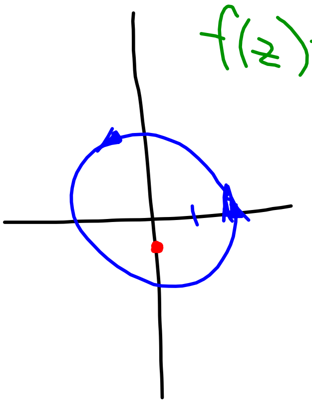
$$\int_{C_2(0)} \frac{\sin z}{\underset{z-(-i)}{z+i}}\,dz = 2\pi i \sin(-i)$$

$$= \cancel{2}\pi \cancel{i}\left(\frac{e^{i(-i)} - e^{-i(-i)}}{\cancel{2}\cancel{i}}\right)$$

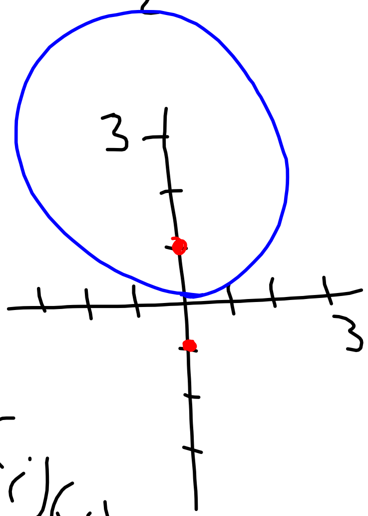
$z_0 = -i$

$f(z) = \sin z$

$$= \pi\left(e - e^{-1}\right)$$



$$\int_{C_2(2i)} \frac{e^z}{z^2+1}\,dz = \int_{C_2(2i)} \frac{e^z}{z^2-(-1)}\,dz$$



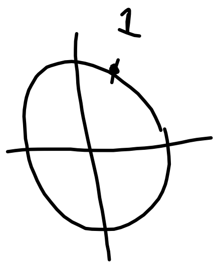
$$= \int_{C_2(2i)} \frac{e^z}{(z+i)(z-i)}\,dz$$

$z_0 = i$ $\quad f(z) = \frac{e^z}{z+i}$

$$= \int_{C_2(2i)} \frac{e^z/(z+i)}{z-i}\,dz$$

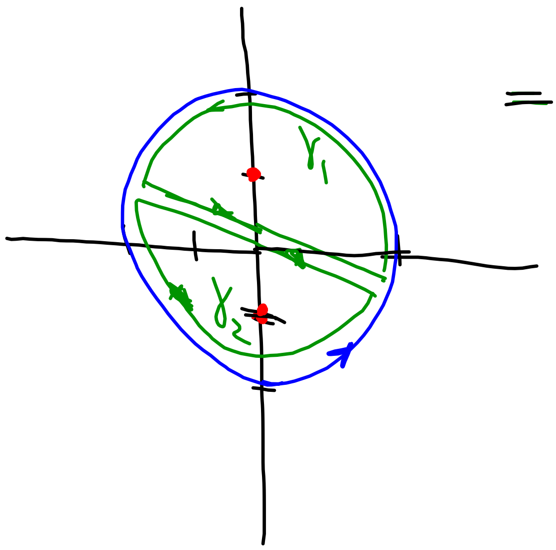
$(-i)(-i) = i^2 = -1$

$$= 2\pi i \cdot \frac{e^i}{i+i}$$



$$= \pi e^i$$

$$\int_{C_2(0)} \frac{e^z}{z^2+1}\,dz = \int_{C_2(0)} \frac{e^z}{(z+i)(z-i)}\,dz$$



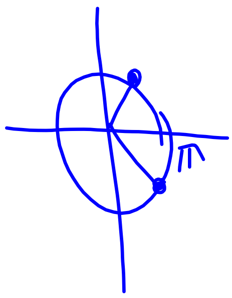
$$= \int_{\gamma_1} \frac{e^z/(z+i)}{z-i}\,dz + \int_{\gamma_2} \frac{e^z/(z-i)}{z+i}\,dz$$

$f(z) = e^z/(z+i)$

$z_0 = i$

$f(z) = e^z/(z-i)$

$z_0 = -i$



$$= \cancel{2}\pi \cancel{i} \cdot \frac{e^i}{\cancel{2i}} + \cancel{2}\pi \cancel{i} \cdot \frac{e^{-i}}{-\cancel{2i}}$$

$$= \pi e^i - \pi e^{-i}$$

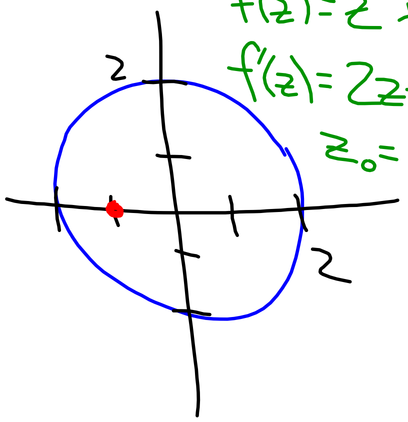
$$\int_{C_2(0)} \frac{z^2+3z-5}{z^2+2z+1}\,dz = \int_{C_2(0)} \frac{z^2+3z-5}{(z+1)^2}\,dz$$

Thm. 5.1

$f(z)=z^2+3z-5$

$f'(z)=2z+3$

$z_0=-1$



$$= 2\pi i \cdot \underbrace{\left(2(-1)+3\right)}_{f'(z_0)}$$

$$= 2\pi i$$

$$\int \frac{}{z^3 + 2z^2} = \int_{C_5(0)} z^2(z+2)$$