1. If C = 45 \mu F, determine the equivalent capacitance for the combination shown?

![Capacitor Diagram]

2. An object 4 cm high is placed 15 cm in front of a convex mirror with a focal length of -10 cm. What is the image position?

3. The electric field in the region of space shown is given by \( E = (8i + 2yj) \) N/C where \( y \) is in...
m. What is the magnitude of the electric flux through the top face of the cube shown?

4. Points A [at (2, 3) m] and B [at (5, 7) m] are in a region where electric field is uniform and given by \( E = (4i + 3j) \) N/C. What is the potential difference \( V_A - V_B \)?

5. What is the current in the 10-Ω resistor shown in the figure?
6. A diver shines light up to the surface of a flat glass-bottomed boat at an angle of 30° relative to the normal. If the index of refraction of water and glass are 1.33 and 1.5, respectively, at what angle does the light leave the glass (relative to its normal)?

7. A 30-turn square coil (length of side = 12 cm) with a total resistance of 2.5 Ω is placed in a uniform magnetic field directed perpendicularly to the plane of the coil. The magnitude of
the field varies with time according to $B = A e^{8t}$, where $A = 50$ mT and $t$ is measured in seconds. What is the magnitude of the induced emf in the coil at $t = 0$?

8. Two very long parallel wires carry currents in the positive x direction. One wire (current = 15 A) is coincident with the x axis. The other wire (current = 50 A) passes through the point (0,4.0 mm,0). What is the magnitude of the magnetic field at the point (0,0,3.0 mm)?


All the equations you need (and a few more you may not):

\[ \mathbf{a} \cdot \mathbf{b} = a \cdot b \cdot \cos \phi \]
\[ \mathbf{a} \times \mathbf{b} = a \cdot b \cdot \sin \phi \mathbf{n} \]
\[ \mathbf{v} = \frac{d\mathbf{r}}{dt} \]

\[ \mathbf{F} = m \mathbf{a} \]

\[ \mathbf{F} = -kq_1q_2/r^2 \]
\[ k = 8.99 \times 10^9 \text{ N.m}^2/\text{C}^2 \]

\[ \mathbf{E} = \mathbf{F}/q_0 \]
\[ e = 1.602 \times 10^{-19} \text{ C} \]

\[ E = \sigma / \epsilon_0 \text{ (surface)} \]
\[ E = 2k\lambda / r \text{ (line)} \]

\[ q_0\Delta V = -W_f \]
\[ V = -\int \mathbf{E} \cdot d\mathbf{s} \]
\[ V = kq/r \]

\[ V = iR \]
\[ Q = CV \]
\[ \tau = RC \]

\[ P = iV \]
\[ U = q^2/2C \]
\[ C_{eq} = C_1+C_2+... \text{ (parallel)} \]
\[ 1/R_{eq} = 1/R_1+1/R_2+... \text{ (pll)} \]

\[ L_{eq} = L_1+L_2+... \text{ (series)} \]
\[ \mu = nA \]

\[ \mathbf{B} = \mu_0\mathbf{n} \text{ (solenoid)} \]
\[ \mathbf{B}(z) = \frac{\mu_0}{2\pi} \frac{\mathbf{A}}{z^3} \]

\[ L = N\Phi / i \]
\[ \mathbf{Emf} = -L \frac{di}{dt} \]

\[ U_B = 1/2 Li^2 \]
\[ \mu_B = \frac{eh}{4\pi m} \]
\[ \tau_L = L / R \]
\[ \omega = 1/\sqrt{LC} \]

\[ E = E_m\sin(kx-\omega t) \]
\[ B = B_m \sin(kx-\omega t) \]

\[ \oint \mathbf{E} \cdot d\mathbf{A} = \frac{q}{\epsilon_0} \]
\[ \oint \mathbf{B} \cdot d\mathbf{A} = 0 \]

\[ \oint \mathbf{B} \cdot d\mathbf{S} = \mu_0 i + \mu_0 \varepsilon_o \frac{d\phi_e}{dt} \]

\[ \theta_B = \tan^{-1}(n_2 / n_1) \]
\[ n_1 \sin \theta_1 = n_2 \sin \theta_2 \]

\[ \mathbf{d} \sin \theta = m\lambda \text{ (m = 0, 1, 2...)} \]

\[ \mathbf{S} = \frac{1}{\mu_0} \mathbf{E} \times \mathbf{B} \]