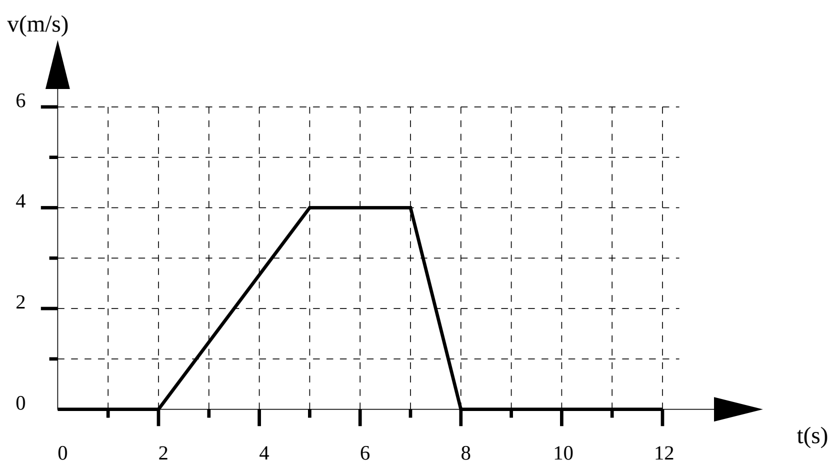
# Exam # 1 – Physics 151

September 17, 2008

Be sure to include pictures, coordinate systems, etc. where reasonable.

1. (10pts) The light year is defined as the distance light travels in one year. Within the solar system this distance is too large to be useful. The distance from the sun to the earth is $1.50 \times 10^8 km$, from the moon to the earth is $3.84 \times 10^5 km$ and the speed of light is $3.00 \times 10^8 m/s$
   (a) What is the distance from the earth to the sun in light minutes?
   (b) What is the distance from the earth to the moon in light seconds?
2. (15pts) A bicycle moves according to the graph of $v$ vs $t$.
   (a) What is the displacement of the bicycle between $t = 0s$ and $t = 12s$?
   (b) What is its acceleration at $t = 3s, 6s$, and $7.5s$?
   (c) Sketch the position vs time graph from $t = 0s$ to $12s$ with $x_o = 0m$.




3. (16pts) A mouse pushes an $50g$ ice cube with its nose across a floor with a force of strenth $2.0N$.
   (a) Write the force from the nose on the ice explicitly as a vector using unit vectors.

(b) What is the force from the ice cube on the mouse's nose?

(c) What is the acceleration of the ice cube?

(d) How far will the mouse need to push the ice cube get it going $15m/s$ if it is initially at rest?

4. (15pts) A crane lifts a load of two boxes of mass $M_t$ and $M_b$ connected by a massless cord of length $L$, as shown in the figure. The boxes are initially at rest with box $M_b$ just touching the ground. The winch of the crane provides a tension $T_H$ on the hoist rope.

   (a) In terms of the above defined quantities and $g$ what is the acceleration of the load?

   (b) What is the tension $T$ in the cord connecting the two masses? Your answer should be in terms of the defined quanities above.

   (c) When the box $M_b$ reaches a height $H$ above the ground the connecting cord snaps. How long has the crane been lifting? Your answer should be in terms of the defined quanities above (including $H$).

   (d) (**Extra Credit**) Using the time the cord snaps as $t = 0$ what is the position of box $M_b$ as a function of time?