$$\vec{E} = (\hat{x} - 2\hat{y})e^{jkz}$$

$$\vec{E}(z,t) = Re\{\vec{E}e^{j\omega t}\}$$

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$$\vec{E}(z,t) = \hat{x}\cos(\omega t - kz) - 2\hat{y}\cos(\omega t - kz)$$

$$\vec{E} = E_x\hat{x} + E_y\hat{y} + E_z\hat{z}$$

$$E_x = \cos(\omega t - kz)$$

$$E_y = -2\cos(\omega t - kz)$$

$$E_z = 0$$

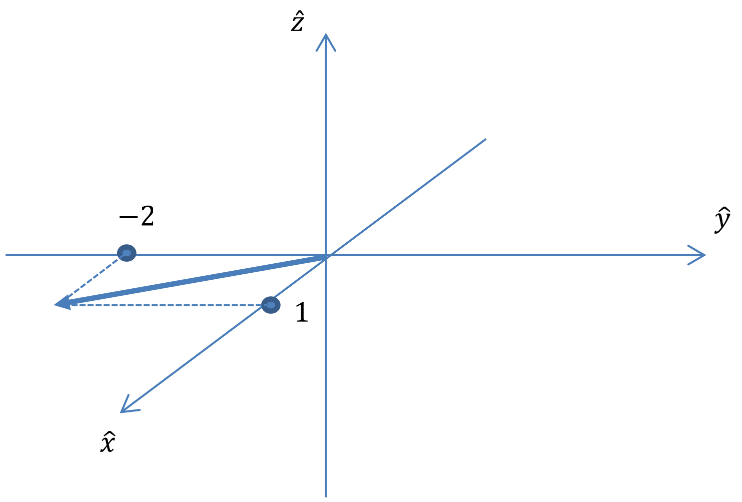
$$\vec{R} = x\hat{x} + y\hat{y} + z\hat{z} = 0 <=> x = y = z = 0$$

$$E_x = \cos(\omega t)$$

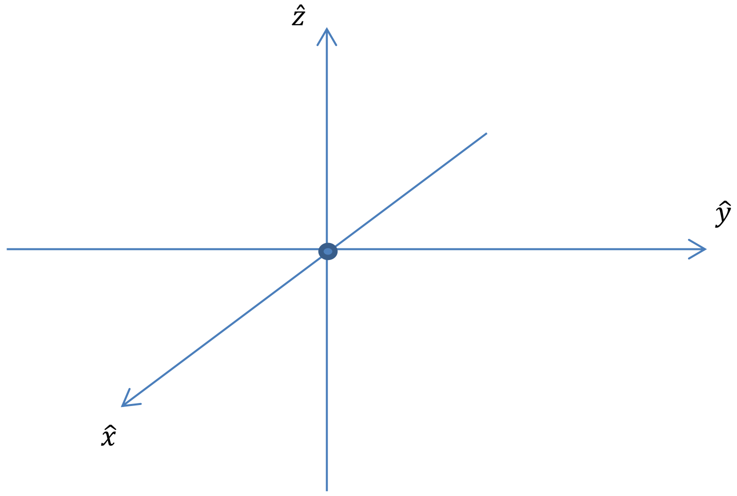
$$E_y = -2\cos(\omega t)$$

$$E_z = 0$$

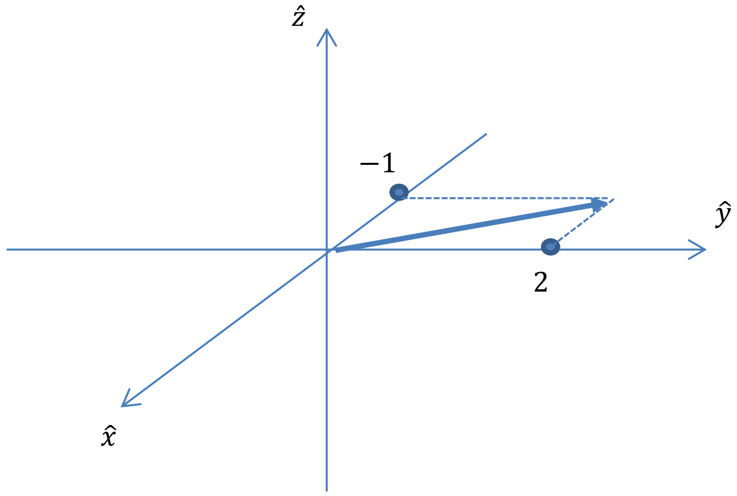
$\omega t \rightarrow$	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π
E_x	1	0	-1	0	1
E_y	-2	0	2	0	-2
E_z	0	0	0	0	0



