Ch. 13 Prob. 34

$N = 20$ turns

$\Phi_m = 5.0t^2 - 2.0t \quad (\text{m Wb})$

a) Find emf as a function of time

$$\mathcal{E} = -\frac{d\Phi_m}{dt} = -\frac{d}{dt}\left(5.0t^2 - 2.0t\right) \times 10^{-3}\ \text{Wb}$$

$$= -(10t - 2) \times 10^{-3}\ \frac{\text{Wb}}{\text{s}}$$

$$\boxed{\mathcal{E} = (-10t + 2) \times 10^{-3}\ \text{V}}$$

b) @ $t = 0\text{s}$ $\quad \mathcal{E} = (-10(0) + 2) \times 10^{-3}\ \text{V}$

$= 2 \times 10^{-3}\ \text{V}$

since the voltage is positive, the current flows counter-clockwise

@ $t = 0.10\text{s}$ $\quad \mathcal{E} = (-10(0.10) + 2) \times 10^{-3}\ \text{V}$

$= (-1 + 2) \times 10^{-3}\ \text{V} = 1 \times 10^{-3}\ \text{V}$

counter-clockwise

@ $t = 1.0\text{s}$ $\quad \mathcal{E} = (-10(1) + 2) \times 10^{-3}\ \text{V}$

$= (-10 + 2) \times 10^{-3}\ \text{V} = -8 \times 10^{-3}\ \text{V}$

since the voltage is negative, the current flows clockwise

@ $t = 2.0\text{s}$ $\quad \mathcal{E} = (-10(2) + 2) \times 10^{-3}\ \text{V}$

$= (-20 + 2) \times 10^{-3}\ \text{V} = -18 \times 10^{-3}\ \text{V}$

clockwise