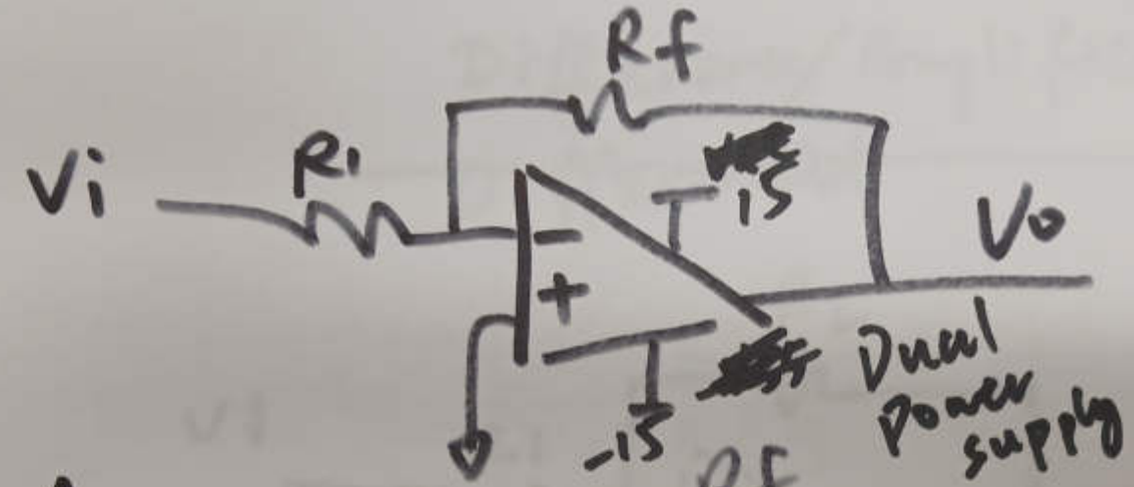
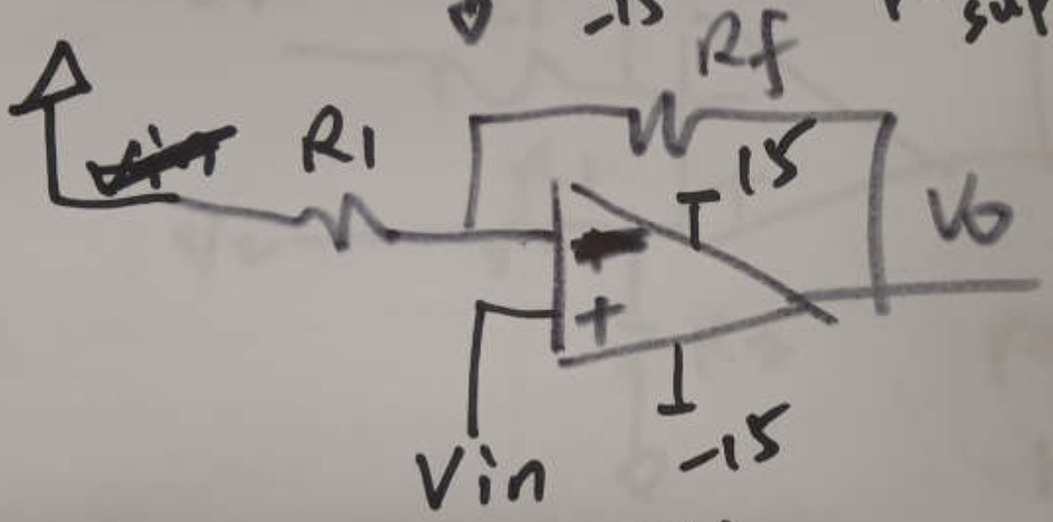