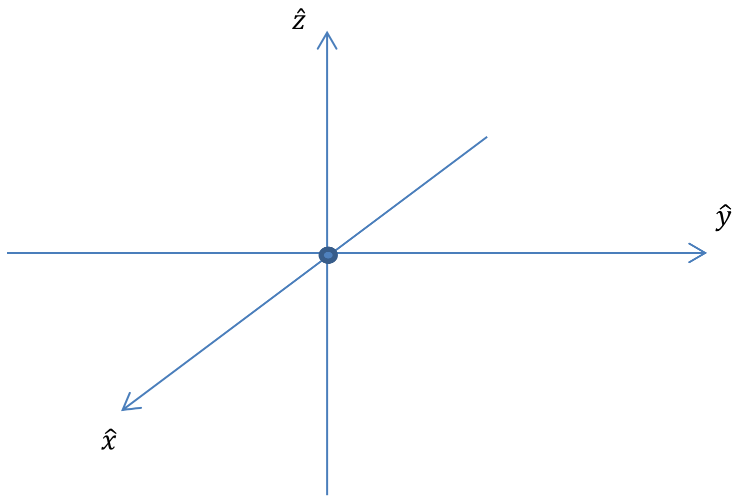
$\omega t \rightarrow$	0
E_x	1
E_y	-2
E_z	0



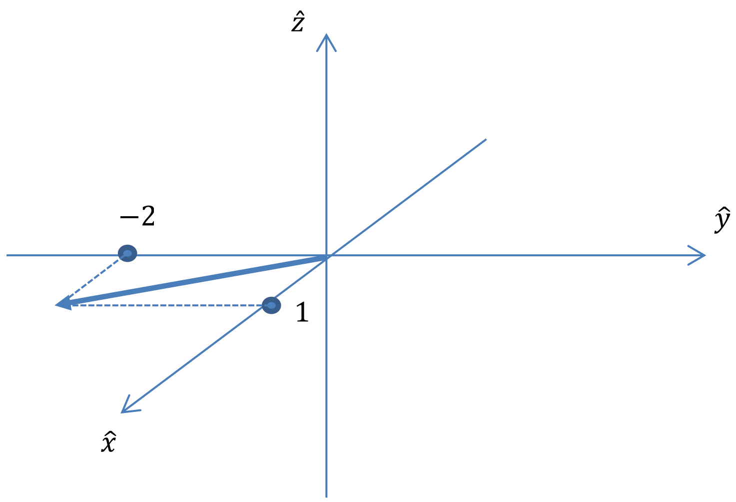
$\omega t \rightarrow$	$\frac{\pi}{2}$
E_x	-1
E_y	2
E_z	0



$\omega t \rightarrow$	π
E_x	-1
E_y	2
E_z	0



$\omega t \rightarrow$	$\frac{3\pi}{2}$
E_x	-1
E_y	2
E_z	0



$\omega t \rightarrow$	2π
E_x	1
E_y	-2
E_z	0

Locus is plane => Linear polarization

Ex:

$$\vec{E} = (\hat{x} - j\hat{y})e^{jkz}$$

$$\vec{E}(z,t) = Re\{\vec{E}e^{j\omega t}\}$$

$$\vec{E}(z,t) = Re\{(\hat{x} - j\hat{y})e^{jkz}e^{j\omega t}\}$$

$$\vec{E}(z,t) = Re\{(\hat{x}e^{jkz}e^{j\omega t} - \hat{y}2je^{jkz}e^{j\omega t}\}$$

