8) d(i)

$$\int_0^{\infty}\frac{x\sin x}{(x^2+1)^2}\,dx = \frac{1}{2}\int_{-\infty}^{\infty}\frac{x\sin x}{(x^2+1)^2}\,dx = \frac{1}{2}\,\operatorname{Im}\int_{-\infty}^{\infty}\underbrace{\frac{xe^{ix}}{(x^2+1)^2}}_{f(z)}\,dx = *$$

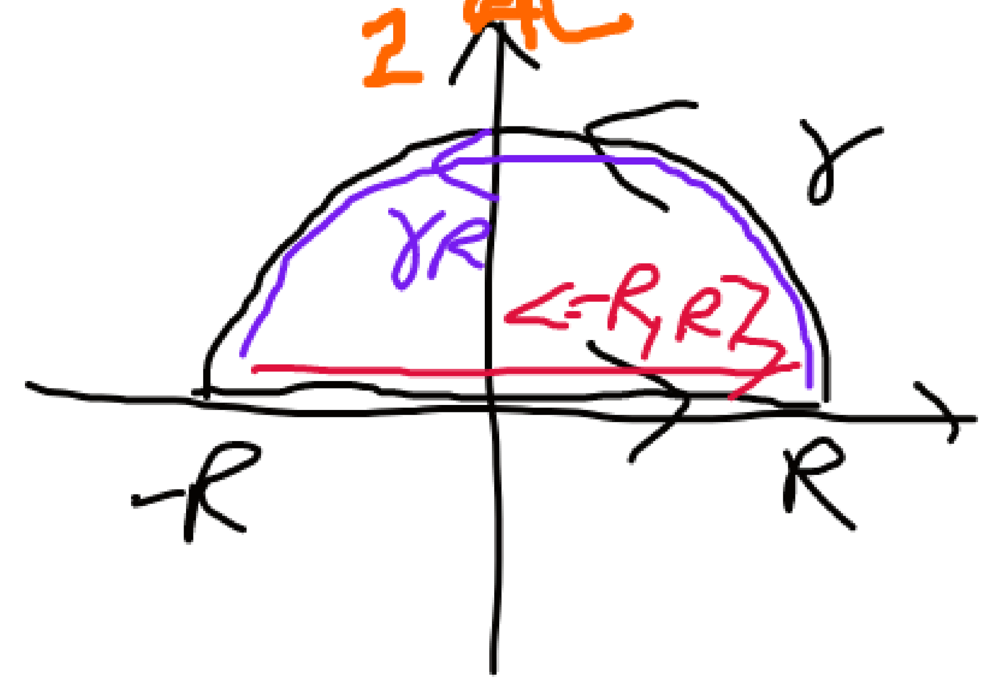
$$\int_{\gamma\, \cancel{<-R,R>}} f(z)\,dz = 2\pi i\,\operatorname{Res}(f,i)\cdot\operatorname{Ind}_\gamma(i) = 2\pi i\cdot\frac{1}{4e}$$

$$\operatorname{Res}(f,i) = \lim_{z\to i}\left(\frac{ze^{iz}(z-i)^2}{(z^2+1)^2}\right)' = \lim_{z\to i}\left(\frac{ze^{iz}}{(z+i)^2}\right)'$$

$$= \lim_{z\to i}\frac{(e^{iz}+ize^{iz})(z+i)^{\cancel{2}} - 2\cancel{(z+i)}\,ze^{iz}}{(z+i)^{\cancel{4}\,3}} =$$

$$= \lim_{z\to i} e^{iz}\left(\frac{z+iz^2+i-z-2z}{(z+i)^3}\right) = \frac{1}{4e}$$

$$* = \frac{1}{2}\operatorname{Im}\frac{\pi i}{2e} = \boxed{\frac{\pi}{4e}}$$



$\gamma = <-R,R> + \gamma_R$

$\gamma_R(t) = Re^{it},\ t\in[0,\pi]$

- $\int_{\gamma_R} f(z)\,dz \longrightarrow 0$ z lematu Jordana

- $$\underbrace{\int_{\gamma} f(z)\,dz}_{=\frac{\pi}{2e}} = \left(\int_{<-R,R>} + \int_{\gamma_R}\right) f(z)\,dz \xrightarrow[R\to\infty]{} \int_{-\infty}^{\infty} f(x)\,dx = 2\cdot\int_0^{\infty}\ldots$$