3/13 in Class – Review for Exam 1

I can't review everything in one class period, so this worksheet is NOT exhaustive. (Examples of things not on this worksheet that could be on the exam: Kirchhoff's Laws, projectile motion, drag, friction, `if/else`, `for` loops, and anything else we did homework on.) Anything we learned, and especially what we have done problems on (both in class and as homework) is fair game for the exam. One exception: animation will not be on the exam.

Make one .m file for all!

As practice for the exam, make all of this one .m file. You are welcome to practice first in the command window, and only cut and paste what works! Call it `review_Yourname.m` and turn it in to me at the end of class.

1. Use MATLAB to evaluate the following:
   (a) 2*3
   (b) 2*3/6*4
   (c) 1/2
   (d) 1\2
   (e) pi
   (f) exp(1)
   (g) sqrt(25)
   (h) sqrt(-25)
   (i) cos(30*pi/180)
   (j) cosd(30)
   (k) cos(pi/2)

2. Use MATLAB to evaluate:
   (a) $e^{-i\pi}$
   (b)
   $$\frac{(2-3)(5+3)}{2-6}$$
   (c)
   $$\frac{\mu_0 I}{2\pi r}$$
   where $\mu_0 = 4\pi \times 10^{-7}$ Tm/A, $I = 3$ A, and $r = 10$cm.
   (d)
   $$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \begin{bmatrix} 7 \\ 8 \\ 9 \end{bmatrix}$$
   (e) Find the inverse of
   $$\begin{bmatrix} 8 & 1 & 6 \\ 3 & 5 & 7 \\ 4 & 9 & 2 \end{bmatrix}$$

3. **The tether ball**: A 0.5kg ball is on the end of a 1.5m rope. The rope is suspended from a pole so that the ball is free to spin in a circle around the pole. (Ignore the fact that on a play ground the rope would wrap around the pole.) The ball is made to go in a horizontal circle around the pole such that the rope makes and angle of 30° with respect to the pole.

   So that we all use the same variables, let's establish the physics 3D spherical coordinates: z goes up along the pole, x comes out of the page, and y goes to the right. Normally, for the pure spherical coordinates, θ comes down from the z axis. Here we will let θ be flipped as shown. ϕ goes from the x axis around toward the $+y$ first.

I used ℓ for the length of the rope and R for the radius of the circle (in the xy plane).

(a) Go to the white board and draw a free body diagram for the ball.

(b) Write Newton's Laws for the ball, leaving symbols like g, ℓ, R, θ, and ϕ in your work.

(c) Integrate to find ϕ as a function of time.

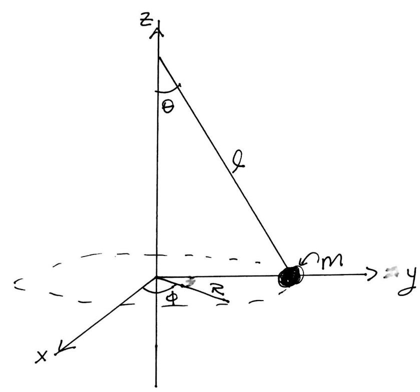
(d) Write a structure plan for how you will write code to find the x and y positions of the ball as a function of time.

(e) Go back to the computer and code it! Save it for today, we might need it again.

(f) Plot *phi* vs t and y vs x on two pages. Call the figure windows Figure(1) and Figure(2) respectively. (Window name, not plot title.)

(g) For the practice, make them look nice: axis labels, a title, add a text block somewhere on one of them. Fix the axes on the plot of y vs x.

(h) Show me the two plots!



4. `save` **and** `load` **practice**:

(a) Take the data you generated from the last problem for t and ϕ and write it out to a text file called `tether.txt` Make it in two columns, the first one for time and the second for angle.

(b) `clear` all the variables from your workspace, and read the data back in. Extract t and ϕ from the file. In Figure(3), plot ϕ vs t again. It should look identical to Figure 1.

5. **Write a function**:

(a) Write the function `xyComp` to find the x and y components of a vector if you are given the magnitude and direction.

(b) Call your function from the (main) script file for a vector $\vec{A}$ that has magnitude 15m and makes an angle of 30° with respect to the $+x$ axis.

(c) Now call it for a $\vec{B}$ that has magnitude 10m and makes an angle of 135° with respect to the $+x$ axis.

(d) Most of us can add the function to the end of the same .m file. If you happen to be using an old version, you will have to send me a separate file for this, call it `xyComp.m`