

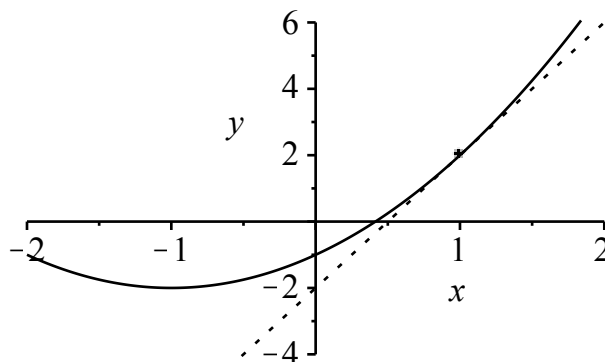
Math 1210-1
Quiz 3 SOLUTIONS
January 29, 2016

Directions: You may ask and answer each others questions on this quiz. The goal is to understand what you're doing and express your thoughts clearly. Write your own solutions though, rather than just copying someone elses. Calculators are not allowed on this quiz. Show your work.

1) Let $f(x)$ be defined by $f(x) = x^2 + 2x - 1$.

a) (2 points) Find and label the point on the graph of $y = f(x)$ for which the x -coordinate is 1, on the figure below. Then roughly sketch the line through that point which is tangent to the graph of f there.

solution: If $x = 1$ then $f(1) = 2$ so the point on the graph is $(1, 2)$. I had the computer sketch the graph of the tangent line. :-)



b) (5 points) Use the limit definition of derivative to find $f'(x)$.

solution:

$$\begin{aligned} f'(x) &= \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \rightarrow 0} \frac{((x+h)^2 + 2(x+h) - 1) - (x^2 + 2x - 1)}{h} \\ &= \lim_{h \rightarrow 0} \frac{(x^2 + 2hx + h^2 + 2x + 2h - 1) - (x^2 + 2x - 1)}{h} \\ &= \lim_{h \rightarrow 0} \frac{2hx + h^2 + 2h}{h} \\ &= \lim_{h \rightarrow 0} 2x + h + 2 = 2x + 2. \end{aligned}$$

So $f'(x) = 2x + 2$.

c) (3 points) Use your work from part b to find a precise equation for the tangent line you sketched in part a. Simplify your tangent line equation so that it is in slope-intercept form.

solution $f'(x) = 2x + 2$ is the slope of the tangent line to the graph of f , at the point on the graph with horizontal coordinate x . So if $x = 1$, $f'(1) = 4$ is the slope of the tangent line to the graph at $(1, 2)$. Thus the tangent line's point-slope form is

$$y - 2 = 4(x - 1)$$

which simplifies to slope-intercept form

$$y = 4x - 2$$

(This should agree roughly with your sketch of the tangent line in part (a).)