$$y(t) = (1.0 \sin(2\pi \cdot 60 \cdot t)) \cdot (3.5 \sin(2\pi \cdot 60 \cdot t)) = 3.5 \sin^2(2\pi \cdot 60 \cdot t)$$

The frequency of the signals is $f = 60$ Hz. Therefore, the period of one cycle is $T = \frac{1}{f} = \frac{1}{60}$ seconds.

We need to compute the integral of $y(t)$ from $t = 0$ to $t = T$:

$$\int_0^T 3.5 \sin^2(2\pi \cdot 60 \cdot t)\, dt$$

We can use the trigonometric identity $\sin^2(\theta) = \frac{1-\cos(2\theta)}{2}$ to simplify the integrand:

$$3.5 \sin^2(2\pi \cdot 60 \cdot t) = 3.5 \cdot \frac{1 - \cos(2 \cdot 2\pi \cdot 60 \cdot t)}{2} = \frac{3.5}{2}(1 - \cos(240\pi t))$$

Now, we can perform the integration:

$$\int_0^{1/60} \frac{3.5}{2}(1 - \cos(240\pi t))\, dt = \frac{3.5}{2} \int_0^{1/60} (1 - \cos(240\pi t))\, dt$$

$$= \frac{3.5}{2} \left[t - \frac{\sin(240\pi t)}{240\pi} \right]_0^{1/60}$$

$$= \frac{3.5}{2} \left[\left(\frac{1}{60} - \frac{\sin(240\pi \cdot \frac{1}{60})}{240\pi} \right) - \left(0 - \frac{\sin(0)}{240\pi} \right) \right]$$

$$= \frac{3.5}{2} \left[\frac{1}{60} - \frac{\sin(4\pi)}{240\pi} - 0 + 0 \right]$$

Since $\sin(4\pi) = 0$, the integral simplifies to:

$$\frac{3.5}{2} \cdot \frac{1}{60} = \frac{3.5}{120} = \frac{7}{240}$$

Therefore, the integral of the multiplication of the two signals over one cycle is $\frac{7}{240}$.

Now, we need to multiply this result by $\frac{2}{T}$:

$$\frac{2}{T} \cdot \left(\int_0^T 3.5 \sin^2(2\pi \cdot 60 \cdot t)\, dt \right) = \frac{2}{1/60} \cdot \frac{7}{240}$$

= 3.5

$$y(t) = (1.0\cos(2\pi\cdot 60\cdot t))\cdot(3.5\sin(2\pi\cdot 60\cdot t)) = 3.5\cos(2\pi\cdot 60\cdot t)\sin(2\pi\cdot 60\cdot t)$$

We can use the trigonometric identity $2\sin(\theta)\cos(\theta) = \sin(2\theta)$ to simplify the integrand:

$$3.5\cos(2\pi\cdot 60\cdot t)\sin(2\pi\cdot 60\cdot t) = \frac{3.5}{2}\sin(2\cdot 2\pi\cdot 60\cdot t) = 1.75\sin(240\pi t)$$

The period of one cycle is $T = \frac{1}{60}$ seconds. Now, we integrate $y(t)$ from $t = 0$ to $t = T$:

$$\int_0^{1/60} 1.75\sin(240\pi t)\,dt = 1.75\int_0^{1/60} \sin(240\pi t)\,dt$$

$$= 1.75\left[-\frac{\cos(240\pi t)}{240\pi}\right]_0^{1/60}$$

$$= 1.75\left(-\frac{\cos(240\pi\cdot\frac{1}{60})}{240\pi} - \left(-\frac{\cos(0)}{240\pi}\right)\right)$$

$= 1.75 \left(-\frac{\cos(4\pi)}{240\pi} + \frac{\cos(0)}{240\pi}\right)$Since $\cos(4\pi) = 1$ and $\cos(0) = 1$, the expression becomes:

$$1.75\left(-\frac{1}{240\pi} + \frac{1}{240\pi}\right) = 1.75\cdot 0 = 0$$

The integral of the multiplication of the two signals over one cycle is 0.

