HW 11 Computational Physics

November 8, 2005 Due November 15

- Lea, Chapter 2, problems 7, 8(a), 10, 11, 14, 16. In 16, only take the derivative using df/dz.
- 1. The following integrals have a contour of integration C which is the circle of radius 2 centered on the origin. Evaluate by hand, by substituting $z = 2e^{i\theta}$ and integrating over the real variable θ .
 - (a) $\oint \frac{dz}{z^2}$
 - (b) $\oint \frac{dz}{z}$
 - (c) $\oint dz$
 - (d) $\oint z \, dz$
- 2. In this problem you will evaluate $\int_C \cos z \, dz$ several ways. Here C is the line segment along y = x beginning at z = 0 and ending at z = 1 + i.
 - (a) Evaluate the integral using the indefinite integral and the endoints.
 - (b) Evaluate the integral by writing z = x + iy, using y = x, and turning the integral into an integral over the real variable x.
 - (c) Now change the contour to a path from z = 0 to z = 1 along the real axis, followed by a vertical path from z = 1 to z = 1 + i. Do the integral of $\sin z$ along this two-step contour by hand (not using endpoints).
- 3. Let $f(z) = z^{\frac{1}{2}}$ have a branch cut along the negative real axis, and let C be the semicircle of radius 1 beginning at i, moving counterclockwise, and ending at -i. This path crosses the cut. Evaluate $\int_C z^{\frac{1}{2}} dz$ using endpoints. Be careful when you cross the cut to stay within the correct branch. Then the integrand is discontinuous across the cut and as a result you need to consider four endpoints.