A cow is launched from a catapult at ground level with an initial speed of 50 meters per second and at an angle of θ from the horizontal. Assume that the only force acting on the cow is gravity.

1. Find a vector-valued function $r(t)$ that describes the path travelled by the cow. Note that your answer will involve θ as a constant.

2. At what time will the bovine hit the ground?

3. How far from the launch point will the cow hit the ground?

4. Find the value of θ that will maximize the horizontal distance traveled.