Finally, we multiply this result by $\frac{2}{T}$:

$$\frac{2}{T}\cdot 0 = 0$$

Therefore, the final result is 0. This makes sense because the sine and cosine functions are orthogonal over a complete cycle.

$$x_1(t) = 1.0 \sin(2\pi \cdot 60 \cdot t)$$

$$x_2(t) = 3.5 \sin(2\pi \cdot 60 \cdot t + \frac{\pi}{6})$$

Their product is:

$$y(t) = x_1(t) \cdot x_2(t) = 1.0 \sin(2\pi \cdot 60 \cdot t) \cdot 3.5 \sin(2\pi \cdot 60 \cdot t + \frac{\pi}{6})$$

$$y(t) = 3.5 \sin(\omega t) \sin(\omega t + \phi)$$

where $\omega = 2\pi \cdot 60$ and $\phi = \frac{\pi}{6}$.

We can use the product-to-sum trigonometric identity:

$$\sin(A) \sin(B) = \frac{1}{2}[\cos(A - B) - \cos(A + B)]$$

Applying this to our product:

$$y(t) = 3.5 \cdot \frac{1}{2}[\cos(\omega t - (\omega t + \phi)) - \cos(\omega t + (\omega t + \phi))]$$

\$$y(t) = 1.75[\cos(-\phi) - \cos(2\omega t + \phi)]$\$Since $\cos(-\phi) = \cos(\phi)$, we have:\$$y($
$1.75[\cos(\phi) - \cos(2\omega t + \phi)]$\$Substituting $\phi = \frac{\pi}{6}$:

$$y(t) = 1.75[\cos(\frac{\pi}{6}) - \cos(120 \cdot 2\pi \cdot t + \frac{\pi}{6})]$$

$$y(t) = 1.75[\frac{\sqrt{3}}{2} - \cos(240\pi t + \frac{\pi}{6})]$$

Now, we need to integrate $y(t)$ over one cycle, $T = \frac{1}{60}$:

$$\int_0^{1/60} 1.75 \left[\frac{\sqrt{3}}{2} - \cos(240\pi t + \frac{\pi}{6})\right] dt$$

$$= 1.75 \left[\int_0^{1/60} \frac{\sqrt{3}}{2} dt - \int_0^{1/60} \cos(240\pi t + \frac{\pi}{6}) dt\right]$$

The first integral is straightforward:

$$\int_0^{1/60} \frac{\sqrt{3}}{2} dt = \frac{\sqrt{3}}{2} [t]_0^{1/60} = \frac{\sqrt{3}}{2} \cdot \frac{1}{60} = \frac{\sqrt{3}}{120}$$

So, the integral of the product over one cycle is:

$$1.75 \left[\frac{\sqrt{3}}{120} - 0\right] = \frac{1.75\sqrt{3}}{120} = \frac{7\sqrt{3}}{4 \cdot 120} = \frac{7\sqrt{3}}{480}$$

Finally, we multiply this result by $\frac{2}{T} = \frac{2}{1/60} = 120$:

$$120 \cdot \frac{7\sqrt{3}}{480} = \frac{120 \cdot 7\sqrt{3}}{480} = \frac{840\sqrt{3}}{480} = \frac{84\sqrt{3}}{48} = \frac{21\sqrt{3}}{12} = \frac{7\sqrt{3}}{4}$$

Therefore, the final result is $\frac{7\sqrt{3}}{4}$.

$$x_1(t) = 1.0\cos(2\pi \cdot 60 \cdot t)$$

$$x_2(t) = 3.5\sin(2\pi \cdot 60 \cdot t + \frac{\pi}{6})$$

Their product is:

$$y(t) = x_1(t) \cdot x_2(t) = 1.0\cos(2\pi \cdot 60 \cdot t) \cdot 3.5\sin(2\pi \cdot 60 \cdot t + \frac{\pi}{6})$$

$$y(t) = 3.5\cos(\omega t)\sin(\omega t + \phi)$$

where $\omega = 2\pi \cdot 60$ and $\phi = \frac{\pi}{6}$.

