Review problems: answers.

① $-i\ln(\sqrt{2}+1) + \frac{\pi}{2} + 2k\pi, \quad -i\ln(\sqrt{2}-1) + \frac{3\pi}{2} + 2k\pi, \quad k \in \mathbb{Z}$

② $\ln(\sqrt{2}+1) + i\left(\frac{\pi}{2} + 2k\pi\right), \quad \ln(\sqrt{2}-1) + i\left(\frac{3\pi}{2} + 2k\pi\right), \quad k \in \mathbb{Z}$

③ a) poles of order 2 at $2i, -2i$.

b) $z=0$: nonisolated.

$z = \frac{2}{(2k+1)\pi}$ $k \in \mathbb{Z}$: simple pole.

c) $z=0$: removable singularity

d) $z=0$: essential singularity

④ note that the integrand is not even.
However, since $\frac{x^2}{(x^2+1)^2(x^2+2x+2)} \sim \frac{1}{x^4}$ as $x \to \pm\infty$,
the improper integral exists.