HW 3

Problem 1

(a):$V(t) = 6cos(wt + \frac{\pi}{4})$

$$\dot{V} = 6e^{j\frac{\pi}{4}}$$

(b):$I(t) = -8sin(wt)$

$$I(t) = -8sin(wt) = -8cos(wt - \frac{\pi}{2})$$

$$\dot{I} = -8e^{-j\frac{\pi}{2}}$$

(c):$A(t) = 3sin(wt) - 2cos(wt)$

由于相量中具有可加性，即$v(t) + u(t) - - > \dot{V} + \dot{U}$

$$cos(wt) = e^{j(wt)} = e^0 \cdot e^{jwt}$$

$$\dot{A} = 3e^{-j\frac{\pi}{2}} - 2e^{j\cdot 0}$$

(d):$C(t) = 6cos(120\pi t - \frac{\pi}{2})$

$$\dot{C} = 6e^{-\frac{\pi}{2}j}$$

(e):$D(t) = 1 - cos(wt)$

由于存在常数1，1与$cos(wt)$的频率不同

$D(t)$不存在相量

(f):$U(t) = sin(wt + \frac{\pi}{3})sin(wt + \frac{\pi}{6})$

$$U(t) = [\frac{1}{2}sin(wt) + \frac{\sqrt{3}}{2}cos(wt)][\frac{\sqrt{3}}{2}sin(wt) + \frac{1}{2}cos(wt)]$$

$$U(t) = \frac{\sqrt{3}}{4} + \frac{1}{2}sin(2wt)$$

由于存在常数，$U(t)$无相量

Problem 2

(a):$t = \frac{l}{c} = 500s$

(b):$W = 1.5 * 10^3 * \pi * (6.4 * 10^6)^2 = 1.9302 * 10^{17}$瓦

(c):

$1s$内太阳辐射出的能量：$W_{total} = 1.5 * 10^3 * \pi * (150 * 10^{19})^2$

由于是以1%的效率进行转换，$1s$内太阳损失的质量$m = \frac{W_{total}}{c^2 * 1\%}$

$$t = \frac{M}{m} = 1.697 * 10^{22}s$$

(d):

$$S = 10^{-20} * 1G = 10^{-11} W m^{-1}$$

$$S = E \times H, H = \frac{E}{\eta}$$

$$\text{由于} P = \frac{E_0^2}{2\eta_0}$$

$$E = \sqrt{2\eta P} = 8.6802 * 10^{-5}$$