I. SS Chapter 2 Exercises 7, 8, 9, 11, 12a

II. Suppose $f, f_1, f_2, \ldots$ are functions on an open subset $\Omega$ and that $f_1, f_2, f_3, \ldots$ are holomorphic in $\Omega$ (note that $f$ is not assumed to be holomorphic). Suppose the sequence $(f_n)$ converges uniformly on every compact subset of $\Omega$ to the function $f$. Prove that $f$ is holomorphic in $\Omega$ and that the sequence of derivatives $(f'_n)$ converges uniformly in every compact subset of $\Omega$ to $f'$.

III. Suppose $C$ is the unit circle traveled counterclockwise once. Calculate the following integrals:

(a) $\int_C \frac{\cos(w)}{w} dw$,  
(b) $\int_C \frac{\sin(w)}{w} dw$,  
(c) $\int_C \frac{\cos(w^2)}{w} dw$.

IV. Suppose $R$ is long thin rectangle of width $\delta$ contained, along with its interior in an open set $\Omega$. Let $\gamma^+$ and $\gamma^-$ be the opposite long sides of $R$ (the perpendicular distance between these two paths is $\delta$) and assume that the two paths are traveled in opposite directions (just as in the “keyhole” contour we used in the proof of Cauchy’s integral formula). Suppose $F$ is a continuous function in $\Omega$. Prove that as $\delta$ approaches 0, $\int_{\gamma^-} F(z) dz + \int_{\gamma^+} F(z) dz$ tends to 0.