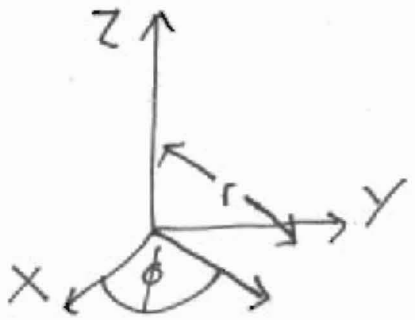
1)

152(5): Assumed Functional Dependence of z on r

Cylindrical Polar Coordinate



$$\left.\begin{aligned} X &= r\cos\phi \\ Y &= r\sin\phi \end{aligned}\right\} -(1)$$
$$Z = Z$$

$$dl^2 = dz^2 + e^{-2\alpha/z}\,dr^2 \quad -(2)$$

Assume

$$r = \beta z \quad -(3)$$
$$dr = \beta\, dz \quad -(4)$$
$$dl^2 = \left(1 + \beta e^{-2\alpha/z}\right) dz^2 \quad -(5)$$
$$dl = \left(1 + \beta e^{-2\alpha/z}\right)^{1/2} dz \quad -(6)$$

The light deflection is:

$$\Delta\phi = \frac{2}{\beta^2}\int_{R_0}^{\infty} \frac{1}{z^2}\left(\frac{1}{b^2} - e^{-2\alpha/z\left(\frac{1}{a^2}+\frac{1}{z^2}\right)}\right)^{-1/2} dl$$

$$= \frac{2}{\beta^2}\int_{R_0}^{\infty} \frac{1}{z^2}\left(\frac{1}{b^2} - e^{-2\alpha/z\left(\frac{1}{a^2}+\frac{1}{z^2}\right)}\right)^{-1/2}\left(1+\beta e^{-2\alpha/z}\right)^{1/2} dz \quad -(7)$$