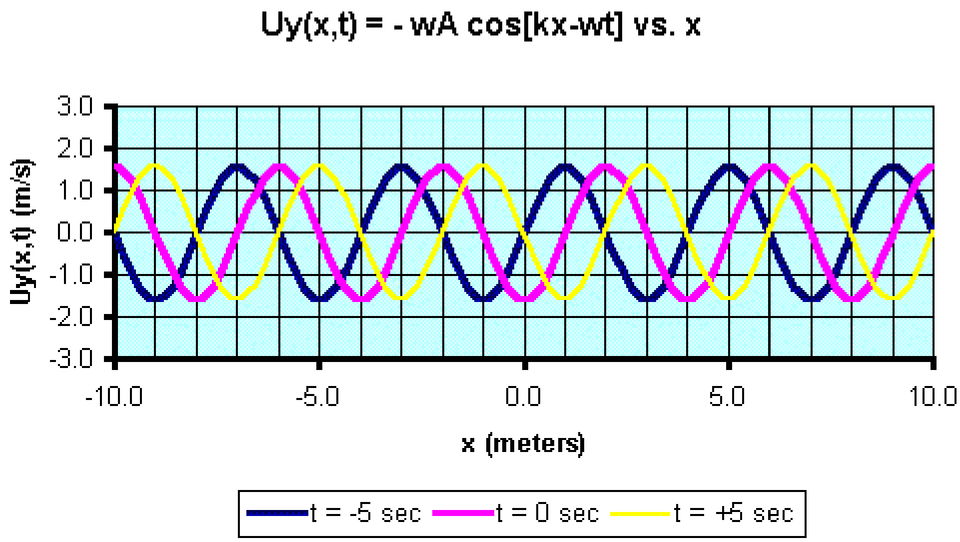

Note that the transverse velocity, $u_y(x, t)$ of a traveling harmonic wave is 90° out of phase with the transverse displacement, $y(x,t)$ of the wave (*i.e.* ¼ of a cycle). This is because the cosine and sine functions are related to each other by a phase angle of $\delta = 90^o$; $\cos\theta = \sin(\theta + 90^o)$, and $\sin\theta = \cos(\theta - 90^o)$, where θ is an arbitrary angle. These relations can be derived from the *angle-addition formulae* for the sine and cosine functions:

$$\sin(A \pm B) = \sin A \cos B \pm \sin B \cos A \quad \text{and:} \quad \cos(A \pm B) = \cos A \cos B \mp \sin A \sin B.$$

Alternatively, we can show the transverse displacement, $y(x,t)$ and the transverse velocity, $u_y(x, t)$ for the above sine-type harmonic traveling wave for fixed position, $x = -5$, 0 and +5 *meters*, as a function of time, t: