Applied Mathematics

Some warming-up problems.

1. A mothball has originally the radius 1 cm. After one month the radius is found to be 1/2 cm. If we assume that the evaporation rate is proportional to the surface area of the ball, determine the radius as a function of time. After how many months will it disappear completely?

2. A small bead is situated at the highest point P_0 of a vertical circle and this point is joined to a lower point P_1 on the circle by a straight wire. Show that if the bead slides down the wire under the action of gravity but without friction, it will reach P_1 in the same time irrespective of its position.

3. According to *Torricelli's law*, water in an open container will flow out through a small hole in the bottom with the same speed as that it would acquire by falling freely from the level of the water to the hole. A hemispherical bowl of radius R is initially full of water, and a small circular hole of radius r is opened in the bottom at time $t = 0$. How long will it take for the bowl to be completely empty?

4. One morning it started to snow, and the snow fell steadily for the rest of the day. At noon a snowplow started to clear a road at a constant rate in terms of the volume of snow removed per hour. The snowplow had cleared 2 km by 2 o'clock and 1 more km by 4 o'clock. When did it start snowing?

Gunnar