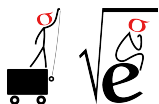
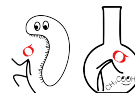




Sigma Tournament



Day 5: Grand Unification



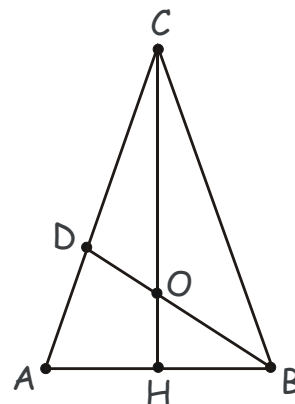
- 1) If you place a person in a hot pool with water temperature reaching 50°C – 60°C , the body will overheat — potentially even burning the skin. However, at air temperatures of 50°C - 60°C in hot desert, people do not get burns. Why do you think this happens?

- 2) Over the course of one hour, how many times do the **minute** and **second** hands of an analog clock form a right angle?



- 3) A ball is dropped from certain height with 0 initial speed. It reached the ground in 5 seconds and bounces off. The ball continues bouncing, and after each bounce it reaches a maximum height, which is 64% of the previous maximum height. Find the time elapsed between the ball's first and fourth collisions with the ground, neglecting air resistance.

- 4) In isosceles triangle ABC ($|AC|=|CB|$), point D divides the side AC into segments such that $|AD|:|CD|=1:2$. If CH is the altitude of the triangle and point O is the intersection of CH and BD , find the ratio $|OH|$ to $|CH|$.



- 5) Burning of propane (C_3H_8) results in formation of water and carbon dioxide. What is the minimal volume of air that should be mixed with 1 liter of gaseous propane (kept at room temperature and normal pressure) to maximize the energy released upon explosion of this air-propane mixture. Assume the fraction of oxygen in air to be 20% (by volume).