Problem Statement

A compass is placed in the middle of a metal loop with radius 0.10m. The compass points in the direction of the Earth magnetic field when the loop is at rest. When the loop revolves around an axis perpendicular to the Earth's surface with constant angular velocity, the average deviation of the compass needle is 2 degrees. Find the resistance R of the metal loop.

Relevant Equations

$$\oint B \cdot dr = \mu_0 I$$

$$V_{ind} = -\frac{d\Phi}{dt}$$

Attempt at solution

B is the horizontal component of the earth magnetic field.

$$\Phi = \pi r^2 B \cos \omega t$$

$$V = -\frac{d\Phi}{dt} = \pi r^2 B \omega \sin \omega t$$

$$I = \frac{V}{R}$$

Now I should calculate the magnetic field induced by the current through the metal loop:

$$\oint B dr = \mu_0 I$$

However, I have no idea what dr might be in this case.