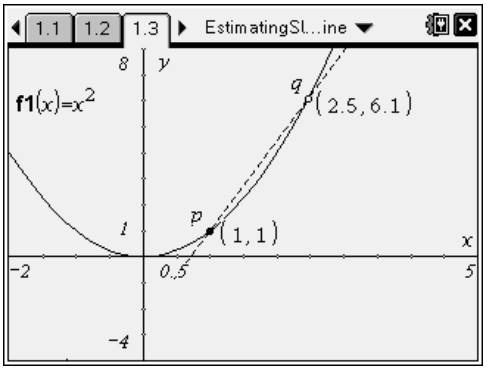
Consider the diagram shown on page 1.3. Use the coordinates of points *p* and *q* to determine the slope of $\overleftrightarrow{pq}$.

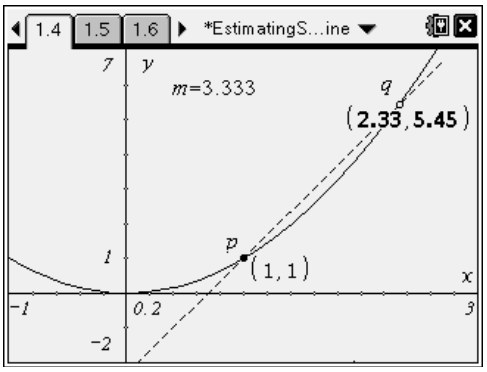


Imagine that you start moving point *q* towards point *p.* What do you think will happen to the slope of $\overleftrightarrow{pq}$?

What will happen to the slope of $\overleftrightarrow{pq}$ when *p* and *q* become the same point? What shall we call $\overleftrightarrow{pq}$ when this happens?

Investigating the slope of a tangent line graphically

Advance to page 1.4. You will see the screen at right showing the graph of the function **f1**(*x*) = x^2 along with secant $\overleftrightarrow{pq}$. The slope, *m*, of $\overleftrightarrow{pq}$ is also displayed on the screen.



Drag point *q* slowly towards point *p* and observe the effect on the slope. As you do this, periodically press ctrl + (.). This will capture the coordinates of point *q* into a spreadsheet, placing the *x*-values in Column A and the *y*-values in Column B. Make sure that you do this enough times that there are about 10 points contained in the spreadsheet by the time point *q* reaches point *p*.

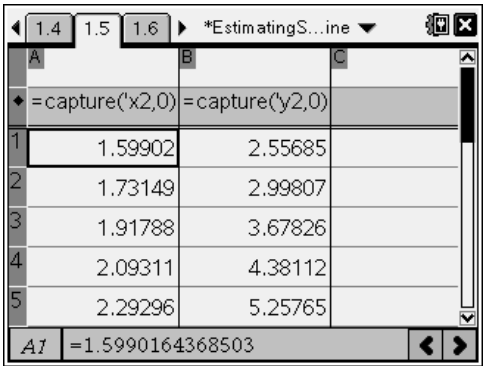
- As you moved point *q* towards point *p*, what value did the slope, *m*, approach?

- In the introduction to this activity, you used the formula for slope, $m = \frac{y_2 - y_1}{x_2 - x_1}$, to find the slope of the secant for *p*(1, 1) and *q*(2.5, 6.1). Why is it <u>not</u> possible to use this formula when points *p* and *q* coincide?

- The slope of the tangent line is often referred to as the *instantaneous rate of change*. Explain what is meant by this.

Advance to page 1.5. You will see the coordinates of point *q* that were recorded in a spreadsheet each time you pressed ctrl + (.). Recall that point *p* is locked in as (1, 1).

In cell C1, you will enter a formula to calculate the slope of $\overleftrightarrow{pq}$ for your first captured point. You should use *cell references* rather than typing the actual numerical values found in A1 and B1.



Use **Fill Down** to copy this formula to all data values.

- How do the values contained in Column C compare with the values of the slope you observed in the graph screen?

- What would happen if a captured point had *x*- and *y*-coordinates ***exactly*** equal to 1?

- How can you estimate the value of the slope of a tangent line at a specific point using the slope formula?