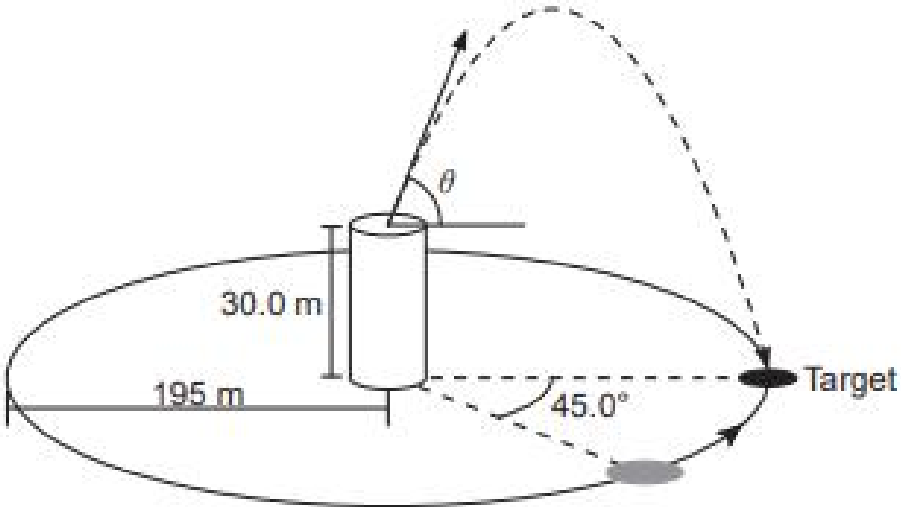
Question 10 **(7 marks)**

In a video game, the players fire arrows from the top of a 30.0 m high castle tower at a flat, 4.00 m wide target moving in a circular path (r = 195 m) around the castle. The player can adjust the vertical angle but the direction of fire is fixed. The launch speed is also fixed at 50.0 m s^{-1}. It takes 32.0 s for the target to complete one revolution of the tower. The shooter fires the arrow when the target has 45.0° of a full revolution to go, as shown in the diagram below.



(a) At what angle θ must the shooter fire the arrow above horizontal for it to hit the centre of the target? (4 marks)

Answer: _____ °

(b) With the use of a calculation, confirm that the arrow hits the target. (3 marks)