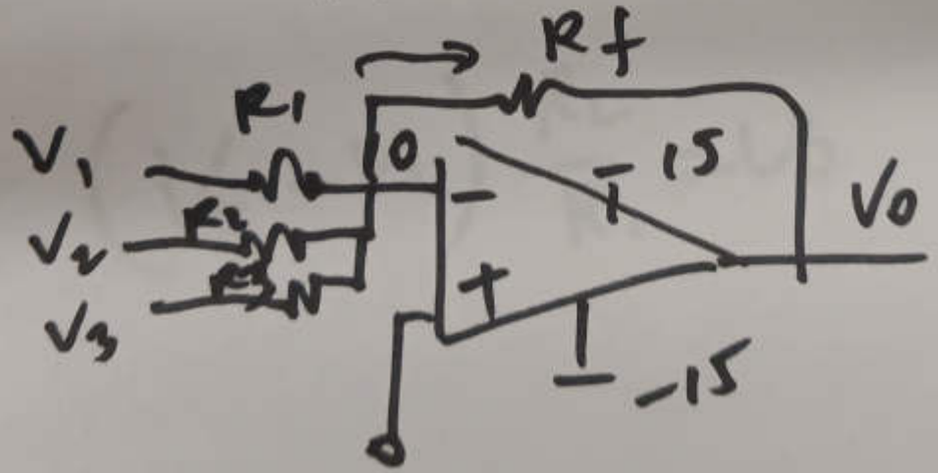
inverting

$$\frac{V_o}{V_i} = -\frac{R_f}{R_1}$$



non-inverting

$$\frac{V_o}{V_i} = 1 + \frac{R_f}{R_1}$$



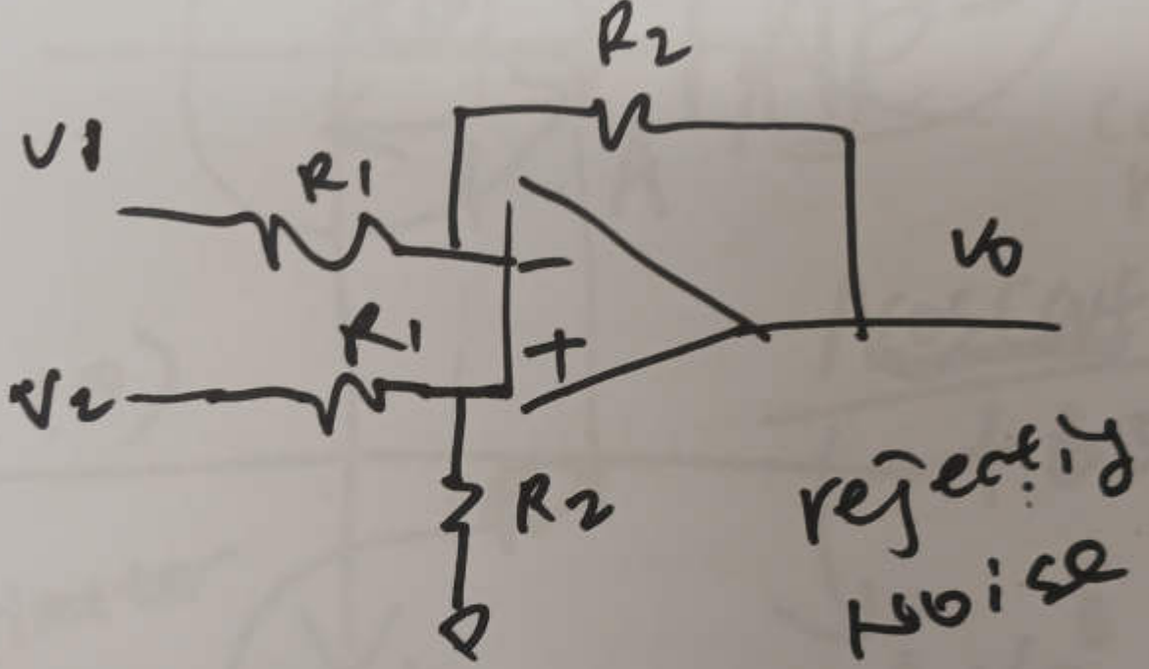
- Summing Amplifier

$$\frac{V_1 - 0}{R_1} + \frac{V_2 - 0}{R_2} + \frac{V_3 - 0}{R_3}$$

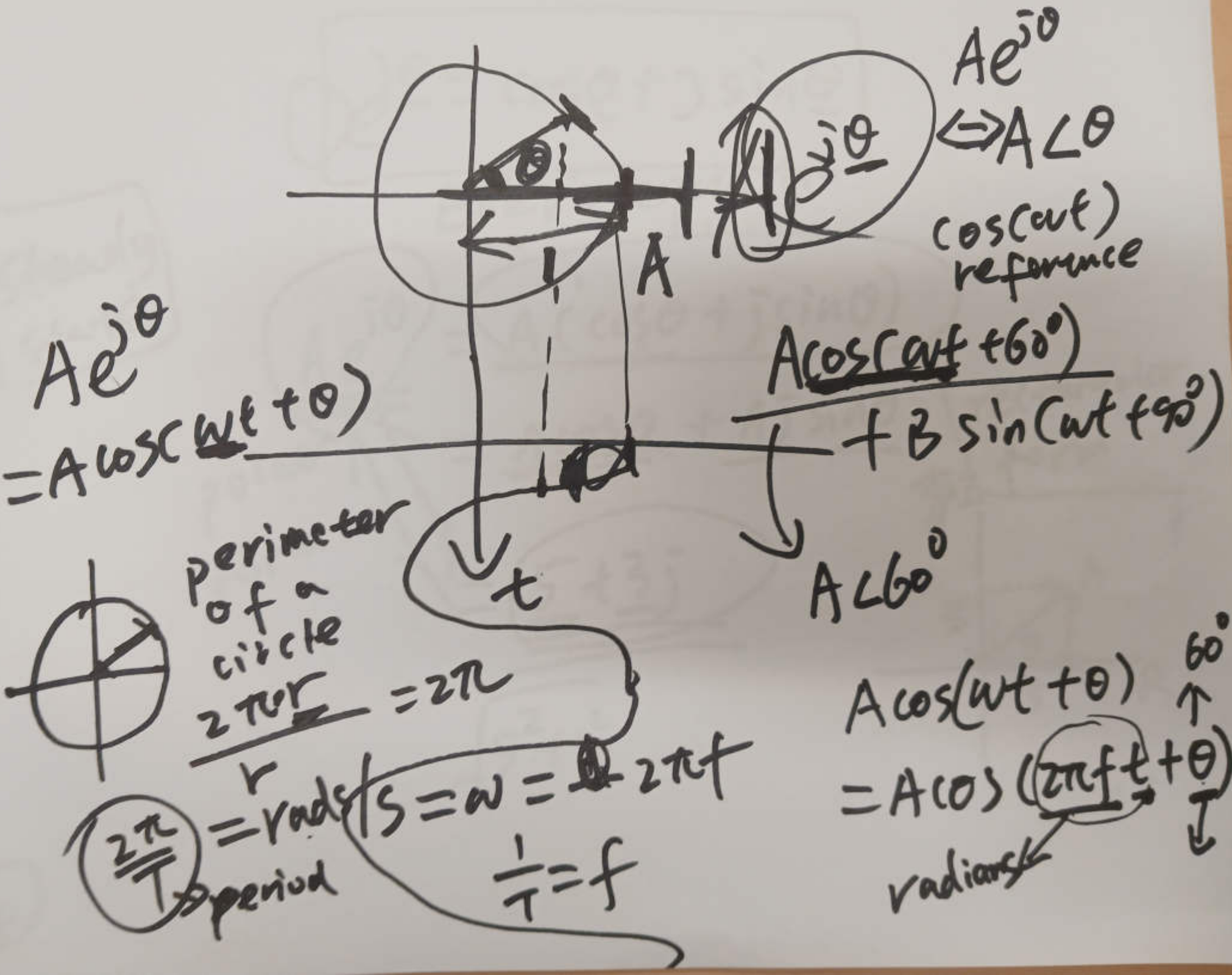
$$= \frac{0 - V_o}{R_f}$$

Difference Amplifier

~~Differential~~



$$\left(V_2 - V_1\right)\frac{R_2}{R_1} = V_0$$


$Ae^{j\theta}$
$\Leftrightarrow A\angle\theta$
$\cos(\omega t)$ reference
θ
A
$Ae^{j\theta}$
$=A\cos(\omega t+\theta)$
$A\cos(\omega t+60^\circ)$
$+B\sin(\omega t+90^\circ)$
$A\angle 60^\circ$
t
perimeter of a circle
$\frac{2\pi r}{r}=2\pi$
$=\text{rads/s}=\omega=2\pi f$
$\frac{2\pi}{T}$ period
$\frac{1}{T}=f$
$A\cos(\omega t+\theta)$
$=A\cos(2\pi f t+\theta)$
radians
60°

