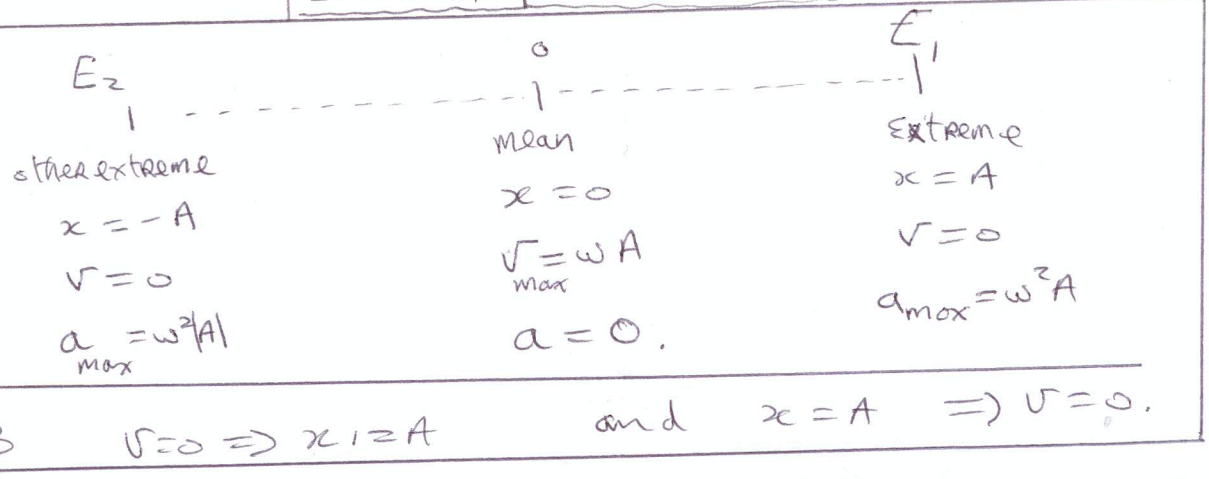
SUMMARY OF THE GEOGRAPHY



NB $v=0 \Rightarrow x = \pm A$ and $x = A \Rightarrow v = 0$.

EXAMPLES

Eg1 A particle moving with S.H.M. has speeds 12 m/s and 16m/s when its displacements from the centre are 16 m and 9 m respectively. Calculate w and A.

$v^2 = \omega^2(A^2 - x^2)$

$x = 9, v = 16 \Rightarrow 16^2 = \omega^2(A^2 - 9^2)$

$256 = \omega^2(A^2 - 81)$ (1)

$x = 16, v = 12 \Rightarrow 12^2 = \omega^2(A^2 - 16^2)$

$\Rightarrow 144 = \omega^2(A^2 - 256)$ (2)

Solve (1) and (2)

$$\frac{256}{144} = \frac{\omega^2(A^2-81)}{\omega^2(A^2-256)}$$

$$\frac{16}{9} = \frac{A^2-81}{A^2-256}.$$

$\Rightarrow 16A^2 - 4096 = 9A^2 - 729.$

$7A^2 = 3367$

$A^2 = 481$

$A = 21.93$ m

Find ω: $v^2 = \omega^2(A^2 - x^2) \Rightarrow 144 = \omega^2(481 - 256)$

$\Rightarrow 144 = \omega^2(225)$

$\Rightarrow .64 = \omega^2$

$\Rightarrow 0.8 = \omega$

Eg2 Aparticle moves so that its displacement from a fixed point o, after t seconds is

$x = 1.2 \sin 4t$.

Find the acceleration of the particle when it is 0.9 m from an extreme position. Find also the time to travel from this position to an extreme.

$x = 1.2 \sin 4t$

$\Rightarrow$ SHM about $x = 0$ with $\omega = 4$, $A = 1.2$

$a = -\omega^2 x$

$x = .3 \Rightarrow a = -4^2(.3)$

$a = -4.8$ m/s²

$|a| = 4.8$ m/s²

$t_{QP} = t_{PQ}$

Use $x = 1.2 \cos 4t$ to find t_{PQ}

$.3 = 1.2 \cos 4t$

$\frac{.3}{1.2} = \cos 4t.$

RADIANS MODE → $.25 = \cos 4t$

$\cos^{-1}(.25) = 4t$

$1.318 = 4t$

$.33$ seconds $= t$

OR: $t_{QP} = \frac{T}{4} - t_{OP}$

$\frac{T}{4} = \frac{1}{4}\left(\frac{2\pi}{\omega}\right) = \frac{1}{4}\left(\frac{2\pi}{4}\right) = \frac{\pi}{8} = .393$

t_{OP}: $.3 = 1.2 \sin 4t \Rightarrow t_{OP} = .063$

$\therefore t_{QP} = .393 - .063 = 0.33$ sec.