We can use the product-to-sum trigonometric identity:

$$\cos(A)\sin(B) = \frac{1}{2}[\sin(A+B) - \sin(A-B)]$$

Applying this to our product:

$$y(t) = 3.5 \cdot \frac{1}{2}[\sin(\omega t + (\omega t + \phi)) - \sin(\omega t - (\omega t + \phi))]$$

\$$y(t) = 1.75[\sin(2\omega t + \phi) - \sin(-\phi)]$\$Since $\sin(-\phi) = -\sin(\phi)$, we have:\$$y(t) = 1.75[\sin(2\omega t + \phi) + \sin(\phi)]$\$Substituting $\phi = \frac{\pi}{6}$:

$$y(t) = 1.75[\sin(120 \cdot 2\pi \cdot t + \frac{\pi}{6}) + \sin(\frac{\pi}{6})]$$

$$y(t) = 1.75[\sin(240\pi t + \frac{\pi}{6}) + \frac{1}{2}]$$

Now, we need to integrate $y(t)$ over one cycle, $T = \frac{1}{60}$:

$$\int_0^{1/60} 1.75 \left[\sin(240\pi t + \frac{\pi}{6}) + \frac{1}{2}\right] dt$$

$$= 1.75 \left[\int_0^{1/60} \sin(240\pi t + \frac{\pi}{6}) dt + \int_0^{1/60} \frac{1}{2} dt\right]$$

For the first integral, we use the substitution $u = 240\pi t + \frac{\pi}{6}$, so $du = 240\pi dt$, and $dt = \frac{du}{240\pi}$. The limits of integration change from $t = 0$ to $u = \frac{\pi}{6}$, and from $t = \frac{1}{60}$ to $u = 240\pi \cdot \frac{1}{60} + \frac{\pi}{6} = 4\pi + \frac{\pi}{6} = \frac{25\pi}{6}$.

$$\int_0^{1/60} \sin(240\pi t + \frac{\pi}{6}) dt = \int_{\pi/6}^{25\pi/6} \sin(u) \frac{du}{240\pi} = \frac{1}{240\pi} [-\cos(u)]_{\pi/6}^{25\pi/6}$$

$= \frac{1}{240\pi} \left(-\cos(\frac{25\pi}{6}) - (-\cos(\frac{\pi}{6}))\right)$Since $\cos(\frac{25\pi}{6}) = \cos(4\pi + \frac{\pi}{6}) = \cos(\frac{\pi}{6}) = \frac{\sqrt{3}}{2}$, the first integral becomes:

$$\frac{1}{240\pi} \left(-\frac{\sqrt{3}}{2} + \frac{\sqrt{3}}{2}\right) = 0$$

The second integral is straightforward:

$$\int_0^{1/60} \frac{1}{2} dt = \frac{1}{2} [t]_0^{1/60} = \frac{1}{2} \cdot \frac{1}{60} = \frac{1}{120}$$

So, the integral of the product over one cycle is:

$$1.75\left[0+\frac{1}{120}\right]=\frac{1.75}{120}=\frac{7}{4\cdot 120}=\frac{7}{480}$$

Finally, we multiply this result by $\frac{2}{T}=\frac{2}{1/60}=120$:

$$120\cdot\frac{7}{480}=\frac{120\cdot 7}{480}=\frac{840}{480}=\frac{84}{48}=\frac{21}{12}=\frac{7}{4}$$

Therefore, the final result is $\frac{7}{4}$.

$$\arctan\left(\frac{1}{1.732}\right)\approx 30^{\circ}$$

Magnitude = 3.5