# Homework 2: Vectors and Kinematics

**Due:** Tuesday September 25, 16:00

**Policy:** Collaboration is allowed, but every student is required to hand in his/her own version of the solutions. Please include your name and student number on the solutions.

**Problem 1.**     1. Consider the vectors $\boldsymbol{A} = (2, -2, 0)$ and $\boldsymbol{B} = (6, -6, -2\sqrt{6})$ in 3-dimensional space. Determine

    (a) $|\boldsymbol{A}|$ and $|\boldsymbol{B}|$,

    (b) $\boldsymbol{A} \cdot \boldsymbol{B}$,

    (c) the angle $\theta$ between $\boldsymbol{A}$ and $\boldsymbol{B}$,

    (d) $|\boldsymbol{A} \times \boldsymbol{B}|$ and $\boldsymbol{A} \times \boldsymbol{B}$.

**Problem 2.** (K. & K. 1.16) The acceleration of gravity can be measured by projecting a body upward and measuring the time it takes to pass two given points in both directions. See the figure below.
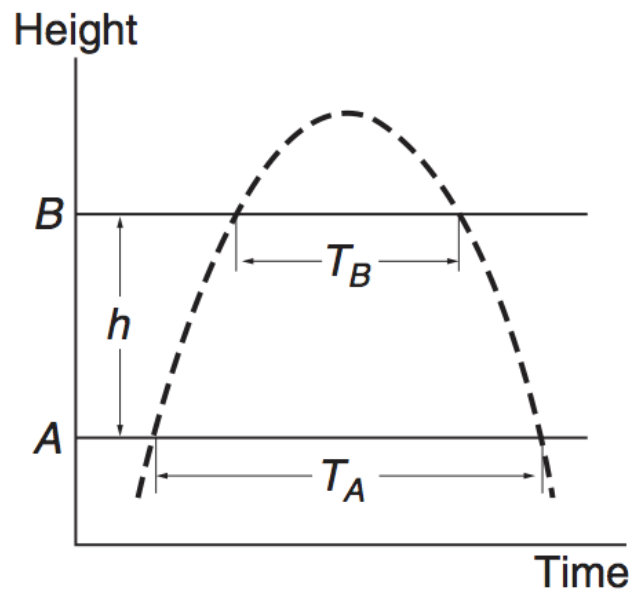


Show that if the time the body takes to pass a horizontal line $A$ in both directions is $T_A$, and the time to go by a second line $B$ in both directions is

$T_B$, then, assuming that the acceleration is constant, its magnitude is

$$g = \frac{8h}{T_A^2 - T_B^2},$$

where $h$ is the height of line $B$ above line $A$.