Part 1 – Graph of Secant and Tangent Lines

On page 1.3, the graph of the function $y = x^2$ and two lines are shown.

The dotted line is the secant line drawn through points *P* and *Q*. The solid line is the tangent line drawn through point *P*.

Move point *Q* along the graph.

- As point *Q* gets closer to point *P*, what do you notice about the lines?

- As point *Q* gets closer to point *P*, what do you notice about values of the slopes?

Part 2 – Finding average rate of change

The slope of the secant line is the average rate of change of the function between two points. To determine the average rate of change of **f1**(*x*) on [1, 1.1]:

Use the graph. On page 1.3, change the *x*-coordinate of point *Q* to 1.1.

- What is the slope of the secant line?

Use the table. On page 1.6, use the Function Table and *Calculator* application.

- What is your expression and the value of your expression?

Part 3 – Finding instantaneous rate of change

The slope of the tangent line gives the instantaneous rate of change.

If you do not know the tangent line, then you can use the slope of the secant line to approximate the instantaneous rate of change.

- Write an expression to estimate the instantaneous rate of change of **f1**(*x*) at $x = 1$.

- What is the value of your estimate?

- What is the actual value of the instantaneous rate of change (slope of tangent line)?

Extension – Rectilinear Motion Application

Use your TI-Nspire handheld to answer the following questions. For each answer, be sure to include appropriate units.

Suppose a particle is traveling along a horizontal line such that its position is given by the function $s(t) = t^3,\ t \geq 0$ where s is measured in meters and t is measured in seconds.

1. What is the *average rate of change* of the position function from $t = 2$ to $t = 4$?

2. *Estimate* the *instantaneous rate of change* of the position function at $t = 2$?

The velocity of the particle is given by the function $v(t) = 3t^2$ where v is measured in meters per second and t is measured in seconds.

3. What is the *average rate of change* of the velocity function from $t = 2$ to $t = 4$?

4. *Estimate* the *instantaneous rate of change* of the velocity function at $t = 2$?