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MTH4040: Coordinating Seminar

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Technology Presentation: Average rates of change, and equation of the Tangent line using Mathematica.

Review of basics:

Find the slopes of the given points using the slope formula, then find the equation of the line using the slope:

NOTE: The slope formula is

1. (1,3) and (2, -5) 2. (2, 5) and (4,15) 3. (-5,7) and (8,-2)

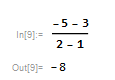
We will use Mathematica for various methods for finding average rates of change, and slopes. Make sure you have Mathematica open!

We are going to do various things with slope and rates of change.

First we are going to calculate the slope, and find the equation of the line using Mathematica. Find the equation of the line using one of the points. For this example, I will use number 1.

Step 1: Go to palettes and select “Basic Math Assistant” (you will need this when we start typing out our equations).

Step 2: Using the points from above, type the points into Mathematica. Use the Basic Math Assistant to set up the fraction. It should look like this.



Step 3: Type the following: Solve[3==-8(1)+b] your equation should be y=-8x+11

Next we will graph the function we obtained. To do this, we will type the following:

Plot[{y=-8x+11},{x,-5,5},PlotRange->{-10,15}]

The graph should look like this:



Next, we will practice taking derivatives of a function, and find the equation of the tangent line using Mathematica.

Suppose we want to find the tangent line of the function. We want to find its derivative (which we will plug in a value for x, and get a slope as a result). Consider the following function:

Find the equation of the tangent line when x=2.

In a new line, type the following command.

D[x^2,x]

This will give us 2x. If we plug in x=2, we will get the slope of the tangent line which will equal 4. To find the equation of the tangent line itself, we will need to use the following formula:

We now have and , so now we can substitute this into our formula.

Which will give us our equation of the line, equaling to

At the end of the packet, you will get a few exercises working with these.

Next, we will find slopes across various points for the function On Mathematica, type the following command. We are going to manipulate points on a graph to find our slope. In Mathematica type the following command.



Some questions to consider:

1. Do you see something happening when you move the “a and b” sliders?
2. What happens then a=b?

Exercises:

Use Mathematica to find the equation of the line given the following points:

1. (-2,4) and (2,4) 2. (3,5) and (10,4) 3. (-12,3) and (3,7)

Use Mathematica to find the derivative, then find the equation of the tangent line at the given points.



Extension:

1. What happens when f(a)=f(b)?
2. How is the average rate of change used in other fields?