$|\varepsilon|<1$ $\boxed{8.1\,c-ii}$ $\varepsilon\in(-1,1)$

$$\int_0^{2\pi}\frac{dt}{(1+\varepsilon\cos t)^2}=\int_0^{2\pi}\frac{dx}{\left(1+\varepsilon\left(\frac{e^{ix}+e^{-ix}}{2}\right)\right)^2}=\int_\gamma\frac{1}{\left(1+\varepsilon\left(\frac{z+\frac{1}{z}}{2}\right)\right)^2}\cdot\frac{1}{iz}\,dz$$

$$=\frac{4}{i}\int_\gamma\frac{z}{(\varepsilon z^2+2z+\varepsilon)^2}\,dz=\left|\,z_{1,2}=\frac{-1\pm\sqrt{1-\varepsilon^2}}{\varepsilon}\,\right|=$$

$$\left|\frac{-1-\sqrt{1-\varepsilon^2}}{\varepsilon}\right|=\frac{1+\sqrt{1+\varepsilon^2}}{|\varepsilon|}\geq\frac{1}{|\varepsilon|}>1$$

$$\left|\frac{\sqrt{1-\varepsilon^2}-1}{\varepsilon}\right|\overset{?}{<}1$$

$$1-\sqrt{1-\varepsilon^2}<\varepsilon\ ?$$

$$\sqrt{1-\varepsilon}\sqrt{1+\varepsilon}=\sqrt{1-\varepsilon^2}>1-\varepsilon\ ?$$

$$=\frac{4}{i\varepsilon^2}\int_\gamma\frac{z\,dz}{(z-z_1)^2(z-z_2)^2}=*$$

$$\mathrm{Res}(f,z_2)=\lim_{z\to z_2}\left(\frac{z}{(z-z_1)^2}\right)'=\lim_{z\to z_2}\frac{(z-z_1)-2z}{(z-z_1)^3}=$$

$$=\frac{-z_1-z_2}{(z_2-z_1)^3}=\frac{2}{\varepsilon\,\frac{(1-\varepsilon^2)^{3/2}}{\varepsilon^3}\cdot 8}=\frac{\varepsilon^2}{4(1-\varepsilon^2)^{3/2}}$$

$$*=2\pi\cancel{i}\cdot\frac{\cancel{4}}{\cancel{i}\cdot\cancel{\varepsilon^2}}\cdot\frac{\cancel{\varepsilon^2}}{\cancel{4}(1-\varepsilon^2)^{3/2}}=\boxed{2\pi(1-\varepsilon^2)^{-\frac{3}{2}}}$$