

Question 5 (12 marks) Use a SEPARATE writing booklet.

(a) A particle is moving in a straight line with Simple Harmonic Motion.

If the amplitude of the motion is 3 cm and the period of the motion is 4 seconds, calculate:

(i) the maximum velocity of the particle. **2**

(ii) the maximum acceleration of the particle. **2**

(iii) the speed of the particle when it is 1 cm from the centre of the motion. **2**

(b) Consider the expansion of $\left(2x + \frac{3}{x}\right)^{11}$.

(i) Write down an expression for the general term of this expansion. **1**

(ii) Find the coefficient of the term containing x^3 . **3**

(c) A geometric series is given by $1 - \cot^2 x + \cot^4 x - \cot^6 x + \dots$ for $\frac{\pi}{4} < x < \frac{\pi}{2}$.

(i) Show that the limit exists and is given by $S = \sin^2 x$. **1**

(ii) Find the set of possible values of S . **1**