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$$\vec{E}(z,t) = \hat{x}Re\{e^{jkz}e^{j\omega t}\} - 2\hat{y}Re\{je^{jkz}e^{j\omega t}\}$$

$$\vec{E}(z,t) = \hat{x}Re\{e^{jkz}e^{j\omega t}\} - 2\hat{y}Re\left\{e^{j\frac{\pi}{2}}e^{jkz}e^{j\omega t}\right\}$$

$$\vec{E}(z,t) = \hat{x}\cos(\omega t - kz) - 2\hat{y}\cos\left(\omega t - kz + \frac{\pi}{2}\right)$$

$$\vec{E}(z,t) = \hat{x}\cos(\omega t - kz) - 2\hat{y}\sin(\omega t - kz)$$

$$\vec{E} = E_x\hat{x} + E_y\hat{y} + E_z\hat{z}$$

$$E_x = \cos(\omega t - kz)$$

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$$\vec{R} = x\hat{x} + y\hat{y} + z\hat{z} = 0 <=> x = y = z = 0$$

$$E_x = \cos(\omega t)$$

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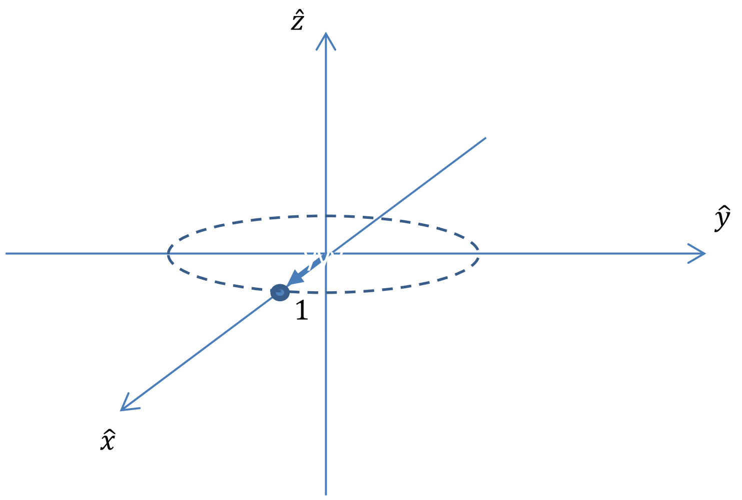
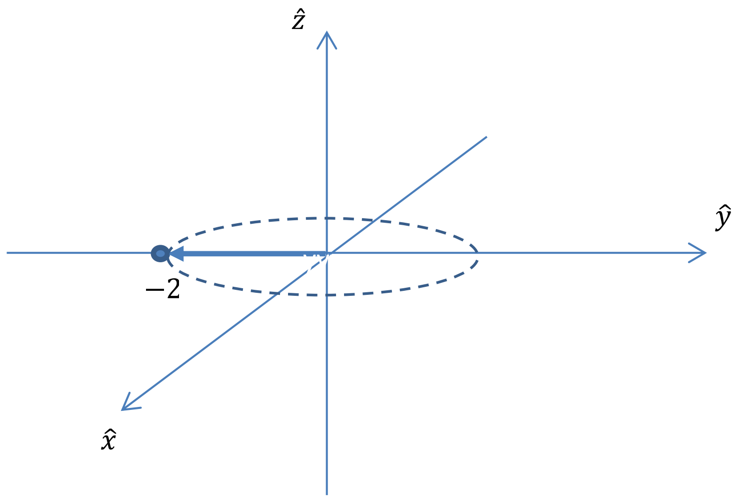
$$E_z = 0$$

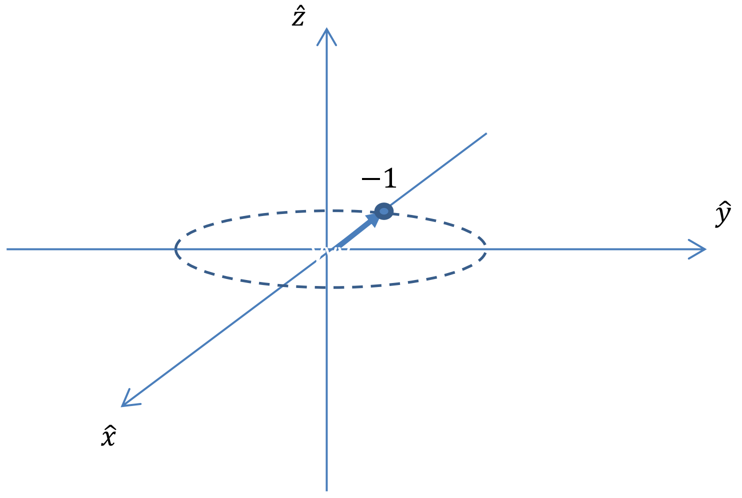
$\omega t \rightarrow$	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π
E_x	1	0	-1	0	1
E_y	0	-2	0	2	0
E_z	0	0	0	0	0



