9 In this question, all distances are in metres and time, t, is in seconds.

A particle P moves with a speed of 14.5 parallel to the vector $\begin{pmatrix} -20 \\ 21 \end{pmatrix}$.

(a) Find the velocity vector of P. [2]

Initially, P has position vector $\begin{pmatrix} 3 \\ 5 \end{pmatrix}$.

(b) Write down the position vector of P at time t. [2]

A second particle Q has position vector $\begin{pmatrix} -1 \\ 3 \end{pmatrix} + \begin{pmatrix} -5 \\ 7.5 \end{pmatrix} t$ at time t.

(c) Find, in terms of t, the distance between P and Q at time t. Simplify your answer. [4]

(d) Hence show that P and Q never collide. [2]

DO NOT WRITE IN THIS MARGIN

10 **(a)** The first 3 terms of an arithmetic progression are $3\sin 2x$, $5\sin 2x$, $7\sin 2x$.

(i) Show that the sum to n terms of this arithmetic progression can be written in the form $n(n+a)\sin 2x$, where a is a constant. [3]

(ii) Given that $x = \frac{2\pi}{3}$, find the exact sum of the first 20 terms. [2]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN