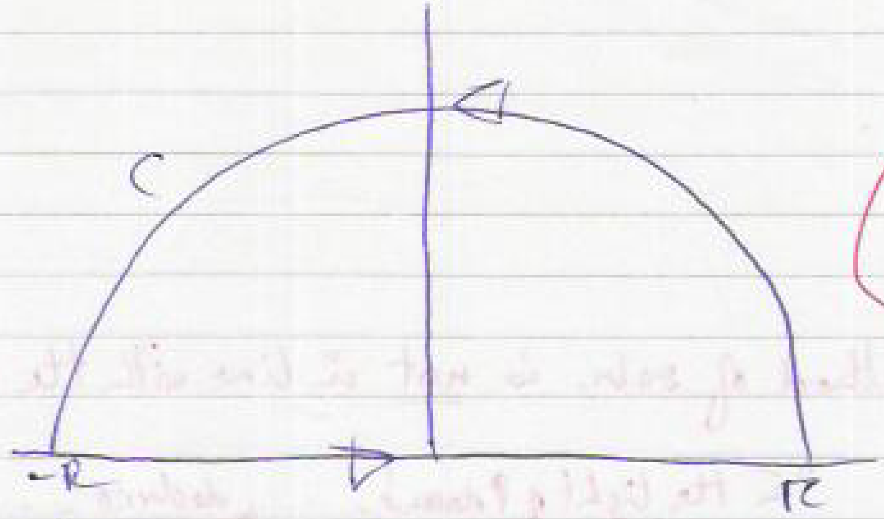
$7\frac{1}{3}$

iii) We take the contour integral around the curve C



to give

$$I = \mathrm{Re}\left(\int_C \frac{e^{iz}\,dz}{(z-x_0)^2+y_0^2}\right)$$

$$= \mathrm{Re}\left(\int_C \frac{e^{iz}\,dz}{(z-x_0-iy_0)(z-x_0+iy_0)}\right)$$

$$= \mathrm{Re}\left(2\pi i \sum_{\text{of in } C} \text{Residues}\left(\frac{e^{iz}}{(z-x_0-iy_0)(z-x_0+iy_0)}\right)\right)$$

$$= \mathrm{Re}\left(2\pi i \frac{e^{i(x+iy)}}{x_0+iy_0-x_0+iy_0}\right) = \mathrm{Re}\left(\pi \frac{e^{i(x+iy)}}{y_0}\right)$$

since only residue at $x_0+iy, y>0$.

We split the integral up

$$\int_C = \int_{-R}^{R} + \int_{|z|=R}$$

$$\int_{|z|=R} \frac{e^{iz}}{(z-x_0)^2+y_0^2}\,dz = \int_0^{\pi} \frac{e^{iRe^{i\theta}}}{(Re^{i\theta}-x_0)^2+y_0^2}\,d(Re^{i\theta})$$

$$= iR\int_0^{\pi} \frac{e^{i(R\cos\theta + iR\sin\theta)}}{(Re^{i\theta}-x_0)^2+y_0^2}e^{i\theta}\,d\theta$$