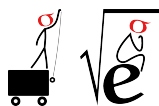
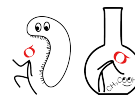




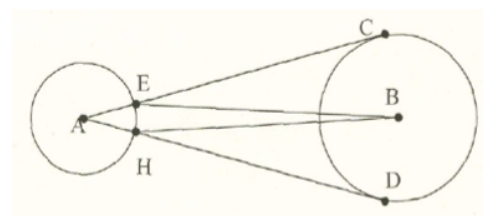
Sigma Tournament



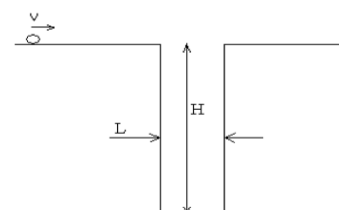
Day 5: Grand Unification



1) Two nonintersecting circles of radii r and R with centers at A and B , respectively, are drawn on a plane (see figure). Two tangents AC and AD intersect the former circle at points E and H , and C , D are tangent points belonging to the second circle. Find the area of the quadrilateral $AEBH$.



2) A puck moving with velocity 5 m/s along a horizontal plane falls into a well of rectangular shape of width 0.6 m and depth 5 m . How many times will it hit the walls of the well before it reaches the bottom? Assume that there is no friction and the collisions with walls are absolutely elastic. $g = 10 \text{ m/s}^2$.



3) It is known that human skin turns red following a brief exposure to cold temperature. However, a sufficiently long exposure to cold turns skin white. Explain reasons for these physiological reactions.

4) Homeopathy is a form of alternative medicine that assumes that poisons can be remedies when taken in extremely small amounts. Imagine that you are preparing such "medicine" yourself. You start with 1 liter of water and dissolve 2.71 g of HgCl_2 in it. After that you mix 1 ml of this solution with 999 ml of water. Repeat this procedure 5 more times (6 times total). How many ions of mercury are contained 1 ml of the final solution, on average?

5) Find a solution of the following equation if it is known that x , y , z , and w are natural numbers.

$$x + \frac{1}{y + \frac{1}{z + \frac{1}{w}}} = \frac{27}{10}$$