Hence, $\phi = \frac{2\pi}{\lambda} \times x$

Or $\phi = k\,x \ldots \ldots \ldots (3)$

Using equation (3) in equation (2), we get

$y = a \sin(\omega t - k x) \ldots \ldots \ldots (4)$ **: Equation of plane progressive wave.**

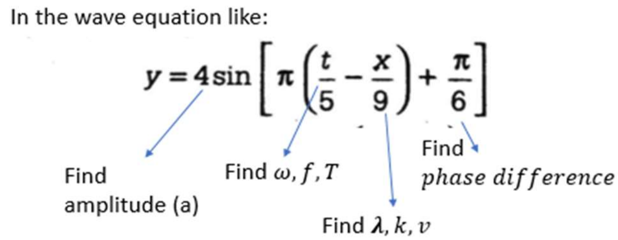
Note:

Wave equation could be of the form:

$y = a\sin[(wt \pm kx) \pm \phi]$

- In the given wave equation, find:

1. Amplitude
2. Angular frequency, frequency and time period
3. Wavelength, propagation constant (angular wave number) and wave velocity
4. Phase difference
5. Initial phase.



Principle of superposition:

Statement:

When a large number of waves are travelling simultaneously through a medium, the resultant displacement of a particle at any point is equal to the vector sum of displacements produced by each individual wave.

If $y_1, y_2, y_3, \ldots \ldots\ldots$ are the displacements at a point due to different waves independently and if those waves travel simultaneously through the point, then the resultant displacement (y) of the point is:

$$\vec{y} = \vec{y_1} + \vec{y_2} + \vec{y_3} + \ldots \ldots \ldots$$

In magnitude,

$$y = y_1 + y_2 + y_3 + \ldots \ldots \ldots$$

1. Two identical sinusoidal waves each of amplitude 10 mm with a phase difference of 90^o are travelling in the same direction in a string. The amplitude of the resultant wave is
   a. 5 mm b. $10\sqrt{2}$ mm c. 10 mm d. 20 mm
2. The displacement of an elastic wave is given by the function $y = 3sin\,\omega t + 4cos\omega t$, where y is in cm and t is in sec. The resultant amplitude is
   a. 3 cm b 4 cm c. 5 cm d. 7 cm
3. Two waves produced displacement at a point given by: $y_1 = a\sin\omega t$ & $y_2 = a\,sin(wt + \pi/2)$. The resultant amplitude is:
   a. 0 b. $2a$ c. $\sqrt{2}a$ d. $a/\sqrt{2}$

Applications of principle of superposition in wave phenomena:

1. **In the formation of stationary wave**
2. **In the interference of waves**
3. **In the diffraction of waves**
4. **In the formation of beats** etc.