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 \( t=t_0 \) 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) \( t_C \leq t \leq t_0 \).

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.

![Diagram of see-saw](image)

3. Evaluate the following definite integrals:

\[
\int_{-1}^{1} dx \ (x + 1)^4 \\
\int_{0}^{\infty} dx \ e^{-\gamma x} \\
\int_{0}^{\pi} dx \ x \sin(x^2)
\]

(1) \( (2) \) \( (3) \)