**Answer on Question #38155 – Physics - Other**

**Question:** the resultant intensity of the interference pattern formed by the two waves represented by, $y_1 = a_1 \cdot \cos(\omega t)$ and $y_2 = a_2 \cdot \cos\left(\frac{\pi}{2} - \omega t\right)$ is:

a) $a_1 - a_2$;
b) $a_1 + a_2$;
c) $a_1^2 - a_2^2$;
d) $a_1^2 + a_2^2$.

**Solution:** let us represent these two waves in the exponential form:

$$y_1 = a_1 \cdot \cos(\omega t) = \mathrm{Re}\left(a_1 \cdot e^{i\omega t}\right),$$

$$y_2 = a_2 \cdot \cos\left(\omega t - \frac{\pi}{2}\right) = \mathrm{Re}\left(a_2 \cdot e^{i\left(\omega t - \frac{\pi}{2}\right)}\right).$$

Here Re means the real part of the complex number. Using this complex form we can easily obtain the resulting wave:

$$y = y_1 + y_2 = a_1 \cdot e^{i\omega t} + a_2 \cdot e^{i\left(\omega t - \frac{\pi}{2}\right)} = e^{i\omega t} \cdot \left(a_1 + e^{-\frac{i\pi}{2}} a_2\right) = e^{i\omega t} \cdot (a_1 - ia_2).$$

The resultant intensity of the interference pattern is equal to the squared amplitude of the resulting wave:

$$I = |y|^2 = \left|e^{i\omega t} \cdot (a_1 - ia_2)\right|^2 = |(a_1 - ia_2)|^2 = (a_1 - ia_2)(a_1 + ia_2) = a_1^2 + a_2^2$$

**Answer:** d) $a_1^2 + a_2^2$.