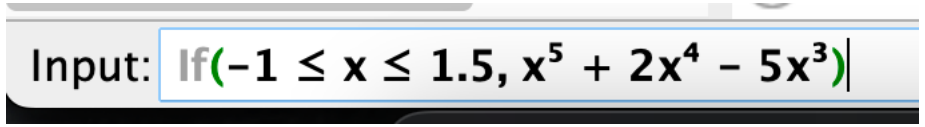
FUNCTIONS AND THEIR TANGENT LINES

STEP 1:

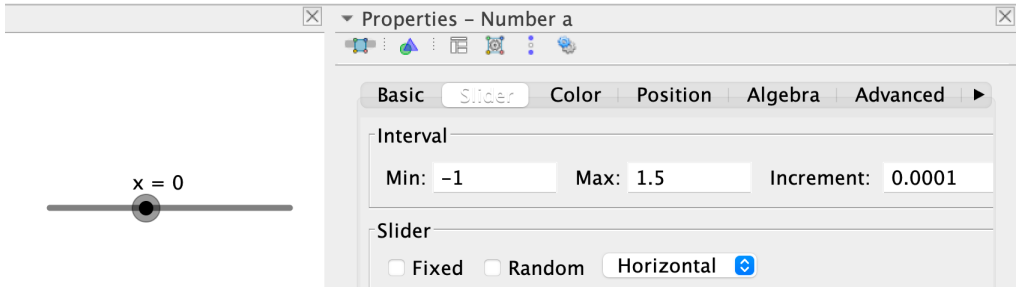
- Input/Graph function with a restricted domain. For example:

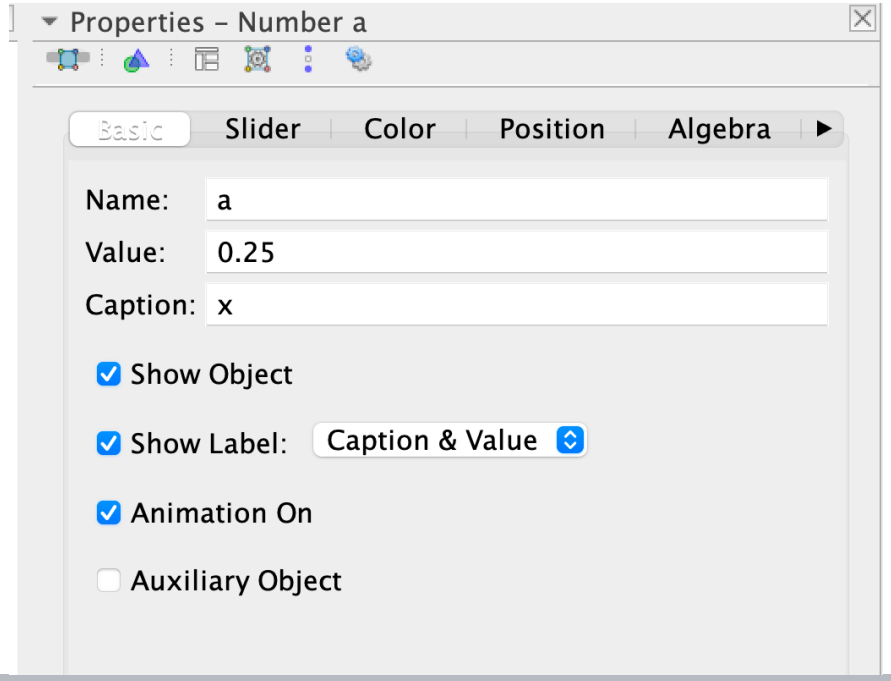
$$f(x) = x^5 + 2x^4 - 5x^3, -1 \leq x \leq 1.5$$



STEP 2:

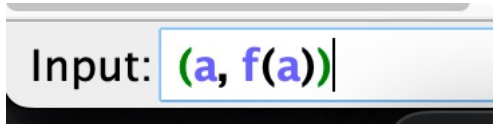
- We make a slider for the restricted domain.
- For correct labeling we make the caption to be x and set show label to caption and value.
- For a smoother transition set increments to 0.001.

