Homework 2

Due Wednesday, September 18 at 7pm

Reading for this week: Chaps 3 & 4.

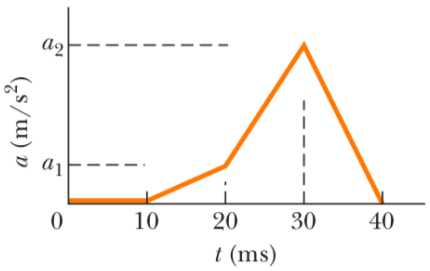
1. **Theory**: In class we constructed part of the following table: Without looking at the book, find

Constant Acceleration	
Equation	Missing Variable(s)
$v = v_0 + at$	$(x - x_0)$
$x - x_0 = v_0 t + \frac{1}{2}at^2$	v
$v^2 = v_0^2 + 2a(x - x_0)$	t
?	a
?	v_0

a way to fill in the two missing entries in this table. Figure out at least two independent checks to confirm that the entries you've constructed are correct and explain how they confirm the validity of your new entries. (Again, checking against the book does not count.)

Exercises:

2. A salamander of the genus *Hydromantes* captures prey by launching its tongue as a projectile (checkout from 1 to 2 minutes on this video): The skeletal part of the tongue is shot forward, unfolding the rest of the tongue, until the outer portion lands on the prey, sticking to it. The figure at right shows the acceleration magnitude a versus time t for the acceleration phase of the launch in a typical situation. The indicated accelerations are $a_2 = 400$ m/s^2 and $a_1 = 100$ m/s^2. What is the outward speed of the tongue at the end of the acceleration phase?



3. HRW Chap 3, P16.
4. HRW Chap 3, P31.
5. HRW Chap 3, P29.

6. Use the definition of scalar product, $\vec{a} \cdot \vec{b} = ab\cos\theta$, and the fact that $\vec{a} \cdot \vec{b} = a_x b_x + a_y b_y + a_z b_z$ to calculate the angle between the two vectors given by $\vec{a} = 2\hat{i} + 3\hat{j} + 3\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} + 3\hat{k}$.

7. HRW Chap 3, P43.

8. The minute hand of a wall clock measures 8 cm from its tip to the axis about which it rotates. The magnitude and angle of the displacement vector of the tip are to be determined for three time intervals. What are the (a) magnitude and (b) angle from a quarter after the hour to half past, the (c) magnitude and (d) angle for the next half hour, and the (e) magnitude and (f) angle for the hour after that?

9. **Problem**: A drowsy cat spots a flowerpot that sails first up and then down past an open window. The pot is in view for a total of half a second. How high above the window top does the flowerpot go? You will need to estimate the top-to-bottom height of the window to find an estimate for how high the pot went.