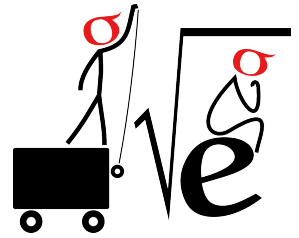


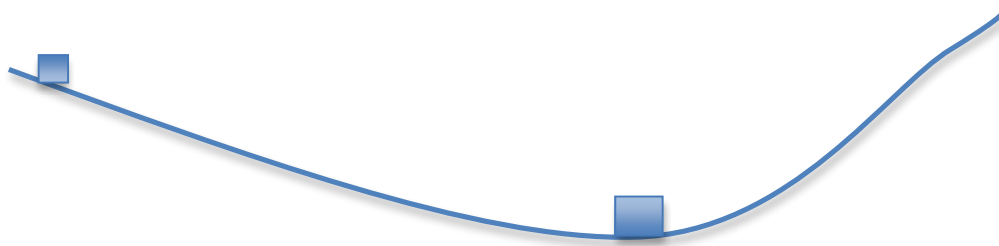
# 2014 Sigma Tournament

## Day 1: Physics & Math

### Round 1



- 1) On the ship, "The Happiness of Pirates," there are several cats and sailors, one cook, and a one-legged captain—all of whom (except the captain) possess the normal number of limbs. Altogether they have 15 heads and 41 legs. How many cats do live on the ship?
- 2) What is the last digit of the number  $2014^{2014}$  ?
- 3) Find the magnitude of an angle (in degrees) between two diagonals of a regular pentagon.
- 4) The block of mass  $m$  slides downhill from the initial height  $H$  and collides with the block of the mass  $2m$ , initially at rest at the lowest point of the descent. Blocks stick together and slide uphill. What is the highest point they reach during the motion? Assume, that friction can be neglected.

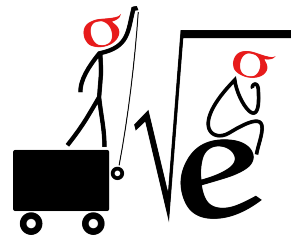


- 5) Two identical blocks made out of two different materials are glued together. The composite object is floating in water. What fraction of the volume of this composite object is submerged in water if the densities of two materials are  $800\text{kg/m}^3$  and  $1100\text{kg/m}^3$ , respectively. The density of water is  $1000\text{kg/m}^3$ .

# 2014 Sigma Tournament

Day 1: Physics & Math

Round 2



## **Experimental problem!**

(4 points for a complete solution)

Find the mass of an unknown weight.

Equipment: unknown weight, known weight (100g) attached to the string, measuring tape, key ring.

Remark: you can also use simple objects around you.