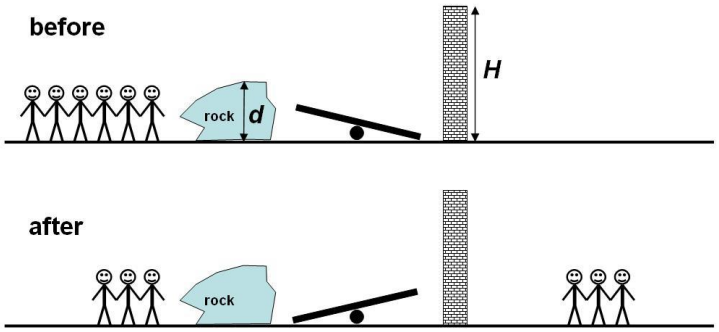
1. In a chemistry experiment a beaker of water is to be heated vigorously using a Bunsen burner and the temperature of the water is measured using a thermometer. A clock is started at t=0 and at t=t_A the heating is begun. The water begins to boil at t=t_B and heating is stopped at t=t_C. at t=t_D the measuring is stopped. Draw a graph of temperature, H, against time, t, for the water.

Suggest mathematical functions which could be used to describe the change in temperature in the ranges a) $t_A \leq t \leq t_B$ and b) $t_C \leq t \leq t_D$.

2. Using a see-saw, six prisoners of similar height and weight would like to help their friends jump to the other side of a prison wall of height H. The rock nearby has a height of d (see figure below). Assuming that the see-saw is ideal, find the maximum ratio of H/d that still allows three prisoners can escape.



3. Evaluate the following definite integrals:

$$\int_{-1}^{1} dx\ (x+1)^4 \qquad (1)$$

$$\int_{0}^{\infty} dx\ e^{-7x} \qquad (2)$$

$$\int_{0}^{\pi} dx\ x\sin(x^2) \qquad (3)$$