Variable Acceleration – Year 1 A LEVEL Maths – www.m4ths.com – Steve Blades ©

(1) A particle's position x relative to the fixed origin O after time t seconds is given by $x = t^3 + t^2 + 4t + 8, t \geq 0$.
(a) Where does the particle start relative to the origin?
(b) Find an expression in terms of t for the velocity v of the particle.
(c) Find the velocity of the particle after 8 seconds.
(d) Prove that the particle is always accelerating in the positive x direction.

(2) A particle has acceleration $(4t - 15)ms^{-2}$ and initial velocity $7ms^{-1}$.
(a) Show that the particle was stationary twice in the first 10 seconds of its journey.
(b) Given that the particle started at the original show that the particle is 28.5 metres from the origin after 3 seconds.
(c) Find the time the particle the particle first returns to the origin O.

(3) A particle has acceleration $(6t - 22)ms^{-2}$ and is initially moving with velocity $7ms^{-1}$.
Find the distance the particle travels in the first 10 seconds.

(4) A particle has acceleration $a = (At^2 - Bt)ms^{-2}$ where A and B are positive constants.
The particle is initially stationary and enters equilibrium $\frac{1}{3}$ of a second after it starts its journey.
The particle has velocity $-\frac{8}{27}ms^{-1}$ when it enters equilibrium.
(a) Find the constants A and B.
Given further that the particle starts at the origin O.
(b) Find the time the particle returns to the origin.