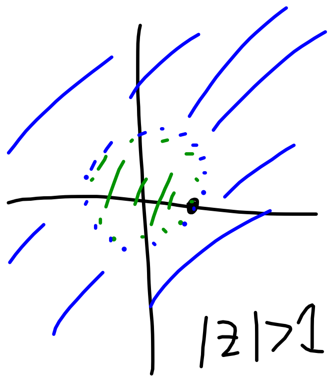
$$f(z)=\frac{1}{1-z}$$

$$f(z)=1+z+z^2+z^3+\cdots \qquad |z|<1$$

$$f(z)=\frac{1}{1-z}$$

$$=\frac{1}{z}\cdot\frac{1}{\frac{1}{z}-1} \qquad \frac{1}{1+\bigcirc}$$



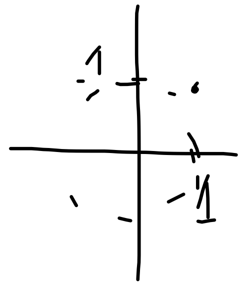
$|z|>1$

$\left|\frac{1}{z}\right|<1$

$$=-\frac{1}{z}\cdot\frac{1}{1-\frac{1}{z}}$$

$$=-\frac{1}{z}\left(1+\frac{1}{z}+\frac{1}{z^2}+\frac{1}{z^3}+\cdots\right)$$

$$=-\frac{1}{z}-\frac{1}{z^2}-\frac{1}{z^3}-\frac{1}{z^4}-\cdots$$

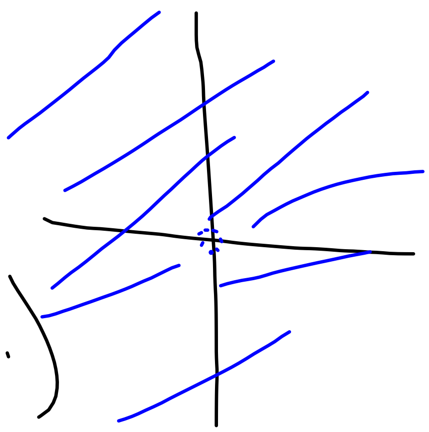


$$\frac{1}{1-z}=-\sum_{k=1}^{\infty}\frac{1}{z^k} \quad \text{if } |z|>1$$

Laurent series for

$\dfrac{\cos z}{z^2}$ centered at $z_0 = 0$

$$\frac{\cos z}{z^2} = \frac{1}{z^2}\cos z$$



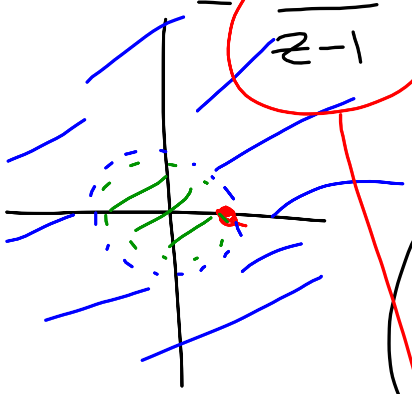
$$= \frac{1}{z^2}\left(1 - \frac{z^2}{2!} + \frac{z^4}{4!} - \frac{z^6}{6!} + \cdots\right)$$

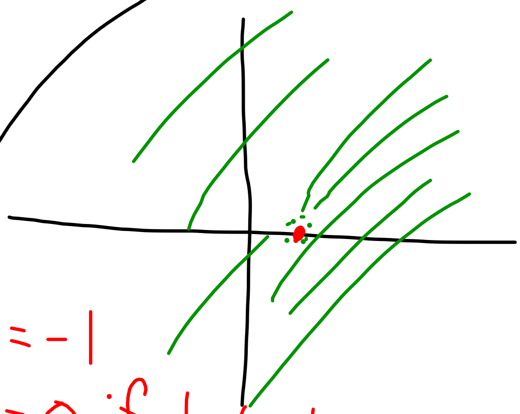
$$= \frac{1}{z^2} - \frac{1}{2!} + \frac{z^2}{4!} - \frac{z^4}{6!} + \cdots$$

$$= \sum_{k=-1}^{\infty} \frac{(-1)^{k+1}}{(2k+2)!} z^{2k}$$

$$f(z) = \frac{1}{1-z}$$ Find Laurent series centered at $z_0 = 1$

$$= \frac{-1}{z-1}$$





$c_{-1} = -1$

$c_k = 0$ if $k \neq -1$

$$\sum_{k=-\infty}^{\infty} c_k (z-1)^k$$

$$\cdots + \frac{c_{-2}}{(z-1)^2} + \frac{c_{-1}}{z-1} + c_0 + c_1(z-1) + c_2(z-1)^2 + \cdots$$

$$g(z) = \frac{1}{z^2}$$

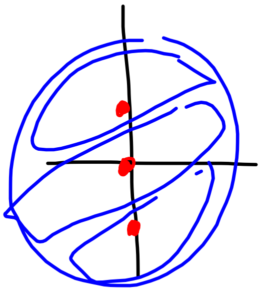
$$\cdots + \frac{c_{-2}}{z^2} + \frac{c_{-1}}{z} + c_0 + c_1 z + c_2 z^2 + \cdots$$

$$f(z) = \frac{z+1}{z-1}$$

$$\int \frac{dz}{z(1+z^2)}$$

$$= \underbrace{(z+1)}_{(z-1)+2} \frac{1}{z-1}$$

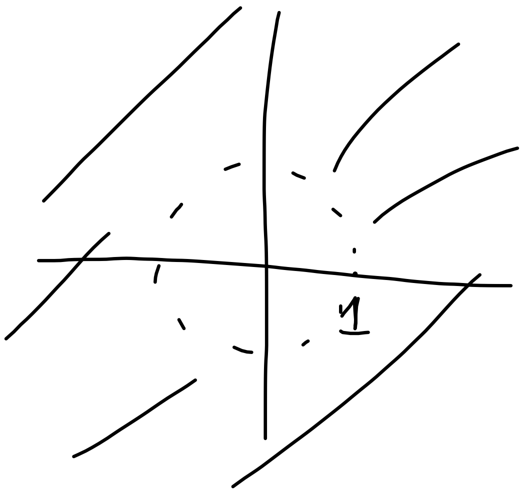
$$2+(z-1)$$



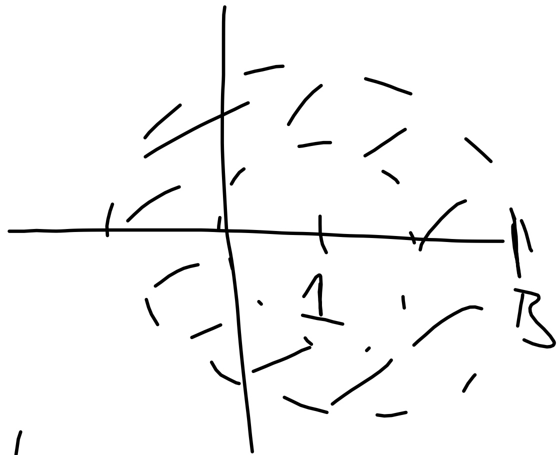
$$+ \frac{c_{-1}}{z-1} + \underbrace{c_0 + c_1(z-1)} + c_2(z-1)^2 + \cdots$$

$c_{-1} = 2$ $c_0 = 1$

$$= \left[2+(z-1)\right] \cdot \frac{1}{z-1} = \frac{2}{z-1} + 1$$



$|z|>1$



$1<|z-1|<2$