point.

Note 2
Problem 3, *Quick Poll*
You may choose to use Quick Poll to assess student understanding. The worksheet questions can be used as a guide for possible questions to ask.