A parallel plate capacitor has circular plates of radius 50 cm and spacing 1 mm. A uniform electric field is established between the plates. The electric field initially has a value of 20 V/m and it is increasing. The changing electric field will create a magnetic field and we are interested in finding the field 2 m from the center of the capacitor.

a. What is the initial electric flux 2 m from the center of the capacitor? (2 points)
b. What is the direction of the magnetic field 2 m from the center of the capacitor? (3 points)
c. If the electric field is changing at a rate of 32 V/(m s), what is the magnitude of the displacement current 2 m from the center of the plate? (3 points)
d. What is the magnitude of the magnetic field 2 m from the center of the plate? (2 points)

Leave your answer in terms of \((\varepsilon_0, \mu_0, \pi)\) considered to be numbers with no units.

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a) \quad \phi_E = EA = 20\left(\frac{V}{m}\right)\pi\left(\frac{1}{2}\right)^2 m^2 = 5\pi V \cdot m \\
b) \quad E \text{ increasing} \\
\Rightarrow \text{displacement current into page} \\
\Rightarrow \text{clockwise}
\]

\[
c) \quad i_d = \varepsilon_0 \frac{d\phi_E}{dt} = \varepsilon_0 A \frac{dE}{dt} \\
\quad = \varepsilon_0 \pi \left(\frac{1}{2}\right)^2 (32) = 8\pi \varepsilon_0 \text{ Amp} \\
d) \quad B = \frac{\mu_0 i_d}{2\pi R} = \frac{\mu_0 8\pi \varepsilon_0}{2\pi (2)} = \frac{\mu_0 \varepsilon_0}{2} T
\]