$$e^{j\theta} = \cos\theta + j\sin\theta$$

Euler's equation

Steady state

$$Ae^{j\theta} = A(\cos\theta + j\sin\theta)$$

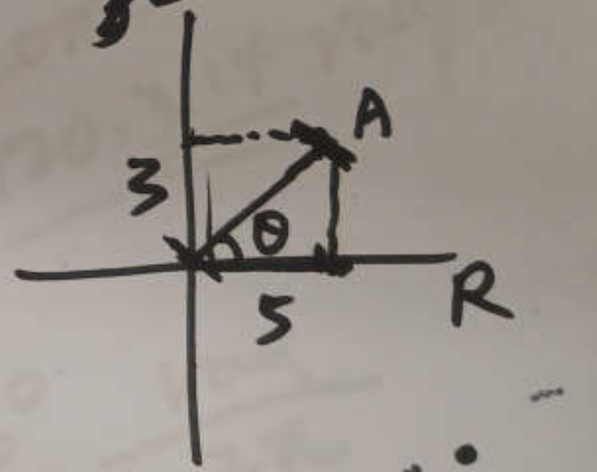
$$= A\cos\theta + Aj\sin\theta$$

$$= 5 + 3j$$

$Ae^{j\theta}$ — polar form

$5 + 3j$ — rectangular form

$\sqrt{5^2 + 3^2}$



$$v(t) = 110\cos(\underbrace{120\pi t}_{\omega t} - 60^\circ)$$

$\frac{60^\circ}{360^\circ} = \frac{\text{radians}}{2\pi}$

$V_m = 110$

magnitude

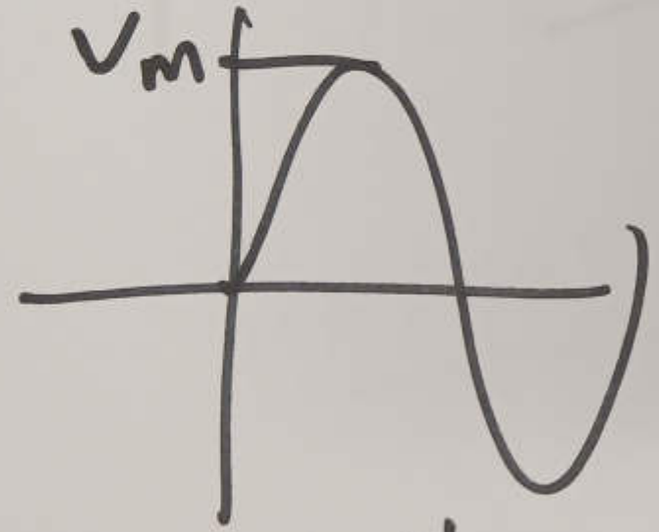
$f =$

$\omega = 2\pi f = 120\pi$

$f = ?$ 60 Hz

$\omega = 2\pi f = 120\pi$

$= 120 \cdot 3.14$ rad/s



ω = rad/s

angular velocity

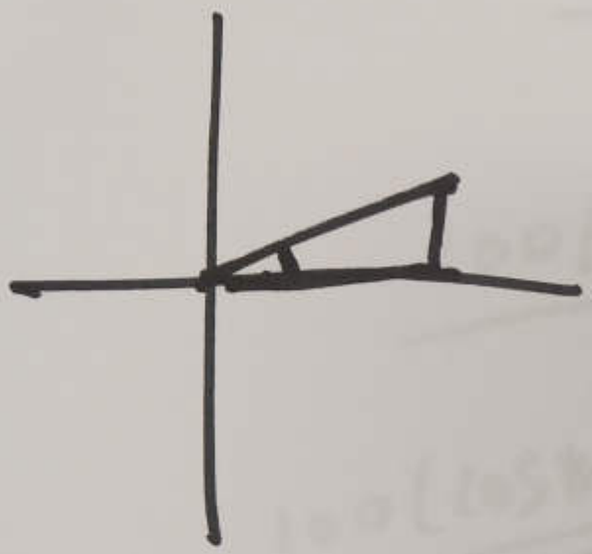
$\theta = -60^\circ$

$\frac{-60^\circ}{360^\circ} = \frac{\text{rad}}{2\pi}$

$T = \frac{1}{f}$

(5)

what is the first time after $t=0$ that $v=110V$?