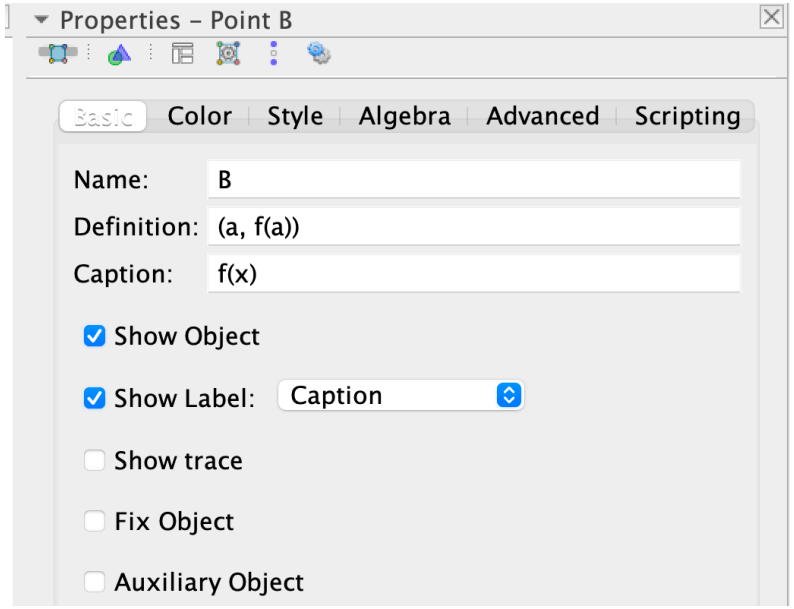




STEP 3:

- Since the slider provides the x-coordinate of our point, we created the slider first and then the point. So, we make the point: $P(a, f(a))$.
- For labeling, we do it similarly as we did for the slider, but we set label to just caption.





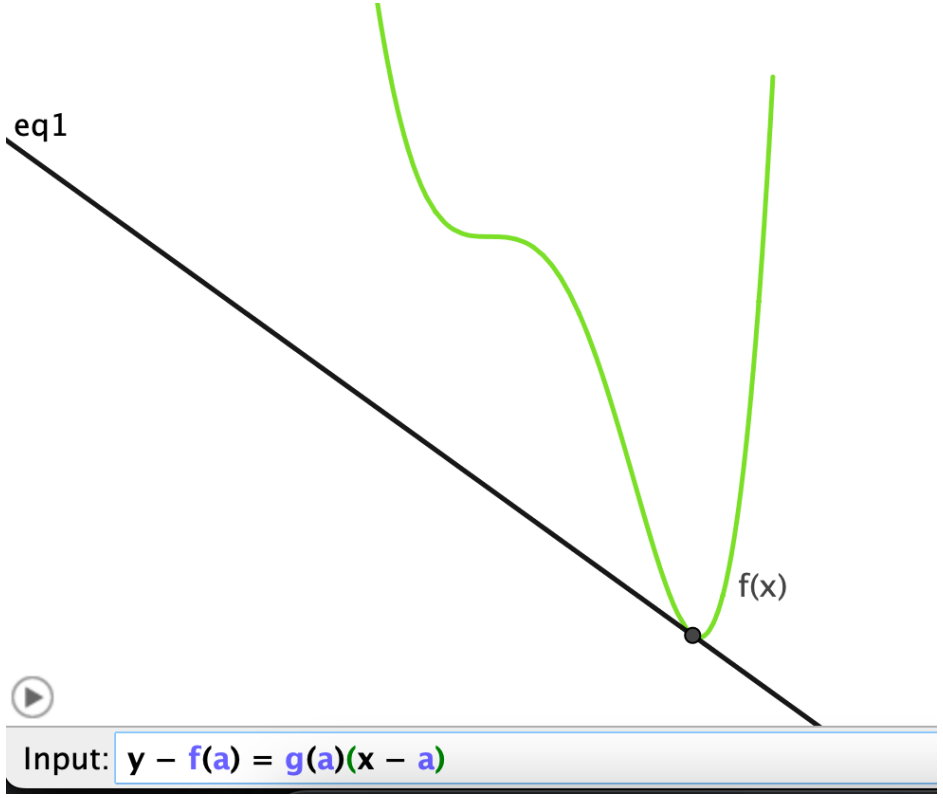
STEP 4:

