Same description as before.

1. §2.4 – 10.
2. §2.4 – 12.
3. §2.4 – 20.
4. §2.4 – 27 and 28a (note that the solution to 27 is essentially given in the back.)
5. ($\mathcal{E}$) Evaluate the following integrals:

$$\frac{1}{2\pi i}\int_{|z|=1}\left(z+\frac{2}{z}\right)^3\,dz; \qquad \frac{1}{2\pi i}\int_{|z|=2}\frac{dz}{z^2-3z}.$$

6. ($\mathcal{E}$) Evaluate the following integrals, where C denotes the contour $|z|=2$, taken in the usual counterclockwise way:

$$\frac{1}{2\pi i}\int_C\frac{\cos z}{z}\,dz; \qquad \frac{1}{2\pi i}\int_C\frac{e^{3z}}{z^4}\,dz; \qquad \frac{1}{2\pi i}\int_C e^{3z}(z-1)^4\,dz.$$

7. Evaluate the following integrals, where C denotes the contour $|z|=1$, taken in the usual counterclockwise way:

$$\frac{1}{2\pi i}\int_C\frac{z}{e^z}\,dz; \qquad \frac{1}{2\pi i}\int_C\frac{e^{3z}}{(z-3)^4}\,dz; \qquad \frac{1}{2\pi i}\int_C\frac{1}{3+4z}\,dz.$$

8. ($\mathcal{E}$) Let

$$f(z)=\frac{1}{1-2z}+\frac{1}{1+z}.$$

Write down the power series for f centered at $z_0=0$ and and $z_0=3$. This can be done in two different ways: either by computing $f^{(n)}(z)$ by an easy induction and evaluation at z_0, or by manipulating the geometric series.

9a. ($\mathcal{E}$) Suppose C is a simple, piecewise smooth, (not necessarily closed!) contour. Prove that $\int_C z\,dz=0$ implies $\int_C z^3\,dz=0$.

9b. Find a simple, piecewise smooth contour C so that $\int_C z^3\,dz=0$ and $\int_C z\,dz=1$.

10. Let C denote a contour consisting of a line segment from $1-2i$ to $4i$ followed by a line segment from $4i$ to $2+i$. Define a branch of the logarithm which is analytic on a domain containing C and use it to evaluate

$$\int_C\frac{dz}{z}$$

This problem requires both a number and a function.