Høsten 2015

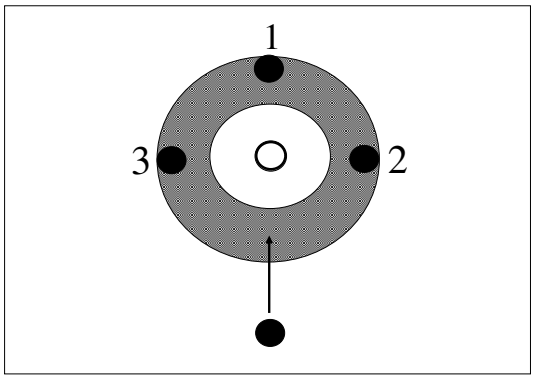
FYS100 Fysikk
Problems week 43

Have a go at these. And for each, make a little sketch to illustrate the solution.

Some problems from the book:

- 9.2, 9.6+7, 9.16, 9.24, 9.29, 9.47, 9.63.

Additional problem 1: (Konte-exam, Feb. 2015)



In the game of curling, massive stones are sent sliding over (essentially) frictionless ice towards a *target circle* at the far end of the pitch (the grey ring in the figure). The radius of the target circle is 2.00 m. Two teams take turns sliding stones, and the winner is whoever gets a stone (or several stones) to stop closest to the centre. All the stones have the same mass of $M = 20.0$ kg, their radius is 15.0 cm, and all collisions are taken to be elastic. There is gravity, $g = 9.80$ m/s^2.
We join the game as the second team (black stones) is ready to throw their last stone, and the configuration is as shown in the figure; the stone of the opposing team (white stones) is currently in the middle of the target circle, with several black stones around.

a) What happens, if the black team choose to hit the central white stone exactly in the middle? Why?

b) The team choose to hit the central white stone slightly to the left of middle, so that it leaves the target circle at an angle θ, exactly halfway between two other black stones (1 and 2, as shown in the figure). Assume that the speed of the incoming black stone immediately before impact is $v = 1.00$ m/s. What is the speed of the white stone, immediately after impact? Does the black stone itself (the one they throw) leave the circle? What is the speed of that stone immediately after impact?

c) Now assume that the ice and stone have a small friction between them, parametrized by a coefficient of kinetic friction of $\mu_k = 0.02$. How far does the black stone slide after the collision before coming to rest? Does it in fact leave the circle? How far does the white stone slide before coming to rest? Does it leave the circle?

d) What possible angles θ could the black team choose to push the white stone instead, if they want the white stone to leave the circle (including friction), but have the black stone stay in the circle (including friction)? Is that possible without hitting any of the other black stones, given the configuration of stones shown in the figure? Why/why not?