My Office Hours: M & W 2:30–4:00, Tu 2:00–3:30, & F 1:30–2:30 or by appointment. **Math Intern:** Sun: 2:00–5:00, 7:00–10pm; Mon thru Thu: 3:00–5:30 and 7:00–10:30pm in Lansing 310. Website: `http://math.hws.edu/~mitchell/Math131F15/index.html`.

☛ *Practice and Reading*

1. (*a*) Reread and review Section 5.5 on substitution, which we will finish next class.
   (*b*) ✍ Practice substitution while things are still relatively simple! Page 391 #9–23 odd, 27.

Hand In Next Class (Also WeBWorK Sets Substitution1 (Due Sunday) and Day09 (Due Tuesday))

Use this sheet. ☞ Be neat so that I can grade these quickly and get them back to you. Put a box around your answers so I can find them. Clearly note any substitution.

2. Determine $\int 3x^2(\underbrace{x^3+9}_{u})^{-5}\,dx.$ $= \int u^{-5}\,du = -\frac{1}{4}u^{-4}+C$

$u = x^3+9$
$du = 3x^2\,dx$

$= \boxed{-\frac{1}{4}(x^3+9)^{-4}+C}$

3. Determine $\int \cos x\sqrt{\underbrace{4+2\sin x}_{u}}\,dx.$ $= \frac{1}{2}\int \sqrt{u}\,du = \frac{1}{2}\cdot\frac{2}{3}u^{3/2}+C$

$u = 4+2\sin x$
$du = 2\cos x\,dx$
$\frac{1}{2}du = \cos x\,dx$

$= \boxed{\frac{1}{3}(4+2\sin x)^{3/2}}$

4. Determine $\int \frac{(\ln t)^3}{t}\,dt.$ (u) $= \int u^3\,du = \frac{1}{4}u^4+C$

$u = \ln t$
$du = \frac{1}{t}\,dt$

$= \boxed{\frac{1}{4}(\ln t)^4+C}$

5. Determine $\int (x+2)\sin(\underbrace{x^2+4x}_{u})\,dx.$ $= \frac{1}{2}\int \sin u\,du = -\frac{1}{2}\cos u+C$

$u = x^2+4x$
$du = (2x+4)\,dx$
$\frac{1}{2}du = (x+2)\,dx$

$= \boxed{-\frac{1}{2}\cos(x^2+4x)+C}$

6. Determine $\int \frac{x^5}{1+4x^6}\,dx.$ $= \frac{1}{24}\int \frac{1}{u}\,du = \frac{1}{24}\ln|u| + C$

$u = 1+4x^6$

$du = 24x^5\,dx$

$\frac{1}{24}\,du = x^5\,dx$

$= \frac{1}{24}\ln|1+4x^6| + C$

always positive

$= \boxed{\frac{1}{24}\ln(1+4x^6) + C}$

7. Fill in the blank with a function that makes this an easy problem and then solve it. $\int e^{x+\tan x}(\underline{1+\sec^2 x})\,dx.$ (u = $1+\sec^2 x$, du = $1+\sec^2 x$)

$\rightarrow = \int e^u\,du = e^u + C = \boxed{e^{x+\tan x} + C}$

8. **Starting Integration Problems.** Sometimes starting a problem is the hardest thing. Decide which method is appropriate for each: basic rules, algebraic simplification, "mental adjustment," still others require u-substitution. Complete the table. **You do not actually have to do the antidifferentiation.**

Integral	**Method**	**If u-sub, then u =? and du =?**
$\int (3x+2)(6x^2+8x)^5\,dx$	u-sub	$u = 6x^2+8x$ $du = (12x+8)\,dx$
$\int (3x+2)(6x+8)\,dx$	multiply – Algebra	
$\int \frac{1}{5\sqrt[4]{x^3}}\,dx$	Simplify – basic rules	
$\int \sec^2(3x)\,dx$	mental adjustment	
$\int \sin(\cos x)\sin x\,dx$	u-sub	$u = \cos x$ $du = -\sin x\,dx$
$\int \frac{4}{1+x^2}\,dx$	basic rule (arctangent)	
$\int \frac{4x}{1+x^2}\,dx$	u-sub	$u = 1+x^2$ $du = 2x\,dx$
$\int \frac{1+x^2}{x}\,dx$	Simplify – divide	
$\int \frac{t}{\sqrt{1-t^2}}\,dt$	u-sub	$u = 1-t^2$, $du = -2t\,dt$
$\int \frac{1}{\sqrt{1-t^2}}\,dt$	basic rule – (arcsine)	