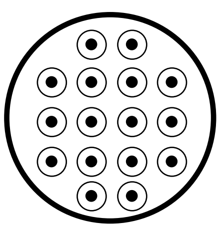
CONCEPT: FARADAY'S LAW WITH CALCULUS

- **Faraday's Law:** constant rate of change in magnetic flux creates an *average* EMF:
  - $\varepsilon_{ind} = N\left|\frac{\Delta\Phi_B}{\Delta t}\right|$
- As Δt becomes very small, "change" ⟶ "derivative" & ε_{ind} becomes an *instantaneous* EMF:
  - $\varepsilon =$ ________ $=$ ____________

Remember; one variable will be *changing* (not uniformly) over time while the other two remain *constant*.

- For changing **magnetic fields** ⟶ $\frac{\mathbf{d\Phi_B}}{\boldsymbol{dt}} =$ ______________
- For changing **Area** ⟶ $\frac{\mathbf{d\Phi_B}}{\boldsymbol{dt}} =$ ______________
- For changing **Angle** ⟶ $\frac{\mathbf{d\Phi_B}}{\boldsymbol{dt}} =$ ______________

EXAMPLE**:** A circular of radius 2m lies flat on a surface, with a magnetic field passing through the loop given by the equation $B(t) = 4 + 3t^2$**.** What is the magnitude of the induced EMF at t = 0.5s?



EXAMPLE: FARADAY'S LAW OF ROTATING RECTANGULAR LOOP

A rectangular conducting loop with length **a** and width **b** is in the presence of a uniform magnetic field pointing into the page**.** The loop is then rotated with an angular speed $\boldsymbol{\omega}$ about its axis**.** What is the induced EMF in the loop as a function of time?