Math Objectives

- Students will explore the slope of secant lines as the line becomes tangent to the curve.

Activity Type

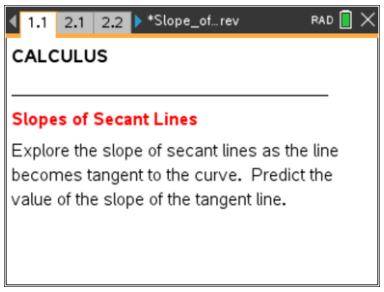
- Student Exploration

About the Lesson

- Students will collect data about the slope of a secant line and then predict the value of the slope of the tangent line by examining the table of collected values.

Directions

- Grab the open circle by pressing ctrl. Move the open circle point on the *x*-axis toward the solid black point on the curve**. At each step the file is set up to capture the value of the slope of the secant line.** Determine the value of the slope of the tangent line by examining the list of slopes on the subsequent page.
- The problems for the students are given on the next pages. The problem number refers to the page of the .tns file where the problem is located.



TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Grab and drag a point

Tech Tips:

- Make sure the font size on your TI-Nspire handheld is set to Medium.
- You can hide the function entry line by pressing ctrl G.

Lesson Materials:
Student Activity
Slope_of_Secant_Line_Student.pdf
Slope_of_Secant_Line_Student.doc

TI-Nspire document
Slope_of_Secant_Line.tns

Visit www.mathnspired.com for lesson updates.

Discussion Points and Possible Answers

Move to page 2.2.

1. Given function **f**(x) = x^2 , Step size = 0.5, Point (1, 1)
   Record your table of slopes and prediction for the slope of the tangent line.

   Prediction for Slope of Tangent Line: 2

Slope of Secant Line
8
7
6
5
4
3

Move to page 3.1.

2. Given function **f**(x) = x^3, Step size = 0.2, Point (1, 1)
   Record your table of slopes and prediction for the slope of the tangent line.

   Prediction for Slope of Tangent Line: 3

Slope of Secant Line
21
16.75
13
9.75
7
4.5

3. Do you feel this prediction is more accurate than your prediction from problem 1? Why or why not?

   Answer: This is more accurate of a prediction because data values were captured for every 0.5 increment.

Move to page 4.1.

4. Given function **f**(x) = $-x^3 - 5x + 3$, Step size = 0.05, Point (1, –3)
   Record your table of slopes and prediction for the slope of the tangent line.

   Prediction for Slope of Tangent Line: –5

Slope of Secant Line
–12
–9.75
–8
–6.75
–6
–5.75

5. Do you feel this prediction is more accurate than your prediction from problem 3? Why or why not?

   Answer: This is just as accurate of a prediction because data values were also captured for every 0.5 increment.

Move to page 5.1.

6. Given function **f**(x) = x^2, Step size = 0.005, Point (1, 1)
   Record your table of slopes and prediction for the slope of the tangent line.

   Prediction for Slope of Tangent Line: 2

Slope of Secant Line
1.3
1.35
1.4
1.7
1.8
1.85
1.9
1.95

Teacher Tip: Students should recognize a greater level of accuracy for the slope of the tangent line.

7. How do the values from this table compare to the values in the table with step size = 0.5?

   Answer: The values for the slope of the secant line are closer to the predicted values for the slope of the tangent line.

8. Does your previous prediction match the prediction with step size = 0.05?

   Answer: Yes, the previous prediction matches the prediction with step size = 0.05.

9. Why do you think step size is an important part of predicting the slope of the tangent line?

   Answer: Step size is an important part of predicting the slope of the tangent line because the smaller the step size, the more precise the prediction.

10. What step size is needed to be sure that your prediction for the slope of the tangent line is equivalent to the actual slope of the tangent line?

    Answer: As the value of the step size approaches zero, the prediction for the slope of the tangent line is equivalent to the actual slope of the tangent line.

Move to page 6.1.

11. Given function **f**(x) = $\sin\left(\frac{x}{x-.1}\right)$, Step size = .005, Point (0, 0)

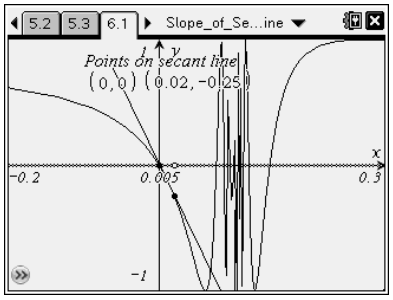
    Record your table of slopes and prediction for the slope of tangent line.

    Prediction for Slope of Tangent Line: –10

Slope of Secant Line
–17.0884
–16.2201
–14.6519
–12.3702
–11.7037
–11.0883
–10.5215

12. What do you notice about the values of the slope in your table and the secant line pictured here?

    Answer: The values of the slope in the table are negative and the secant line is decreasing.



Adjust the screen for question 6.1 to match the screen above. Use this new window to predict the value of the slope of the tangent line.

13. Calculate the slope of each secant line and record them in the table.

    New Prediction for Slope of Tangent Line: –12

Slope of Secant Line
–16.6249
–15.4592
–12.3702

14. How does the new window affect your prediction?

    Sample answer: The new window changed my prediction. The larger step size made my prediction less accurate.