$\cos(\quad) = 1$

$110\cos(\quad)$

$110\cos(120\pi t - \frac{\pi}{3})$

$120\pi t - \frac{\pi}{3} = 0$

$120\pi t = \frac{\pi}{3}$

$t = \frac{1}{360}$

$\frac{60^\circ}{360^\circ} = \frac{rad}{2\pi}$

$rad = \frac{\pi}{3}$

$$y = 100\cos(300t + 45^\circ) + 500\cos(300t - 60^\circ)$$

$$100\angle 45^\circ + 500\angle -60^\circ$$

$$100(\cos 45^\circ + j\sin 45^\circ) + 500(\cos 60 + j\sin -60)$$

$$100\cdot\cos 45^\circ + j100\sin 45 + 500\cos 60 - 500j\sin 60$$

$$a + jb \Rightarrow A\cos(300t + \angle)$$

$$\sqrt{a^2+b^2} \qquad \arctan\frac{b}{a}$$

(1)

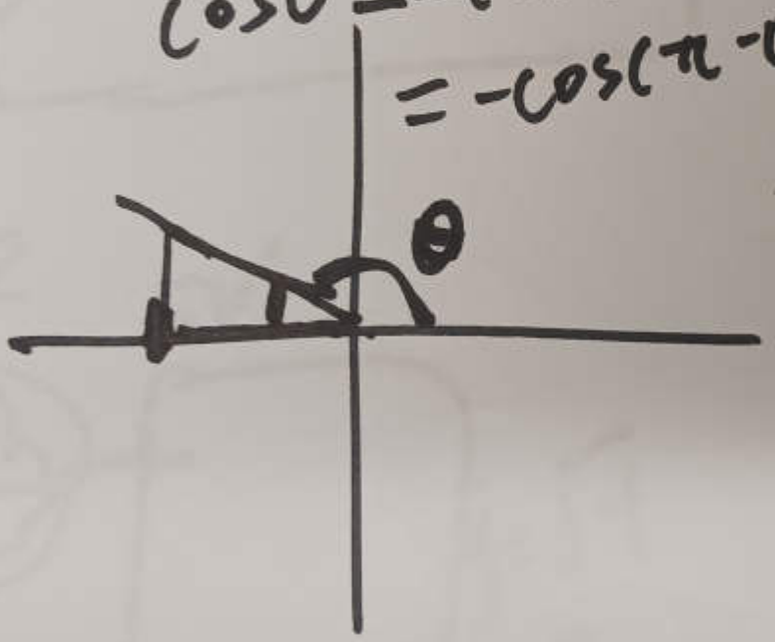
$y = 60\cos(100t + 60^\circ) - 120\sin(100t - 125)$

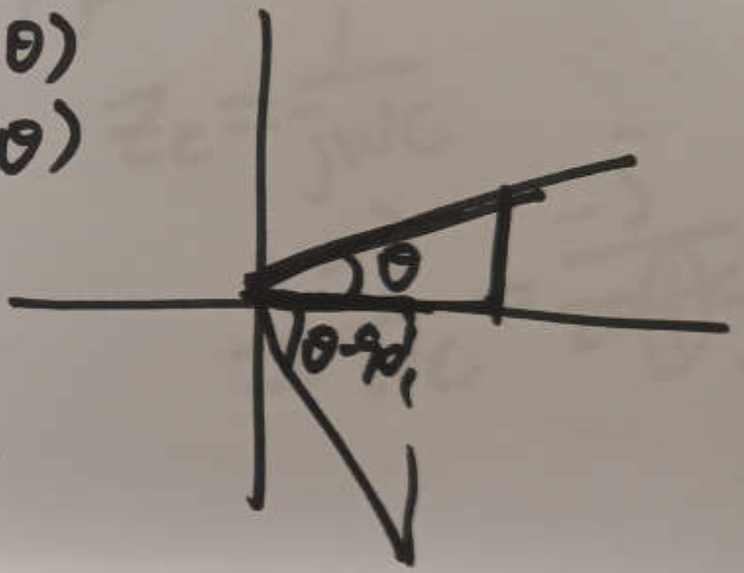
$= 60\angle 60 - 120\cos(100t - 125 - 90^\circ)$

