# Storming Nottingham Castle Investigation

Nottingham Castle below is a daunting castle to attack. It has enormous 50 meter high walls that are 10 meters thick. There are archers on the castle walls firing arrows to stop the rescue attempt of Maid Marion. You must therefore be no closer to the castle than 100 meters. Your target is the Sheriff of Nottingham. He is in his parlor 20 meters inside the walls of the castle, sitting 10 meters above the ground.

Q1: Using any suitable strategy (including technology), find an equation that models a reasonable flight path of a successful projectile catapulted over the castle walls – the aim is to hit the sheriff!

Q2: Explain how your model would change if the walls were 75 meters high and the archers could only fire to a distance of 50 meters from the wall.

Sketch of what's happening:
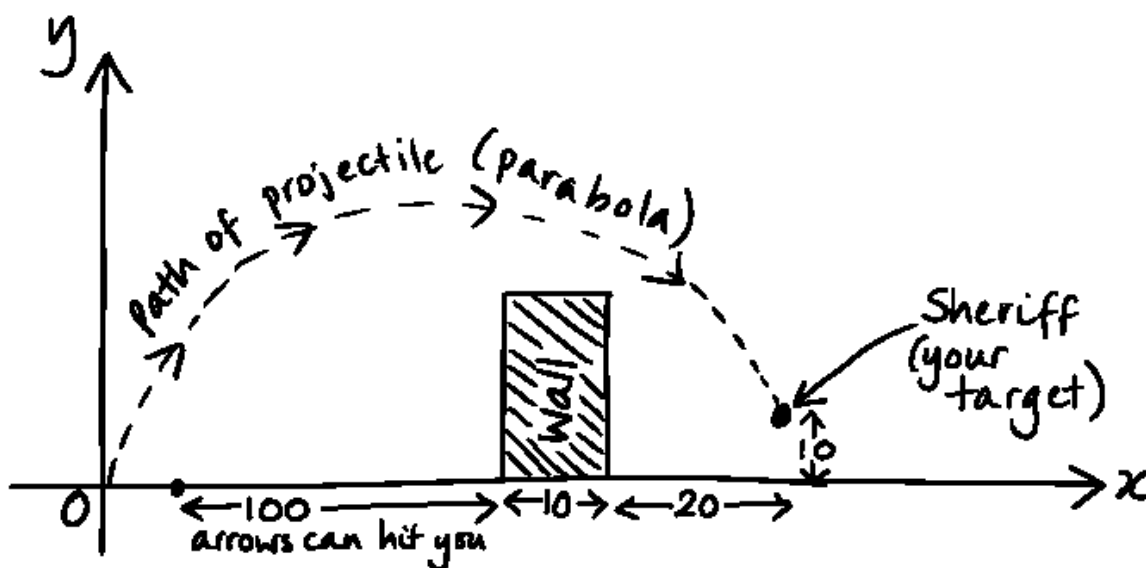
Standard form of a quadratic function: $y = ax^2 + bx + c$ where a, b, c are constants

Factorised form of a quadratic function: $y = a(x - S)(x - T)$ where S, T, a are constants

Vertex form of a quadratic function: $y = a(x - h)^2 + k$ where a, h, k are constants

To achieve a good score you will need to:

- Explain/Show *how* you obtained your model (your quadratic function)
- Explain which form of a quadratic model you chose and why (factorised form, vertex form or standard form) – you must give a **reasoned justification** for your choice
- Explain what each part of the function (i.e. each constant) represents in the projectile path
- *Prove* that your model works without using a graph/diagram
- Explain *how* your model would change as the circumstances of the attack changed.
- This task should be no longer than 2 pages