Kinematics Calculus problems

1. The velocity of a particle moving on a line at time t is given by the equation v(t) = 4t2 + 6t. How many meters did the particle travel from t = 1 to t = 8? What is the acceleration of the ball at t = 3?
2. Determine an expression for the speed of a rocket moving straight upward in the y direction if its height, while the engine is still firing, is given by the expression y(t) = 4.0 m + (8.2 m/s) t. What is the location of the rocket at time t = 2?
3. Over a certain stretch of track, a roller coaster’s position is given by the equation x(t) = (10 m) + (60 m/s)t (– 15 m/s/s)t2 where x is measured from a starting line. When and where is the speed equal to zero?

Solutions: 1

Integrate v(t) to get 4/3 t3 + 3t2 and then find the solution over the interval 1 – 8. [682.6 + 192] – [4/3 + 3] = 870 m

Acceleration of the ball at t = 3 is solution of derivative of v(t) at 3 s

dv/dt = 8t+ 6 🡺 at t = 3 = dv/dt = 30 m/s/s

dy/dt = speed = 8.2 m/s

location is position at t = 2 y = 4.0 +(8.2 m/s)\*2 = 20.4 m

dx/dt = - 30 m/s/s (t) + 60 m/s set that equal to zero and solve for time

at t = 2 s v = 0