6. The fixed point A is **vertically above** the fixed point B, with $AB = 3l$

A light elastic string has natural length l and modulus of elasticity $4mg$
One end of the string is attached to A and the other end is attached to a particle P of mass m

A second light elastic string also has natural length l and modulus of elasticity $4mg$
One end of this string is attached to P and the other end is attached to B.

Initially P rests in equilibrium at the point E, where AEB is a **vertical** straight line.

(a) Show that $AE = \frac{13}{8}l$

(4)

The particle P is now held at the point that is a distance $2l$ vertically below A and released from rest.

At time t, the vertical displacement of P from E is x, where x is measured vertically downwards.

(b) Show that $\ddot{x} = -\frac{8g}{l}x$

(4)

(c) Find, in terms of g and l, the speed of P when it is $\frac{1}{8}l$ below E.

(3)

(d) Find the length of time, in each complete oscillation, for which P is more than $1.5l$ from A, giving your answer in terms of g and l

(3)

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Question 6 continued

(Total for Question 6 is 14 marks)