A square wire loop 3 m on a side lies at right angles to a uniform magnetic field of 8 T that completely fills the loop. A 6 V bulb is in series with the loop. The magnetic field is decreased steadily to zero over a time interval $\Delta t$.

1. What is the initial value of the flux?
2. Is the flux increasing or decreasing?
3. Will the current go clockwise or counterclockwise?
4. How long must $\Delta t$ be if the light is to shine at full brightness during this time?

1. \[
\phi_B = NBA \cos \theta
\]
\[
= (1)(8)(3^2) \cos 0^\circ
\]
\[
= 72 \text{ Tm}^2 = 72 \text{ wb}
\]

2. $B$ decreases, $\phi_B$ decreases

3. decrease thumb parallel to original

$\Rightarrow$ clockwise

4. \[
Emf = -\frac{d\phi_B}{dt}
\]
\[
= -A \frac{dB}{dt} = -(3^2) \frac{B_f - B_i}{\Delta t} = -9 \frac{(0-8)}{\Delta t}
\]
\[
\Delta t = 1.25
\]