According to the Standards:

Instructional programs from preK-grade 12 should enable students to:

- Recognize and use connections among mathematical ideas
- Make and investigate mathematical conjectures

In grades 9-12 students should

1. Students should develop an increased capacity to link mathematical ideas and a deeper understanding of how more than one approach to the same problem can lead to equivalent results.

Calculus Scope and Sequence: Applications of Derivatives
Keywords: Mean Value Theorem, MVT
Description: This activity will illustrate The Mean Value Theorem

Mean Value Theorem: If f, is a function continuous over a closed interval [a,b] , differentiable on the open interval (a,b) then there is a number c in the interval (a,b) such that $f'(c) = \dfrac{f(b) - f(a)}{b - a}$.

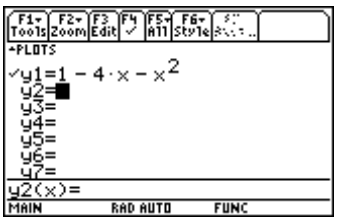
(Alternately stated: *If f, is a function continuous over a closed interval [a,b] , differentiable on the open interval (a,b) then there is a number c in the interval (a,b) such that the tangent line at x=c, is parallel to the secant line connecting x=a and x=b*)

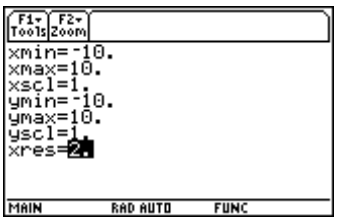
Determine whether the hypotheses of the MVT hold for the following and if so, find a value of *c* satisfying the conclusions of the theorem:

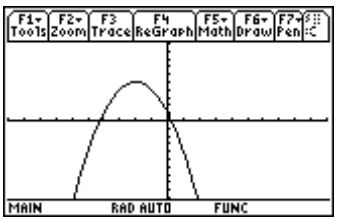
$f(x) = 1 - 4x - x^2$, [-5,0]

Since it's a polynomial function, it will be continuous and differentiable everywhere. So what remains is to find the value of *c*.

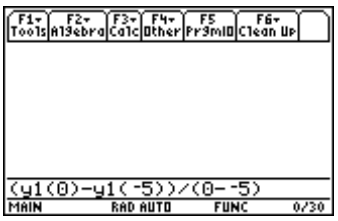
1. Go to the Y= screen and input the function into y1
2. Graph in the standard window (Zoom – 6)
3. Find the equation of the secant line through the interval given
4. Find the value of *c*
5. Find the equation of the tangent line
6. Sketch both lines on the graph for visual confirmation

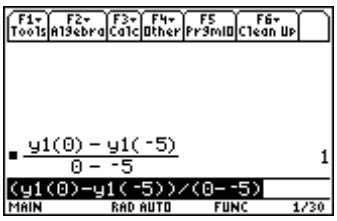




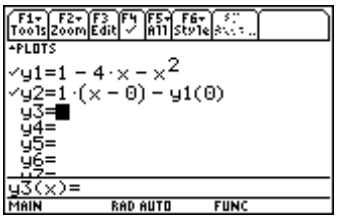


Slope of Secant line:



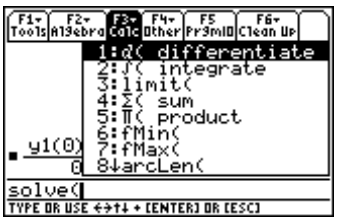


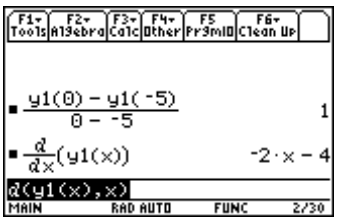
Equation of Secant line:



First we need to get the derivative of y1 and store it in y3

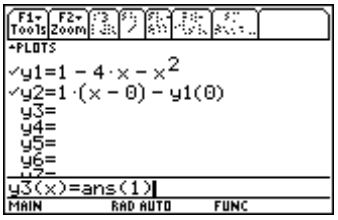
- Go to HOME
- Go to F3-Calc-#1
    - Derivative syntax: (function, variable)

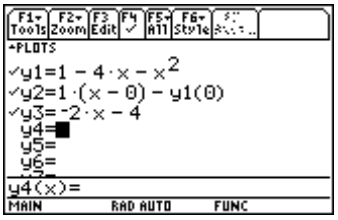




To Store in y3:

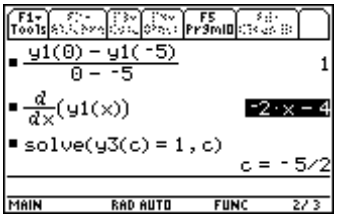
- Go to Y=
- Go to y3(x)
- Press 2nd-Ans-ENTER



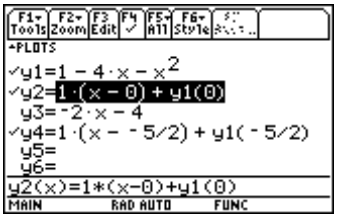


Finding a value of *c*:

- Go to HOME
- Use F2-Algebra-#2 Solve
    - Solve arguments: (function=solution, variable)

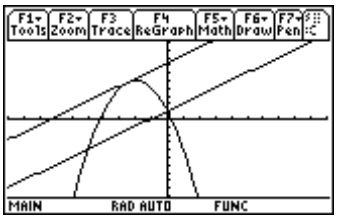


The Equation of the tangent line:



(note: be sure to shut off the derivative function using F4)

The graph:



What you see is a picture of where the instantaneous rate of change (the derivative) is equal to the average rage of change over the interval given.