**11A Functions of Time**



1. A body moves in a straight line, such that its displacement, $s$ metres, from a point O at time $t$ seconds is given by $s=2t^{3}-3t$ for $t>0$
2. Find the value of $s$ when $t=2$
3. Find the time taken for the body to return to O.
4. A toy train travels along a straight track, leaving the start of the track at time $t=0$. It then returns to the start of the track. The distance, $s$ metres, from the start of the track at time $t$ seconds is modelled by:

$s=4t^{2}-t^{3}$ where $0\leq t\leq 4$

Explain why there is a time restriction on this model

1. A body moves in a straight line such that its velocity, $v ms^{-1}$, at time $t$ seconds is given by:

$v=2t^{2}-16t+24$ for $t\geq 0$

Find:

1. The initial velocity
2. The values of t when the body is instantaneously at rest
3. The value of t when the velocity is 64ms-1
4. The greatest speed of the body in the interval $0\leq t\leq 5$

**11B Differentiating between x, v, a**



1. A particle P is moving along the x-axis. At time t seconds, the displacement x metres from O is given by:

$$x=t^{4}-32t+12$$

Find:

1. The speed of P when t = 3
2. The value of t for which P is instantaneously at rest
3. The magnitude of acceleration when t = 1.5

**11C Maxima & Minima**

1. A child is playing with a yo-yo. The yo-yo leaves the child’s hand at time $t=0$ and travels vertically in a straight line before returning to the child’s hand. The distance in metres, $s$ of the yo-yo from the child’s hand after time $t$ seconds is given by:

$s=0.6t+0.4t^{2}-0.2t^{3},$ $0\leq t\leq 3$

1. Justify the restriction $0\leq t\leq 3 $
2. Find the maximum distance of the yo-yo from the child’s hand, to 3sf

**11D Integrating between x, v, a**

1. A particle is moving on the x-axis. At time $t=0$, the particle is at the point where $x=5$. The velocity of the particle at time t seconds ($t\geq 0$) is $\left(6t-t^{2}\right) ms^{-1}$. Find:
2. An expression for the displacement of the particle from O at time t seconds
3. The distance of the particle from its starting point when $t=6$
4. A particle travels in a straight line. After $t$ seconds its velocity, $v ms^{-1}$, is given by $v=5-3t^{2},    t\geq 0$. Find the distance travelled by the particle in the third second of its motion.

**11E Deriving SUVAT**

1. A particle moves in a straight line with constant acceleration, $a ms^{-2}$. Given that its initial velocity is $u ms^{-1}$ and its initial displacement is 0m, prove that:
2. The particle’s velocity at time $t$ seconds is given by $v=u+at$
3. The particle’s displacement, $s$, at time t is given by $s=ut+\frac{1}{2}at^{2}$