8E Integrating Vectors

1. A particle P is moving in a plane. At time t seconds, its velocity, $\boldsymbol{v} ms^{-1}$, is given by:

$$v = 3t\boldsymbol{i} + \frac{1}{2}t^2\boldsymbol{j}$$

When $t = 0$, the position vector of P with respect to a fixed origin O is $(2\boldsymbol{i} - 3\boldsymbol{j})\ m$. Find the position vector of P at time t seconds

2. A particle P is moving in a plane so that, at time t seconds, its acceleration is:

$$\boldsymbol{a} = (4\boldsymbol{i} - 2t\boldsymbol{j})ms^{-2}$$

At $t = 3$, the velocity of P is $6\boldsymbol{i}\ ms^{-1}$ and the position vector of P is $(20\boldsymbol{i} + 3\boldsymbol{j})\ m$ with respect to a fixed origin O. Find:

a) The angle between the direction of motion of P, and $\boldsymbol{i}$, when $t = 2$

b) The distance of P from O when $t = 0$

3. The velocity of a particle at time t seconds is given by:

$$\boldsymbol{v} = (3t^2 - 8)\boldsymbol{i} + 5\boldsymbol{j}$$

When $t = 0$, the position vector of P with respect to a fixed origin is $(2\boldsymbol{i} - 4\boldsymbol{j})\ m$

a) Find the position vector of P after t seconds

A second particle Q moves with constant velocity $(8\boldsymbol{i} + 4\boldsymbol{j})\ ms^{-1}$. When $t = 0$, the position vector of Q with respect to the origin O is $2\boldsymbol{i}\ m$.

b) Prove that P and Q collide