HW assignments. 23A. F 07. Assignments AM ('After Midterm').

special symbols: sitting before a problem number
* = DO ThIs ! It very likely will be used, in class, and on final.
H = Hard
E = Extra ... for yr own edification
NOTE: the assignments for Nov 16, 19 and Dec 3 are markedly longer than the rest. You will want to start these early.

Nov 2 . Fri. 1, 3, 8, 22
Nov 5. Mon. 3.4: 1, 5, 10, 25
Nov 7. Wed: 3.5: 2, 3, * 5, 8, 10, H: 13
Nov 9. Fri. 4.1 : 1, 4, 7, 15:
Nov 11 (holiday)
Nov 14: Wed 4.2: 2,8, H 12, 13, E: 14-17
Nov 16. Fri. 4.3: 1-8, 9, 10, 12, 15
Nov 19. Mon. 4.4: 1-4, 6, 15, 16, 18, 20, 29, H: 33
Nov 21. Wed, Take a breather. Prepare body and mind for eating too much.
Nov 23. Fri. Rest. Begin moving blood back to brain.
Nov 26. (Differential forms HW A) 8.6: 1-5.
Nov 28. Differential forms HW B. See below.
Nov 30. Differential forms HW C. See below.
Dec 3. Mon. 4.4: 1, 3, 7, 8, 22, 23, 26, 28, 30, 31, AND also
Review of ch 4 on p. 313 to 316: 2, 5, 6, 10, 17-20, 23, 24, 28,

Differential forms HW B.

1. Using the standard formulae for converting between Cartesian and polar coordinates, show that $(xdy - ydx)/(x^2 + y^2) = d\theta$.

2. Using complex notation, with $z = x + iy$, so that $dz = dx + idy$, show that

$$dz/z = (xdx + ydy)/(x^2 + y^2) + i(xdy - ydz)/(x^2 + y^2).$$

Hint. Remind yourself of the trick involved in dividing one complex number by another, so that in the result there are no 'i's in the denominator

3. Convert the result of ex.2 to polar coordinates, in order to show that $dz/z = dr/r + i(d\theta)$.

4. Conclude that the integral of dz/z around a closed curve c which avoids the origin equals $i2\pi N$ where N is the number of times c winds around the origin in the counterclockwise sense. [This formula is fundamental to any course in complex variable]

5. E. By writing $z = re^{i\theta}$ and $d(\log z) = dz/z$ rederive the results from ex. 3.

Differential forms HW C.

1. If $\omega = P(x, y)dx + Q(x, y)dy$, compute $d\omega$.

2. Write down Stokes' eqn $\int\int_D d\omega = \int_C \omega$ for the case of ω from ex. 1. Make sure to draw a picture and explain what D and C are, and how they are related. Look up "Green's theorem in the plane" in your last quarter calc. text, or the current text, or on Wikipedia. Compare.

3. Using the conversion from polar to Cartesian coordinates, compute $\omega = xdy - ydx$ in terms of polar coordinates. Your answer should have the form $f(r, \theta)dr + g(r, \theta)d\theta$.

4. Compute $d\omega$, for ω as in ex. 3. Apply the results from ex. 2 to show that the line integral $\int_C \omega$ around a closed curve C in the plane equals twice the area D enclosed by that curve.

5. Use an argument involving infinitesimal isosceles triangles with opening angle $d\theta$ and long equal sides r, and the expression found in 3, to provide a geometric rationale for the result found in 4.