Using Integration

If we know the acceleration, we can integrate to find expressions for velocity and displacement. Recall that the area under a velocity-time graph gives the displacement. Be careful if the velocity (and hence the area) falls under the t-axis as this will give negative displacement.

Example

A particle P, moves in a straight line. At t seconds its acceleration is $(6t + 12)ms^{-1}$. When t = 0, P is at the point A and its velocity is $3ms^{-1}$.

a) Find an expression for the velocity of P in terms of t

b) Find the distance travelled between times t = 3 and t = 5

Example *(Textbook Page 189 Example 7)*

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.

Test Your Understanding *(EdExcel M2 June 2015 Q6)*

A particle P moves on the positive x-axis. The velocity of P at time t seconds is $(2t^2 - 9t + 4)$ m s^{-1}. When $t = 0$, P is 15 m from the origin O.

Find

(a) the values of t when P is instantaneously at rest,

(3)

(b) the acceleration of P when $t = 5$

(3)

(c) the total distance travelled by P in the interval $0 \leqslant t \leqslant 5$

(5)

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