

Contemporary Physics I – HW 1

HW 1

Due October 2, 2009

Please answer all questions clearly and concisely. While you need not transcribe the question completely, it should be clear from your answer alone what you are talking about.

You are strongly encouraged to discuss the homework with your classmates, but you must complete the written homework by yourself, and of course, the material you submit must be your own.

Remember, show all of your work!

1. You have the following vectors:

$$\begin{aligned}\vec{u} &= 12\hat{i} - 5\hat{j} \\ \vec{v} &= 3\hat{i} - 4\hat{j}\end{aligned}$$

Compute the following:

- (a) $3\vec{u}$
 - (b) $\vec{u} + \vec{v}$
 - (c) $|\vec{u}|$
 - (d) What angle does \vec{v} make with the x-axis?
 - (e) $\vec{u} \cdot \vec{v}$
 - (f) What is the angle between \vec{u} and \vec{v} ?
2. Construct a vector of length, 10, which makes an angle $5\pi/6$ with respect to the x-axis.
 3. Consider a particle at position:

$$\vec{r} = 10m\hat{j}$$

moving with a constant velocity:

$$\vec{v} = 1m/s\hat{i} - 2m/s\hat{j}$$

After 3 seconds, how far will the particle be from the origin?

4. A few quickies on the standard model:
 - (a) Imagine I had a boson with a charge of +2. What quarks would comprise that? Is there a real such particle (look at your table)? What is it called?
 - (b) Draw a “Feynman Diagram” for a photon scattering off an electron. Turn that diagram on its side (90 degrees). What’s going on now?
 - (c) Draw a Feynman diagram for a down-quark turning into an up-quark. Make sure that charge is conserved. What force is at work?

(over)

5. Consider a 2kg block. What is the momentum if the speed is:

(a) 10 m/s ?

(b) 400 m/s?

(c) 2×10^8 m/s

(d) 2.9×10^8 m/s

6. 1.HW.95 (in your textbook, naturally)

7. 1.HW.100