

1. A cubical block of ice has an edge of 10 cm. It melts so that its volume decreases at a constant rate of 25 cm^3 per hour and the block remains cubical. Find:
 - (a) the volume V at any time t .
 - (b) the time required to completely melt the ice.
2. The mass M of a radioactive substance is initially 10 grams and 20 years later its mass is 9.6 grams.
 - (a) Find the annual decay rate given that the rate of decay of a radioactive substance is proportional to the mass of that substance present at any time (ie $\frac{dM}{dt} = -kM$)
 - (b) In how many years will the mass be halved?
3. A radio-active material decays according to the exponential function $M = M_0 e^{kt}$. If the initial mass is 50 grams and the mass after 10 years is 40 grams, find:
 - (a) the value of k
 - (b) the amount of material present after 15 years.
 - (c) the half-life of the material. (The half-life of a radio-active material is the time taken for the material to halve its mass)
4. A particle starts from rest 5 m from a fixed point O and moves in a straight line with an acceleration $a = 3t - 4$. Find the velocity and position of the particle and at time t .
5. A particle is moving in a straight line in such a way that its distance, x metres, from a fixed point O, in the line, after t seconds is given by $x = 4t - 5t^2 + 2t^3$. Find:
 - (a) the difference in position from when $t = 2$ and $t = 3$.
 - (b) the velocity after 2 seconds.
 - (c) the time when the particle is at rest.
 - (d) where the particle is at rest.
 - (e) the maximum velocity reached by the particle.
6. The position x m at any time t seconds of a particle moving in a straight line is given by $x = 2t^3 - 9t^2 + 12t + 6$. Find:
 - (a) when its acceleration is zero and its velocity at that time.
 - (b) when its velocity is zero and its acceleration at that time.
7. A particle moves in a straight line and at any time t seconds, its velocity v m/s is given by $v = e^{-t}$. If initially the particle is 2 m from a fixed point O in the line, find its position x at any time t .
Sketch the graph of x as a function of t .
8. A particle moves in a straight line so that at any time t its velocity is given by $v = \frac{1}{1+t}$.
 - (a) If its distance from a fixed point O in the line is x , show that $x = \log_e(1+t)$ given that $x = 0$ when $t = 0$.
 - (b) Show that the particle is moving away from O as t increases.
 - (c) Find the acceleration when $t = 0$.