

## The Robert Goskowicz Challenge

A drawbridge to a castle spans a deep, dire moat. The drawbridge measures 25 feet in length. It is connected by a chains to a winch inside the castle. The holes to the winches are 24 feet above the floor of the entrance to the castle. The chains are fastened to the drawbridge with eyebolts 1 foot down from the top, ensuring a good seal when closed.

The good wizard of the castle made the drawbridge mechanism even more efficient by casting a spell to remove friction from all of its moving parts.

The winch can wind in the chain at a constant rate of 1 foot per second.

The good wizard then levitated a magic, frictionless cannonball (because he couldn't grab it to pick it up by hand!) to a point half way between the eyebolts for the connecting chains on the drawbridge.

As the chain is wound in, the drawbridge comes up, and the cannonball starts rolling. Answer the following:

- 1) How long does it take the drawbridge to close?
- 2) How fast is hinge angle changing after 10 sec?
- 3) How long does it take the cannon ball to cross the bridge?
- 4) How fast is ball rolling down the hallway (remember, the ball is frictionless)?
- 5) Write an equation giving the balls height in terms of its horizontal displacement while the ball rolls on the drawbridge.