- (i) Since our function is $f(x) = x^5 + 2x^4 - 5x^3$ is our function, then $f'(x) = 5x^4 + 8x^3 - 15x^2$. So, we get a new function,

$$g(x) = 5x^4 + 8x^3 - 15x^2.$$

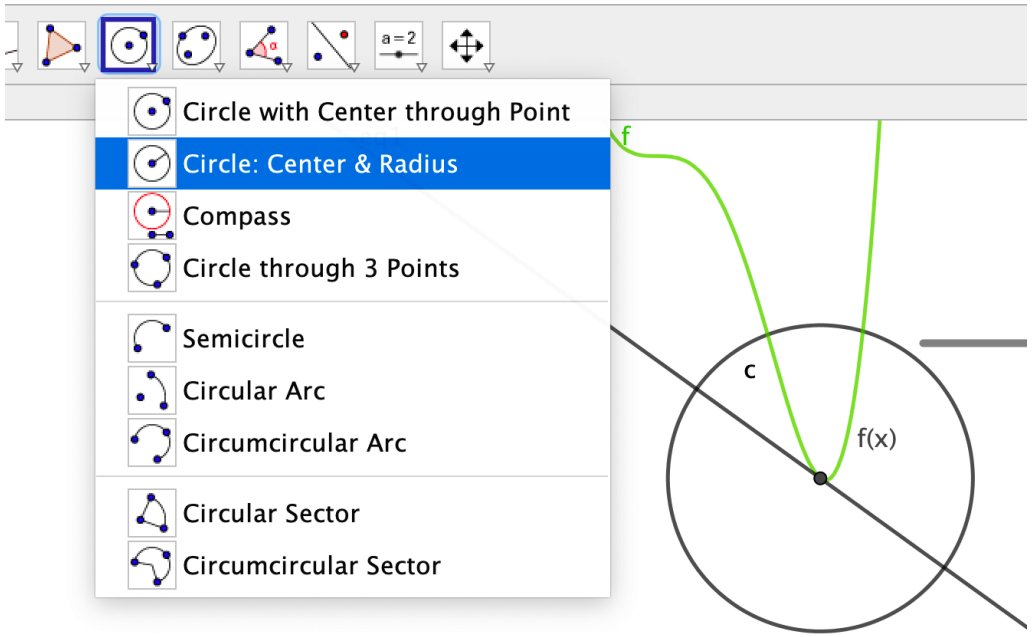
- This $g(x)$ gives us the function to calculate the slope of the tangent lines
- (ii) Create the tangent line equation:

$$y - f(a) = g(a)(x - a).$$



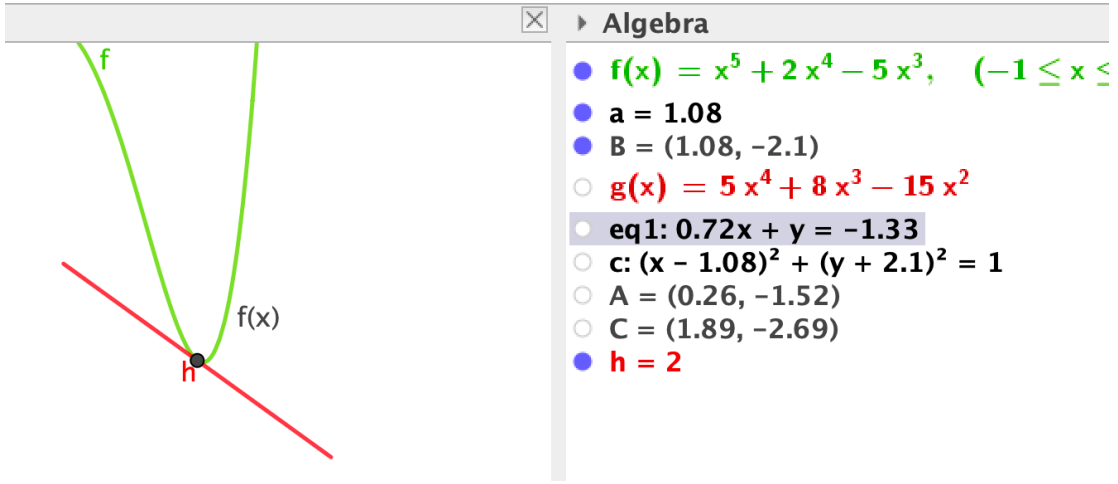
STEP 5:

- As we can see from step 4, the tangent line is not quite as ‘visually appealing’, so to make it nice we turn the tangent line into a tangent segment.
- The first step to do this is to make a circle centered at the point we made in step 3, and with a reasonable radius to serve as the length of the segment.



STEP 6:

- Make a line segment using the points at which the tangent line intercepts the circle from the previous step. Then hide the tangent line, the circle, and segment endpoints by unselecting them from the Algebra window.



STEP 7:

- For the last step, we want the line segment we created to change colors when the tangent segment has a negative, positive, or zero slope.
- To accomplish this, we go to the script on update for the line segment and write:

If(g(a)==0, SetColor(h,"purple"))

If(g(a)>0, SetColor(h,"blue"))

If(g(a)<0, SetColor(h,"red"))