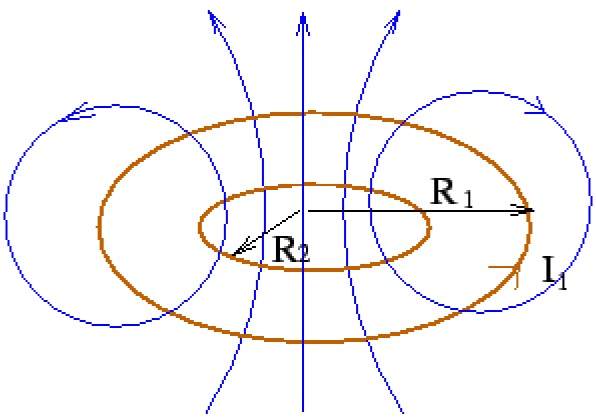
Exercise 01

A conducting circle having a radius R_0 at time $t = 0$ is in a constant magnetic field B perpendicular to its plane. The circle expands with time with its radius becoming $R = R_0(1 + \alpha t^2)$ at time t. Calculate the emf developed in the circle.

(Ans. $-4\pi R_0^2 \alpha t(1+\alpha t^2)B$)

Exercise 1

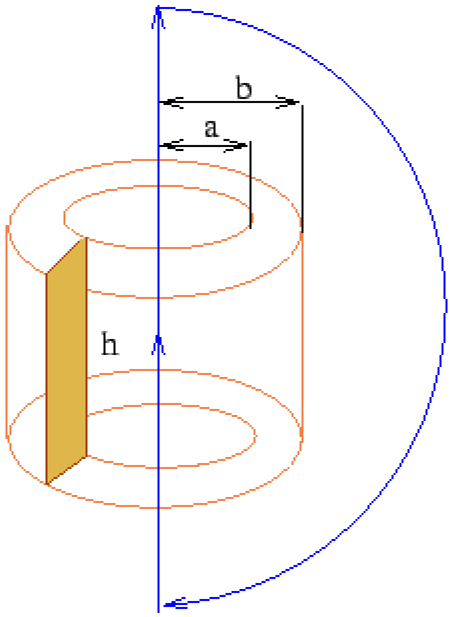
The figure shows two coplanar and concentric rings of radii R_1 and R_2 where $R_1 \gg R_2$. Determine the mutual inductance of the coils. Solve the problem by considering the current to be changing in either of the coils.

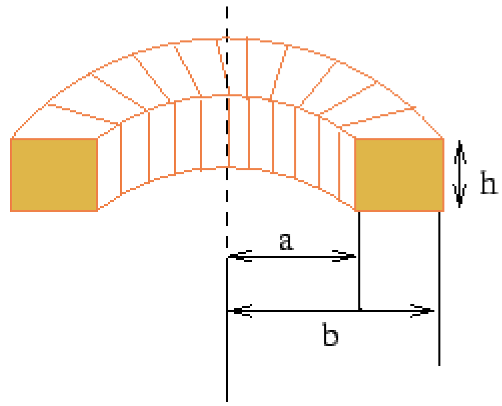


(Ans. $\mu_0 \pi R_2^2 / 2R_1$).

Exercise 2

A toroidal coil of rectangular cross section, with height h has N tightly wound turns. The inner radius of the torus is a and the outer radius b. A long wire passes along the axis.





The ends of the wire are connected by a semi-circular arc. Find the mutual inductance. Show explicitly that $M_{21} = M_{12}$.

(Hint : When the current flows in the turns of toroid, the field at a distance r from the toroid axis is $\mu_0 NI/2\pi r$. The semi-circular area traps flux only in one rectangular turn of height h and width $b-a$.   Answer : ($\mu_0 Nh/2\pi \ln(b/a)$.)