MAT 136 (Calculus I), Prof. Jim Swift
Worksheet 5, Slope of the tangent line

(a) Use the on-line desmos graphing calculator to graph $y = \dfrac{\sin(x)}{x}$.

(b) Note that the function is undefined at $x = 0$. Use the graph to estimate the limit: $\lim_{x\to 0} \dfrac{\sin(x)}{x} \approx$ 1. (Remember this for set 5, problem 10.)

(c) Put a point on the desmos graph at $P = (1, \sin(1))$. (Type in "$(1, \sin(1))$", not the numerical approximation.)

(d) Draw a line with slope m through the point P, with a slider for m.

(e) Use the slider to estimate the slope of the tangent line to the graph $y = \frac{\sin x}{x}$ at $x = 1$. Change the limits of the slider to go from $m = -1$ to $m = 0$, and try to get an estimate of m that is good to 2 significant figures. Fill in the blank: $m \approx$ −0.30 (but hard to tell: −0.29 −0.31 are acceptable)

(f) Write an expression for the slope of the secant through $P = (1, \sin(1))$ and $Q = (x, \sin(x)/x)$. Note that the slope of the secant line is a *new* function of x. Fill in the blank:

$$m_{PQ}(x) = \frac{\frac{\sin(x)}{x} - \sin(1)}{x - 1}$$

(g) Plot $m_{PQ}(x)$ with desmos. (You can just type the expression, without "$y =$".)

(h) Zoom in on this new graph to estimate the slope of the tangent line to the graph $y = \frac{\sin(x)}{x}$ at $x = 1$, to three significant figures. Fill in the blank

$$m = \lim_{x\to 1} m_{PQ}(x) \approx -0.301$$