13.3: 23. $f(z) = \frac{z^3}{(z+i)^3}$ at i

$$DQ = \frac{f(z) - f(i)}{z - i}$$

$$= \frac{\frac{z^3}{(z+i)^3} - \frac{i^3}{(2i)^3}}{z - i}$$

13.4: 7. $f(z) = \frac{i}{z^8} = \frac{i}{(re^{i\theta})^8} = \frac{i}{r^8 e^{i8\theta}}$

$$= i\left(\frac{1}{r^8}\right) e^{-i8\theta}$$

$$= i\left(\frac{1}{r^8}\right)\left[\cos 8\theta - i \sin 8\theta\right]$$

$$= \underbrace{\left(\frac{1}{r^8}\sin 8\theta\right)}_{u(r,\theta)} + i\underbrace{\left(\frac{1}{r^8}\cos 8\theta\right)}_{v(r,\theta)}$$

13.5: 17. e^{z^3}

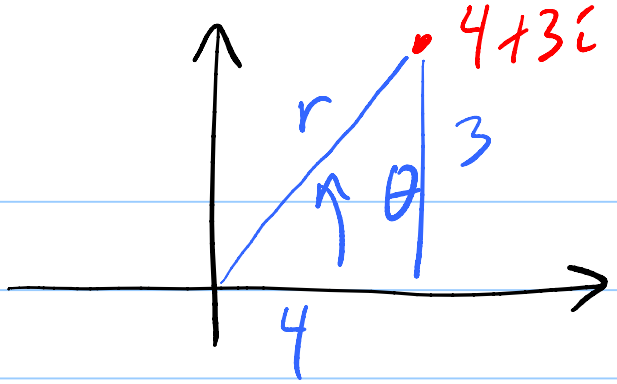
$$(x+iy)^3 =$$

$$(x+iy)\left[(x^2 - y^2) + i\,2xy\right] \qquad i^2 = -1$$

$$e^{u+iv} = e^u(\cos v + i \sin v)$$

$$= (e^u \cos v) + i(e^u \sin v)$$

13.5: 9.



$r = \sqrt{4^2+3^2} = 5$

$\theta = \text{Arctan}\ \frac{3}{4}$

13.4: 7. $f(z) = i/z^8 = u(x,y) + iv(x,y)$

$= \frac{i}{(re^{i\theta})^8} = \frac{i}{r^8 e^{i8\theta}} = i\frac{1}{r^8} e^{-i8\theta}$

$= i\frac{1}{r^8}(\cos 8\theta - i \sin 8\theta)$

$= \underbrace{\left(\frac{1}{r^8}\sin 8\theta\right)}_{u(r,\theta)} + i\underbrace{\left(\frac{1}{r^8}\cos 8\theta\right)}_{v(r,\theta)}$

13.3: 7. $\text{Re}\, z \geq -1 \qquad z = x+iy$

$x \geq -1$