8A Movement on a Plane

1. A particle starts from the point with position vector $(3\boldsymbol{i} + 7\boldsymbol{j})m$ and moves with constant velocity $(2\boldsymbol{i} - \boldsymbol{j})\ ms^{-1}$.

a) Find the position vector of the particle after 4 seconds

b) Find the time at which the particle is due east of the origin

2. A particle P has velocity $(-3\boldsymbol{i} + \boldsymbol{j})\ ms^{-1}$ at time $t = 0$. The particle moves with constant acceleration $a = (2\boldsymbol{i} + 3\boldsymbol{j})\ ms^{-2}$. Find the speed of the particle and the bearing on which it is travelling at time 3 seconds.

3. An ice skater is skating on a large flat ice rink. At time $t = 0$ the skater is at a fixed point O and is skating with velocity $(2.4\boldsymbol{i} - 0.6\boldsymbol{j})\ ms^{-1}$.

   At time $t = 20$ the skater is travelling with velocity $(-5.6\boldsymbol{i} + 3.4\boldsymbol{j})\ ms^{-1}$.

   Relative to O, the skater has position vector $\boldsymbol{s}$ at time t seconds.

   Modelling the skater as having constant acceleration, find:

a) The acceleration of the ice skater

b) An expression for $\boldsymbol{s}$ in terms of $\boldsymbol{t}$

c) Find the time at which the skater is directly north-east of O

d) A second skater travels such that she has position vector $\boldsymbol{r} = (1.1t - 6)\boldsymbol{j}\ m$ relative to the same point O at time t.