4. *[In this question the unit vectors* **i** *and* **j** *are directed horizontally and vertically upwards respectively.]*

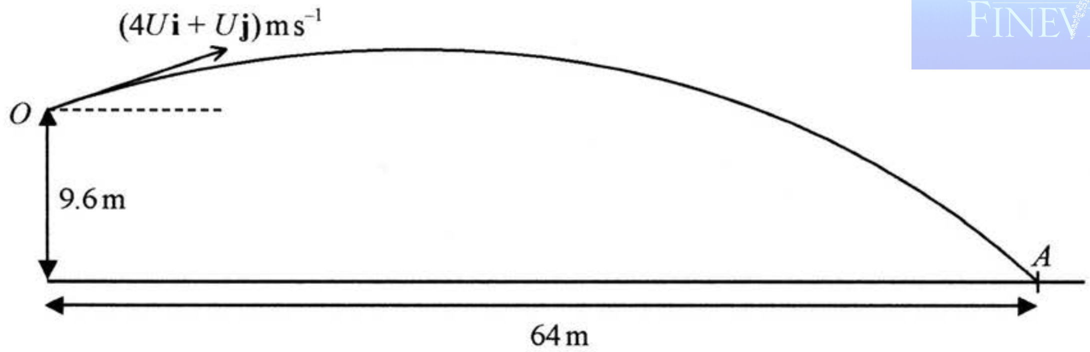

Figure 2

The point O is 9.6 m above horizontal ground.

A small ball is projected with velocity $(4U\mathbf{i} + U\mathbf{j})\,\text{m s}^{-1}$, where U is a positive constant, from the point O

The ball first hits the ground T seconds later, at the point A

The point A is at a horizontal distance of 64 m from O, as shown in Figure 2.

In an initial model

- the ball is modelled as a particle moving under gravity
- air resistance is ignored
- the ball has an initial speed of $V\,\text{m s}^{-1}$

Using this model,

(a) show that $UT = 16$

(2)

(b) find the value of V

(6)

(c) State two improvements to the model, other than including air resistance, that would make the model more realistic.

(2)