Definition of

Derivative

1. Go to Desmos.com
2. Type in f(x) = 2x2 + 3x + 1

Note: You could do this with ANY function, but we’ll start with a quadratic because they’re a little less complicated down the road.

1. Assign a value to a =

Note: You should get a “slider”

Note: a represents an aribitrary x – value. Ideally we’d use x here, but Desmos would interpret it as a vertical line, and we don’t want that!

1. Type in f(a)
2. Graph the point (a, f(a))

Note: Drag the slider from step 2 if you can’t see the point.

1. Assign a value to h = Note: You should get a second “slider”
2. Type in f(a+h).
3. Graph the point (a + h, f(a + h))
4. Write an m= equation in terms of the points we graphed in #5 & #8 for the slope of the lines between the two graphed points.

Note: We want to write a GENERAL equation for ANY slope, so do not use the numerical values, rather the expressions that represent them. Stumped? Google “slope formula”

1. Write an s = equation for the line connecting the two points using the point in #5 and the slope in #9.

Note: This line is a secant to f(x) because it intersects it at two points. That is why we called it s =

Note: We want to write a GENERAL equation for ANY secant, so do not use the numerical values, rather the expressions that represent them. Stumped? Google “point slope form”

1. Move the sliders until the secant line looks more like a tangent line.

Note: A tangent is a line that touches a function at exactly one point.

* What do you notice about the sliders when the line looks as tangent as possible? Hint: You can type in values if you want to.
* Does this remind you of anything?

1. A derivative is a general form equation for the slope of the line tangent to a function at a point. We can find the derivative by taking the limit of the slope of the secant as h approaches 0. Write the limit definition of the derivative in your notes, then use it to find the derivative of your function from #2. Be careful with your Algebra! Check your work with your teammates.

* Type this equation in as d(x) = Note: Technically, the derivative would be written f’(x), but that’s not possible in Desmos.
* Is the graph of the derivative tangent to the function? Why? …Stumped? Keep going!

Note: if you’d like to, you can deselect the d(x) equation so that it doesn’t show on your graph for now.

1. Type in d(a). Move your sliders again so that the secant looks as tangent as possible.

* Do you notice any similarities in any of the values Desmos is giving you now? Go back and answer the question from #12

1. Write an equation for the tangent line to our general point from #5 as t=
2. Move the sliders around as much as you want!
3. Desmos can actually evaluate derivatives (although it can’t give us an equation like the definition from #12 can).

* Change the line that says d(x)=\_\_\_ to d(x)=(d/dx)f(x).
* Change the line that says d(a) to (d/dx)(a).
* NOW change f(x) in the first line to any equation you want!
* Turn off everything except f(x) and (d/dx)f(x) and see what the derivative looks like for all types of functions.

1. Save your hard work by creating an account really quick.