13 A small ball B moves in the plane of a fixed horizontal axis Ox, which lies on horizontal ground, and a fixed vertically upwards axis Oy. B is projected from O with a velocity whose components along Ox and Oy are $U\,\text{ms}^{-1}$ and $V\,\text{ms}^{-1}$, respectively. The units of x and y are metres.

B is modelled as a particle moving freely under gravity.

(a) Show that the path of B has equation $2U^2y = 2UVx - gx^2$. **[3]**

During its motion, B just clears a vertical wall of height $\frac{1}{2}a$ m at a horizontal distance a m from O. B strikes the ground at a horizontal distance $3a$ m beyond the wall.

(b) Determine the angle of projection of B. Give your answer in degrees correct to **3** significant figures. **[5]**

(c) Given that the speed of projection of B is $54.6\,\text{ms}^{-1}$, determine the value of a. **[2]**

(d) Hence find the maximum height of B above the ground during its motion. **[3]**

(e) State **one** refinement of the model, other than including air resistance, that would make it more realistic. **[1]**