$\sin\theta = \cos(\theta - 90^\circ)$

$\cos\theta = -\cos(180 - \theta)$

$= -\cos(\pi - \theta)$

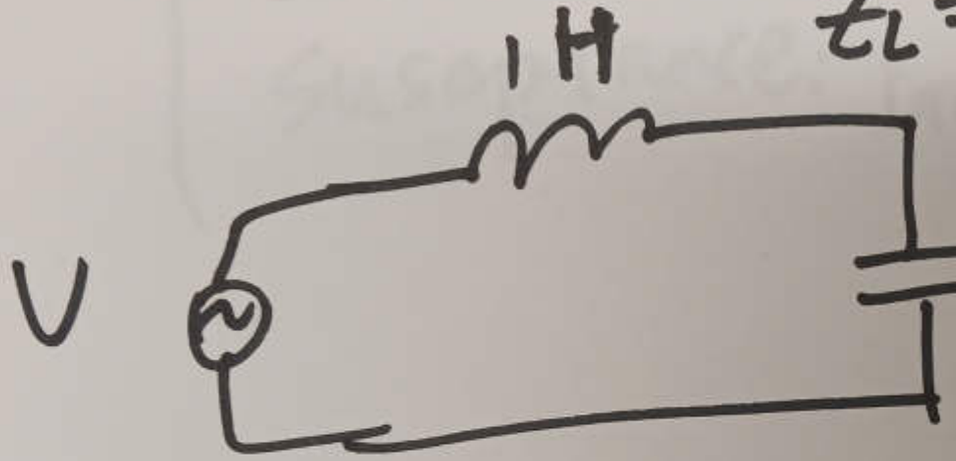




(8)

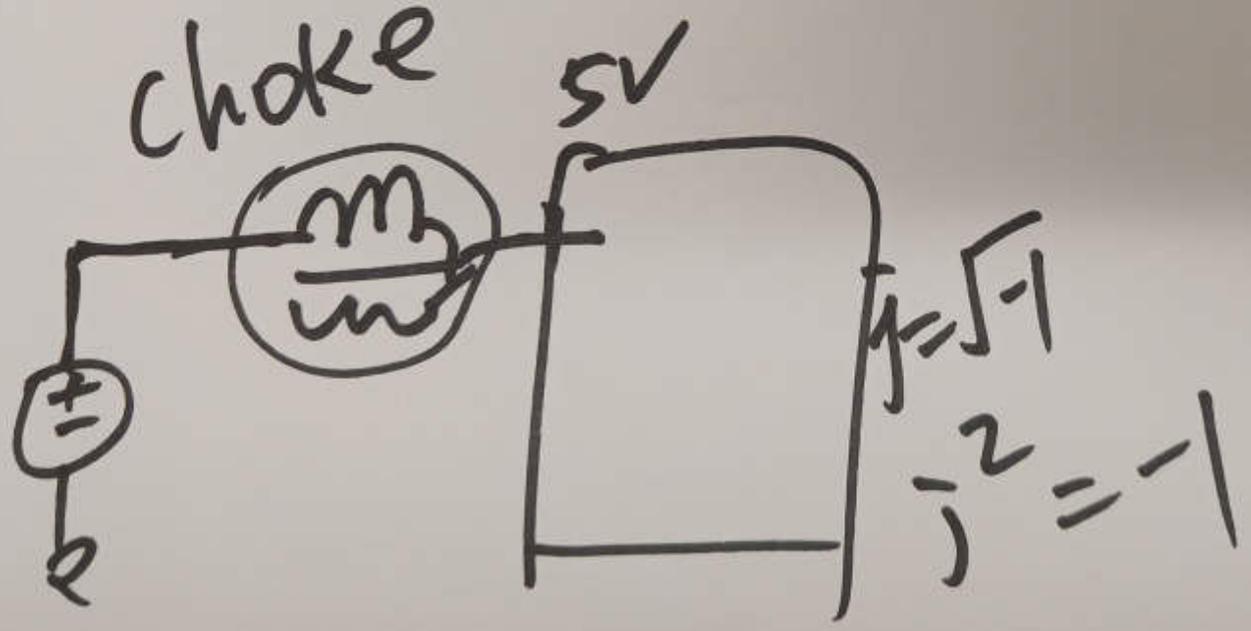
impedance

$Z_L = j\omega L = j 2\pi f L$



$Z_C = \frac{1}{j\omega C}$

$= \frac{-j}{\omega C} = \frac{-j}{2\pi f C}$



$j = \sqrt{-1}$

$j^2 = -1$

Admitance : inverse of impedance

conductance : real part of admittance

Suseptance : imaginary