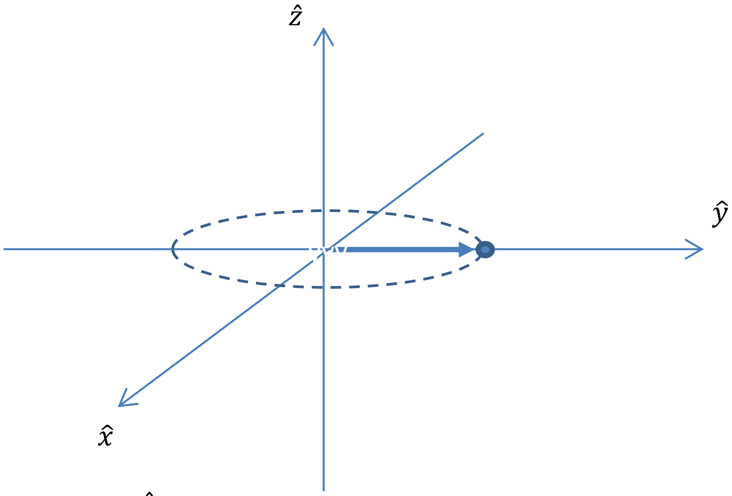
$\omega t \rightarrow$	0
E_x	1
E_y	0
E_z	0



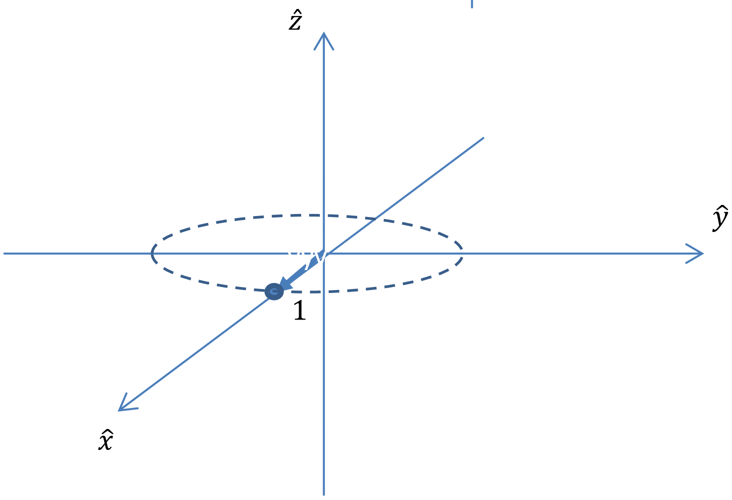
$\omega t \rightarrow$	$\frac{\pi}{2}$
E_x	0
E_y	-2
E_z	0



$\omega t \rightarrow$	π
E_x	-1
E_y	0
E_z	0



$\omega t \rightarrow$	$\frac{3\pi}{2}$
E_x	0
E_y	2
E_z	0



$\omega t \rightarrow$	2π
E_x	1
E_y	0
E_z	0

$$\vec{E}(z,t) = \hat{x}\cos(\omega t - kz) - 2\hat{y}\sin(\omega t - kz)$$

$$\vec{E} = E_x\hat{x} + E_y\hat{y} + E_z\hat{z}$$

$$E_x = \cos(\omega t - kz)$$

$$E_y = -2\sin(\omega t - kz)$$

$$E_z = 0$$

$$\frac{(E_x)^2}{1} + \frac{(E_y)^2}{2^2} = 1 = \frac{(\cos(\omega t - kz))^2}{1} + \frac{(-2\sin(\omega t - kz))^2}{2^2}$$

$$\frac{(E_x)^2}{1} + \frac{(E_y)^2}{2^2} = (\cos(\omega t - kz))^2 + (\sin(\omega t - kz))^2 = 1$$

$$\frac{(E_x)^2}{1} + \frac{(E_y)^2}{2^2} = 1$$

Locus is an elipsoid => Elliptical polarization