9 **(a)** The 1st term of an arithmetic progression is 9.
The last term of this progression is 159.
The sum of all the terms is 2604.

The 12th term of this arithmetic progression is the 1st term of a geometric progression.
The 8th term of this arithmetic progression is the 2nd term of the geometric progression.

Find the sum of the first 6 terms of the geometric progression. [7]

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(b) A different geometric progression has 1st term $\sin\theta$.
The common ratio of this progression is $\cos\theta$ where $45° \leqslant \theta \leqslant 135°$.

(i) Show that this progression has a sum to infinity. [1]

(ii) Show that this sum to infinity can be written as $\operatorname{cosec}\theta + \cot\theta$. [4]

10 In this question, time is in seconds.

(a) At time $t = 0$, particle P starts from the point with position vector $-30\mathbf{j}$.
P travels with speed $58\,\text{ms}^{-1}$ in the direction $20\mathbf{i} + 21\mathbf{j}$.

Find the position vector of P at time t. [3]

(b) Also at time $t = 0$, particle Q starts from the point with position vector $-10\mathbf{i} + 18\mathbf{j}$.

Q travels with speed $75\,\text{ms}^{-1}$ at an angle α above the positive x-axis, where $\tan\alpha = \frac{7}{24}$.

Find the position vector of Q at time t. [4]

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