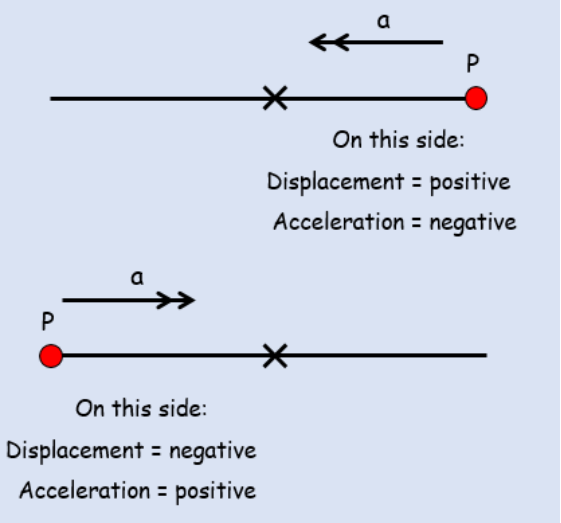
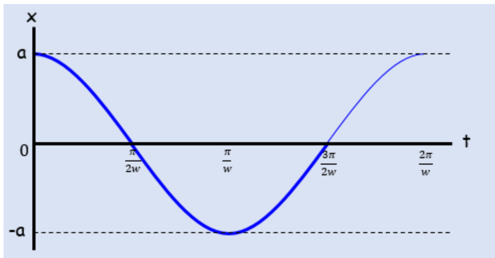
8B Simple Harmonic Motion

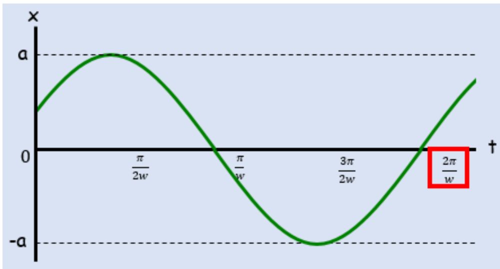


$$\ddot{x} = -w^2 x$$

$$v^2 = w^2(a^2 - x^2)$$

$$x = a\sin(wt + C\ )$$





$$Period = \frac{2\pi}{w}$$

1. A particle is moving along a straight line. At time t seconds its displacement, $x\ m$ from a fixed point O is such that:

$$\frac{d^2x}{dt^2} = -4x$$

Given that at $t = 0$, $x = 1$ and that the particle is moving with velocity $4\ ms^{-1}$:

a) Find an expression for the particle's displacement after t seconds

b) Determine the maximum displacement of the particle from O.

2. A particle P is attached to the ends of two identical elastic springs. The free ends of the springs are attached to two points A and B. The point C lies between A and B such that ABC is a straight line and $AB \neq BC$. The particle is held at C and then released from rest.
   At time t seconds, the displacement of the particle from C is $x\,m$ and its velocity is $v\,ms^{-1}$.
   The subsequent motion can be described by the differential equation $\ddot{x} = -25x$.

a) Describe the motion of the particle

b) Given that when $t = 0$, $x = 0.4$ and $v = 0$, find x as a function of t

c) State the period of the motion and state the maximum speed of P.