Question 1

$OACB$ is a parallelogram. O is the origin, A has coordinates $(5, 6)$ and B has position vector $\mathbf{b} = -2\mathbf{i} - 7\mathbf{j}$.

(a) Find the coordinates of point C.

[3]

M is the midpoint of $\overrightarrow{AB}$.

(b) Prove that $\overrightarrow{OM} = \overrightarrow{MC}$.

[3]

(c) Find the exact distance $|\overrightarrow{MC}|$.

[2]

Question 2

A car and a motorcycle are at rest adjacent to one another at a set of traffic lights on a long straight stretch of road. They set off simultaneously at time $t = 0$. The car accelerates uniformly at 6 ms^{-2} until it reaches a speed of 30 ms^{-1} which it then maintains. The motorcycle accelerates uniformly for 9 seconds until it reaches 36 ms^{-1} and then remains at this speed.

(a) Find the acceleration of the motorcycle.

[1]

(b) Draw on the same speed-time graphs to illustrate the movement of both vehicles.

[4]

(c) Find the value of t when the car again draws level with the motorcycle.

[7]