Math 101 – WORKSHEET 6
SUBSTITUTION

Theorem (Substitution)**.** $\int f'(g(x))g'(x)\,\mathrm{d}x = f(g(x)) + C$. *Equivalently,* $\int f(g(x))g'(x)\,\mathrm{d}x = \int f(u)\,\mathrm{d}u$ *where* $u = g(x)$.

(1) Evaluate the integrals
   (a) $\int \sin x \cos x\,\mathrm{d}x =$
   (hint: use $u = \sin x$)

Problem. It's easy to check that $\left(-\frac{1}{4}\cos(2x)\right)' = \frac{1}{2}\sin(2x) = \frac{1}{2}\cdot 2\sin x\cos x = \sin x\cos x$. How is that possible?

   (b) (Final, 2014) $\int \cos^3 x \sin^4 x\,\mathrm{d}x =$

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(c) (Final, 2013) $\int_1^3 (2x-1)e^{x^2-x}\,\mathrm{d}x =$

(d) (Final, 2012) $\int_0^3 (x+1)\sqrt{9-x^2}\,\mathrm{d}x =$