Example 1. *(Escape Velocity)*

A body of constant mass $m$ is projected away from the earth in a direction perpendicular to the earth’s surface with an initial velocity $v_0$. Assuming that there is no air resistance, but taking into account the variation of the earth’s gravitational field with distance.

An illustration of a body in the earth’s gravitational field

Answer the following questions.

1. Find an expression for the velocity during the ensuing motion.
2. Find the initial velocity that is required to lift the body to a given maximum altitude \( \xi \) above the earth.

3. Find the least initial velocity for which the body will not return to the earth, and it is called the escape velocity.
Example 2. (*Problem 21, if time permit*)

A ball with mass $m = 0.15\text{kg}$ is thrown upward with initial velocity $20\text{m/s}$ from the roof of a building of $30\text{m}$ high. The air resistance force of magnitude $|v|/30$ is directed opposite to the velocity.

1. Find the maximum height above the ground that the ball reaches.

2. Find the time that the ball hit the ground.