Physics 3210, Spring 2019 Homework #1

Due *in class* Thursday January 17^{th}

1. Find the cosine and the sine of the angle between

$$\vec{A} = 3\hat{\imath} - \hat{\jmath} + 2\hat{k} \qquad \text{and}$$
$$\vec{B} = -\hat{\imath} - \hat{\jmath} + 4\hat{k}$$

2. *K&K*[1] Problem 1.7. (See hint in back of book.)

3. Find a unit vector perpendicular to both $\vec{A}$ and $\vec{B}$, from Problem 1 above.

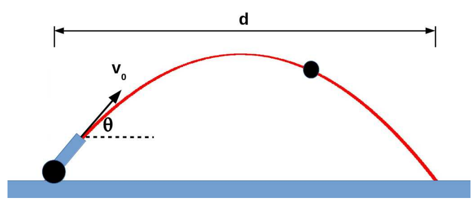
4. *K&K* Problem 1.10, but use the vector $\vec{A}$ from Problem 1 above.

5. A bomber plane flies horizontally over level terrain at 700 km/hr, at an altitude of 3.0 km, and drops a bomb. Neglect air resistance.

   (a) How far does the bomb travel horizontally between its release and hitting the ground?

   (b) If the bomber maintains its course, where is it when the bomb hits the ground?

6. A cannonball is fired with initial speed v_0 at an angle of θ with respect to the ground. Assume air resistance can be neglected.



   (a) Find an equation for the distance d traveled by the ball before it hits the ground, as a function of v_0, θ, and g.

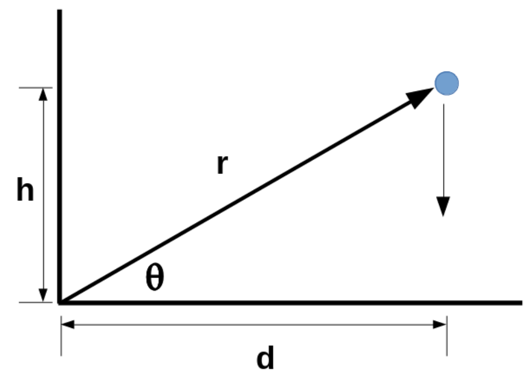
   (b) For which angle θ will the range d of the cannonball be maximized?

Problems continued on the next page.

[1] *K&K* $\equiv$ *Kleppner and Kolenkow, An Introduction to Mechanics*

7. *K&K* Problem 1.20. It will probably help to start by making sketches of speed versus time and position versus time for the car.

8. Consider uniform acceleration in polar coordinates. Suppose a ball is dropped at rest from a height h and horizontal distance d from the origin of coordinates. Find the radial speed dr/dt and angular speed $\omega = (d\theta/dt)$ just before the ball hits the ground.



9. *K&K* Problem 1.25.

10. *K&K* Problem 1.27.