Mathematica for physicists - Exercise 3

Due to 30/04/2019

Exercise 1

- Evaluate the integral:
$$\frac{1}{2\pi i}\int \frac{e^{zt}}{z^2(z^2+2z+2)}dz \tag{1}$$
on the circle $|z|=3$, using the residue theorem and by direct integration.
- Plot the vector plot and the stream plot of the integrand: $\frac{e^{zt}}{z^2(z^2+2z+2)}$.

Exercise 2

Show that
$$\int_0^{2\pi} \frac{d\theta}{a+b\sin\theta} = \frac{2\pi}{\sqrt{a^2-b^2}} \tag{2}$$
using the residue theorem. Use the substitution $\sin\theta = \left(e^{i\theta}-e^{-i\theta}\right)/(2i) = (z-z^{-1})/(2i), dz = ie^{i\theta}d\theta = izd\theta$.