Quiz #1 Review

Math 141: Section 33.

January 25, 2013

1. **Inverse Functions**: You should be able to
   (a) Find an equation for the inverse (whenever you can)
   or to use "educated guess and check" to find $f^{-1}(a)$ (when you have no choice),
   (b) Compute the value of $(f^{-1})'(a)$ using the formula from the theorem.
2. **Natural Logarithms**: You should know
   (a) The definition of $\ln(x)$, its domain, range, and graph,
   that $\ln(e) = 1$, that $\ln(1) = 0$, that $\lim_{x\to\infty} \ln(x) = \infty$, and that $\lim_{x\to 0+} \ln(x) = -\infty$.
   (b) The Laws of Logarithms.
   (c) The relevant differentiation/integration formulas.
3. **Natural Logarithms**: You should be able to
   (a) Do calculus for functions involving $\ln(x)$ and $\frac{1}{x}$.
   (b) Introduce logarithms ("logarithmic differentiation")
   to take the derivative of a function like $x^{\sin(x)}$.
4. **Natural Exponentials**: You should know
   (a) The definition of e^x, its graph, its domain, its range, etc.
   (b) Laws of Exponents
   (c) The derivative and integral formulas for e^x.
5. **General Exponentials/Logs**: You should know
   (a) The definition of the general exponential function: $a^x = e^{x\cdot\ln(a)}$
   (b) The derivative formulas for a^x and $log_a(x)$, and the corresponding integration formulas.
   (c) The shape of a^x when $0 < a < 1$, and when $a > 1$.
   (d) How to compute the derivative of functions like $x^{\sin(x)}$
   by using logarithmic differentiation.
   (e) How to compute the derivative of functions like $x^{\sin(x)}$
   by setting $x^{\sin(x)} = e^{\sin(x)\cdot\ln(x)}$ and using the chain rule.
6. **Trigonometry**: You should know
   (a) The graphs of sin, cos, tan,
   and that $\csc(x) = \frac{1}{\sin(x)}$, that $\sec(x) = \frac{1}{\cos(x)}$, and that $\cot(x) = \frac{1}{\tan(x)}$.

(b) The values of all 6 trigonometric functions evaluated at $\theta = \pi, \frac{\pi}{2}, \frac{\pi}{3}, \frac{\pi}{4}, \frac{\pi}{6}$, etc.

(c) The derivatives of all six trigonometric functions.

(d) The derivatives of $\sin^{-1}(x)$, $\cos^{-1}(x)$, and $\tan^{-1}(x)$,
along with the corresponding integration formulas. (Know these *very* well).

(e) The derivatives of $\csc^{-1}(x)$, $\sec^{-1}(x)$, and $\cot^{-1}(x)$,
as well as the corresponding integration formulas. (Know these).

7. **Trigonometry**: You should be able to

(a) Use the "right triangle method" to use the value of *one* trigonometric function at θ to find the value of *any other* trigonometric function evaluated at θ.

(b) Rewrite $\cos(\sin^{-1}(x)) = y$ as the statement

"$y = \cos(\theta)$ **for** the angle θ **in** the domain of $\sin^{-1}$ **such that** $\sin(\theta) = \frac{x}{1}$."

(c) Use the "right triangle method" to compute things like $\cos(\sin^{-1}(x))$.

8. **Calculus 1**: You should be able to

(a) Use the chain rule (*especially* with complicated functions),

(b) Use the quotient and product rule,

(c) Use "u-substitution" to compute definite and indefinite integrals,

(d) Simplify a formula using algebraic/logarithmic/exponential rules,
(Both as a step toward computing an integral or derivative
and as a way of seeing which multiple-choice answer matches your solution).

(e) Analyze a function using calculus. This includes finding the tangent lines at a point, finding the max/min values on an interval, etc.

(f) Compute involved limits such as $\lim_{x \to 0} e^{\sin(\tan^{-1}(-\ln(x)))}$.

9. **General Skills**: You should be able to

(a) Use *any* of the differentiation/integration formulas as a part of a multi-step problem.

(b) Use your knowledge in two ways: (1) to "push" a problem forward toward a solution, and (2) to "pull" the problem toward a question that you can solve.

(c) Work on hard problems under serious time pressure! The problems are not always in order of increasing difficulty. If you can't solve a problem, mark it and return to it later. (Just make sure you fill in the answer sheet correctly!)