

# NCERT 12.8 8

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## Question 8

Suppose that the electric field amplitude of an electromagnetic wave is  $E_0 = 120\text{N/C}$  and that its frequency is  $f = 50.0\text{ MHz}$ .

(a) Determine,  $B_0, \omega, k$  and  $\lambda$

(b) Find expressions for  $\mathbf{E}$  and  $\mathbf{B}$

$$c = \frac{2\pi f}{k} \quad (1)$$

$$c = f\lambda \quad (2)$$

$$\lambda = \frac{c}{f} \quad (3)$$

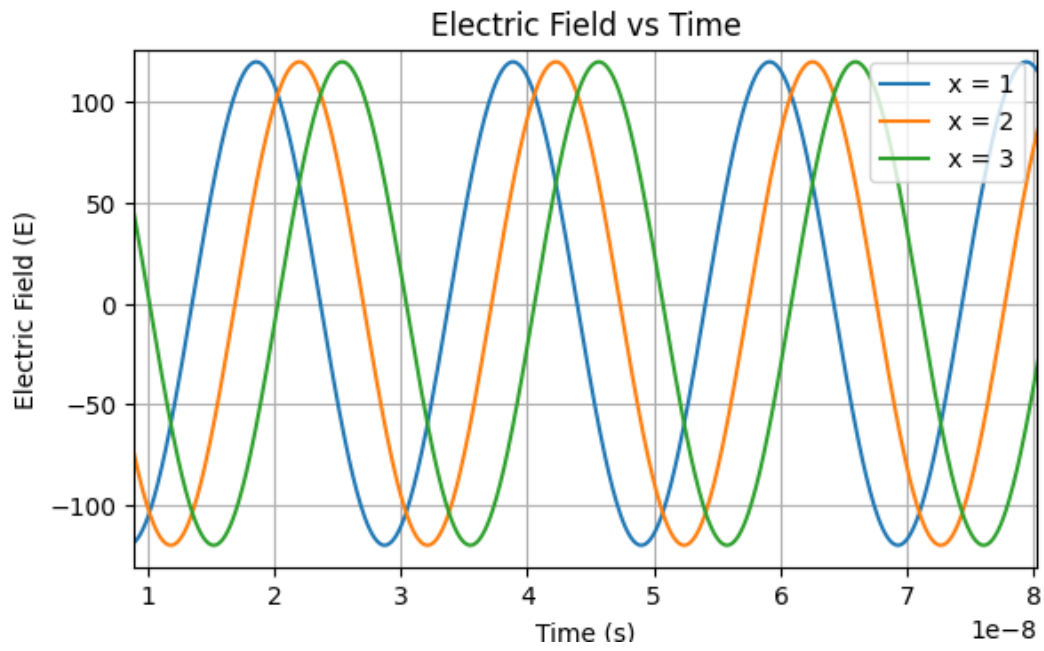
Solution:

TABLE I  
INPUT PARAMETERS

Symbol	Description	value
$f$	frequency of source	50.0 MHz
$E_0$	Electric field amplitude	120 N/C
$c$	speed of light	$3 \times 10^8$ m/s
$\mathbf{e}_2, \mathbf{e}_3$	Standard Basis vectors	N/A

TABLE II  
FORMULAE AND OUTPUT

Symbol	Description	Formula	Value
$\mathbf{E}$	Electric field vector	$E_0 \sin(kx - 2\pi ft)\mathbf{e}_2$	$120 \sin[1.05x - 3.14 \times 10^8 t]\mathbf{e}_2$
$\mathbf{B}$	Magnetic field vector	$B_0 \sin(kx - 2\pi ft)\mathbf{e}_3$	$(4 \times 10^{-7}) \sin[1.05x - 3.14 \times 10^8 t]\mathbf{e}_3$
$B_0$	Magnetic field strength	$\frac{E_0}{c}$	400nT
$\omega$	Angular frequency	$2\pi f$	$3.14 \times 10^8$ m/s
$k$	Propagation constant	$\frac{2\pi f}{c}$	1.05rad/s
$\lambda$	Wavelength	$\frac{c}{f}$	6.0m

Fig. 1. Graph of  $E$ Fig. 2. Graph of  $B$ 