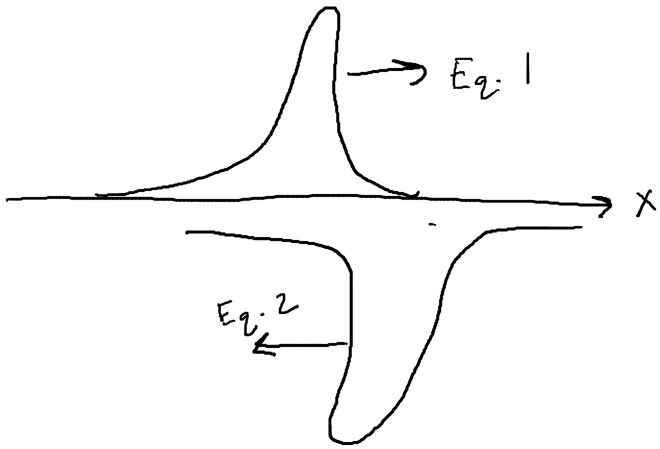
HW 5 Solutions

1. (a) Each function is a pulse moving in opposite directions



b) $$\frac{5E_0}{(3x-4t)^2+2} - \frac{5E_0}{(3x+4t-6)^2+2} = 0$$

$$\frac{1}{(3x-4t)^2+2} = \frac{1}{(3x+4t-6)^2+2}$$

$$(3x+4t-6)^2 + \cancel{2} = (3x-4t)^2 + \cancel{2}$$

$$\cancel{9x^2} + 24xt - 36x + \cancel{16t^2} - 48t + 36 = \cancel{9x^2} - 24xt + \cancel{16t^2}$$

$$48xt - 36x - 48t + 36 = 0$$

$$48t(x-1) - 36(x-1) = 0$$

$$48t = 36$$

$$t = \frac{36}{48} = \frac{3}{4}$$

c) Same eq. as (b)

$$48t(x-1) - 36(x-1) = 0$$

$$x = 1$$

2. $\dfrac{E_{10}}{E_{20}} = 2$ $C = \dfrac{I_{max} - I_{min}}{I_{max} + I_{min}}$ $I_{max} = I_1 + I_2 + 2\sqrt{I_1 I_2}$

$I_{min} = I_1 + I_2 - 2\sqrt{I_1 I_2}$

$\dfrac{\sqrt{I_1}}{\sqrt{I_2}} = 2$ $= \dfrac{\cancel{4}\,2\sqrt{I_1 I_2}}{2(I_1 + I_2)} = \dfrac{2\sqrt{I_1 I_2}}{I_1 + I_2}$

$\sqrt{I_1} = 2\sqrt{I_2}$ $= \dfrac{4 I_2}{4I_2 + I_2} = \boxed{\dfrac{4}{5}}$

$I_1 = 4 I_2$

$C = \dfrac{1}{2} = \dfrac{2\sqrt{I_1 I_2}}{I_1 + I_2}$ $\dfrac{E_{10}}{E_{20}} = r = \dfrac{\sqrt{I_1}}{\sqrt{I_2}}$ $\sqrt{I_1} = r\sqrt{I_2}$

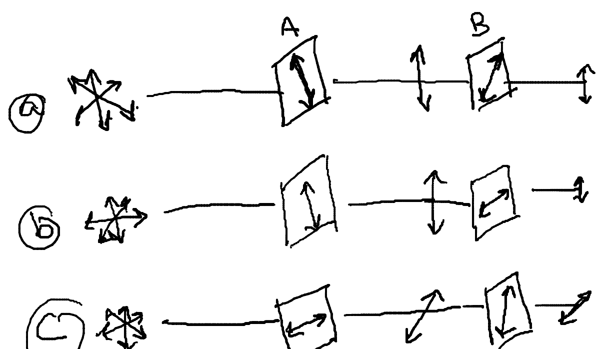
$C = \dfrac{2r\, I_2}{r^2 I_2 + I_2} = \dfrac{2r}{1 + r^2} = \dfrac{1}{2}$

$4r = 1 + r^2$

$r^2 - 4r + 1 = 0$

$r = \dfrac{+4 \pm \sqrt{16 - 4}}{2} = \dfrac{4 \pm 2\sqrt{3}}{2} = \boxed{2 \pm \sqrt{3}}$

3. case 1 : unpolarized light



$I = I_0 \cos^2 45$
↑ before B

$I = I_0 \cos^2 60$

$I = I_0 \cos^2 45$

$\therefore$ a = c > b

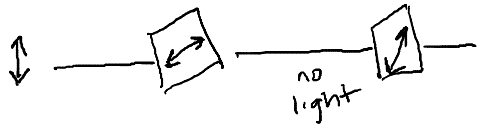
case 2 : vertically polarized light

a same

b same

a > b > c

(b) same

(c) 

$I = 0$

(a) > (b) > (c)