8C Calculus in Mechanics

1. A particle is moving in a straight line with acceleration at time t seconds given by:

   $a = cos2\pi t\ ms^{-2}, \quad t \geq 0$

   The velocity of the particle at time $t = 0$ is $\frac{1}{2\pi}\ ms^{-1}$. Find:

a) An expression for the velocity at time t seconds

b) The maximum speed of the particle

c) The distance travelled in the first 3 seconds

2. A particle of mass 6kg is moving on the positive x-axis. At time t seconds the displacement, s, of the particle from the origin is given by:

   $s = \left(2t^{\frac{3}{2}} + \frac{e^{-2t}}{3}\right)m$, where $t \geq 0$

a) Find the velocity of the particle when $t = 1.5$

b) Given that the particle is acted on by a single force of variable magnitude $F\ N$ which acts in the direction of the positive x-axis, find the value of F when $t = 2$