Discussion Problems for Math 180

Tuesday, September 22, 2014

Try to solve each problem, especially the earlier ones, in 2 - 3 minutes.

1. What is the domain of the function $\sqrt{1+x}$?
2. What is the difference, if any, between the functions $s(x) = x/\sqrt{x}$ and $t(x) = \sqrt{x}$?
3. Find the tangent lines to the curve $y = \sin^2(x)$ at $(0,0)$ and at $\left(\frac{\pi}{3}, \frac{3}{4}\right)$. *Note: we haven't covered the chain rule yet, so you can't cite it here.*
4. Consider the function
$$f(x) = \begin{cases} 1 & \text{if } x < 1, \\ 2 & \text{if } 1 \leq x \leq 3, \\ 3 & \text{if } x = 3, \\ x - 4 & \text{otherwise.} \end{cases}$$
Sketch the graph of f. What is its domain? At which points is it continuous? Justify your answers.
5. What is the derivative $f'(x)$ of the function $f(x)$ from the previous problem? Sketch its graph.
6. Consider the function $g(x) = x^3 + x + 1$. At which *points* (if any) does this function have a horizontal tangent line?
7. Consider the function $h(x) = x^2e^x - 3xe^x + 2e^x$. At which points (if any) does this function have a horizontal tangent line?
8. For which value(s) of c is the function
$$\phi(x) = \begin{cases} \sin(x + c) & \text{if } x < \frac{\pi}{2}, \\ 1 & \text{otherwise,} \end{cases}$$
continuous? Differentiable?
9. Determine the derivative of $\cos(x)$ using the definition.