

Graphing the Tangent to a Curve

by – Lynda Ferneyhough

Activity overview

Students will graph a function and the graph of the tangent line's slope as a point moves around the curve.

Concepts

- *An investigation in the relationship of tangents to curves.*
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Teacher preparation

Students will work from a calculator document.

Classroom management tips

Each student can be given a different function by using the last four digits of their student number as the coefficients in a cubic function. Positive and negative signs can be used alternately. A cubic function with visible local maximum and local minimum points is easier to see the affect of the investigation.

TI-Nspire Applications

TI-Nspire, Graphs, Lists & Spreadsheet and Notes are used during this activity.

Step-by-step directions

Graphing the Tangent to a Curve

by: Lynda Ferneyhough

Grade level: secondary

Subject: Precalc/Trig

Time required: 45 minutes

Students will enter a function and investigate the slope of the tangent line at a point as it moves around the curve.

The next page is a Graphs page. Press $\text{2nd} \rightarrow \text{on}$ > Graphs.

Students enter a function $f1(x) = a \cdot x^3 + b \cdot x^2 - c \cdot x - d$ using the last four digits of their student number for the coefficients a, b, c, d . Hide or show the function line by pressing $\text{ctrl} \rightarrow \text{G}$.

Alter the window as necessary. Press $\text{menu} \rightarrow \text{Window/Zoom} > \text{Window Settings}$.

A sample is shown at the right here.

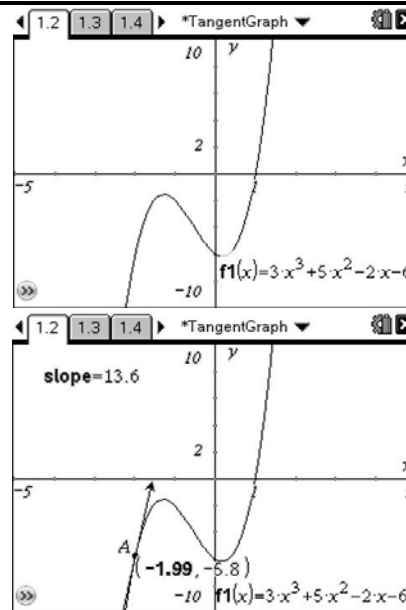
Place a point, A, on the curve and draw the tangent at the point.

$\text{menu} > \text{Points \& Lines} > \text{Point On}$, move to curve until pencil appears. Press enter then label point as capital A. Hovering over the x and y coordinates allows you to reduce the accuracy by pressing the negative sign. $\text{menu} > \text{Points \& Lines} > \text{Tangent}$, move to curve until pencil appears.

Measure the slope of the tangent and store the value as **slope**.

$\text{menu} > \text{Measurement} > \text{Slope}$, move to the tangent line and enter . Click on the slope value until it is shaded press $\text{shift} \rightarrow \text{var}$ and enter word "slope".

Store the x-coordinate of point A as **xa**.



The next page is Lists & Spreadsheet. Press $\text{2nd} \rightarrow \text{on}$ > Lists & Spreadsheets.

Move to white space beside column letter. Call column A xcoa, and column B tanslope.

In column A's formula line do an automatic data capture of **xa**, and in column B capture **slope**. Press $\text{menu} > \text{Data} > \text{Data Capture} > \text{Automated Data Capture}$.

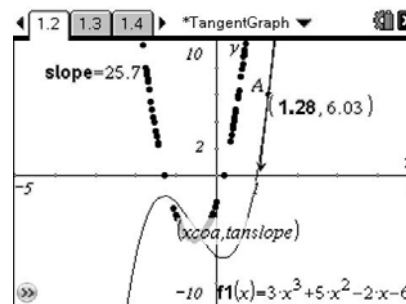
	A	B
	xcoa	tanslope
	=capture(xa,1)	=capture(slope,1)
1	-1.98552	13.6253
2		
3		
4		
5		
	tanslope:=capture(slope,1)	

Return to the graph $\text{ctrl} \rightarrow \leftarrow$.

Change the graph type to scatter plot. $\text{P} \rightarrow \text{2nd} \rightarrow \text{tab} \rightarrow \text{log} \rightarrow \text{log} \rightarrow \text{menu} \rightarrow \text{Graph Type} > \text{Scatter Plot}$

Put xcoa into the x-list and tanslope into the y-list. Enter to get variable list, choose name and tab to next list.

Grab point A and slowly move it around the curve. Move over point A and press $\text{2nd} \rightarrow \text{on}$ until the hand closes.



1.1 1.2 1.3 TangentGraph

You are going to enter a function and investigate the slope of the tangent line at a point as it moves around the curve.

The next page is a Graphs page.

Enter a function $f(x) = ax^3 + bx^2 - cx - d$ using the last four digits of your student number for the coefficients a, b, c, d .

Alter the window as necessary.

1.2 1.3 1.4 TangentGraph

The next page is Lists & Spreadsheet.

Call column A xcoa, and column B tanslope.

In column A's formula line do an automatic data capture of xa, and in column B capture slope.

1.1 1.2 1.3 TangentGraph

13.29 y

2 x

-20 20

$f(x) =$

1.3 1.4 1.5 TangentGraph

A	B	C	D	E	F	G	H
1							
2							
3							
4							
5							
A1							

1.1 1.2 1.3 TangentGraph

Place a point, A, on the curve and draw the tangent at the point.

Measure the slope of the tangent and store the value as slope.

Store the x-coordinate of point A as xa.

1.4 1.5 1.6 TangentGraph

Return to the graph.

Change the graph type to scatterplot.

Put xcoa into the x list and tanslope into the y list.

Grab point A and slowly move it around the curve.