# St John Baptist De La Salle Catholic School, Addis Ababa Homework 2 3rd Quarter

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#### March 4, 2023

Notes, and use of other aids is allowed. Read all directions carefully and write your answers in the space provided. To receive full credit, you must show all of your work. Cheating or indications of cheating and similar answers will be punished accordingly.

#### Information

- The homework is due on Friday, March 3.
- You should Work on it in groups and consult me if you have any questions. Cheating within groups is unacceptable.
- For purposes of neatness and simplicity of grading, you should do the homework on an A-4 paper.

## Questions

- 1. When is the cross product used? How is it different from the dot product? What are the applications of the cross product?
- 2. Let  $\vec{A} = -\hat{i} + 2\hat{j} + 5\hat{k}$  and  $\vec{D} = 9\hat{i} H\hat{j} + 5\hat{k}$ . For what value(s) of H are the vectors A and D perpendicular?
- 3. After you find the value of H, find  $\vec{A} \times \vec{D}$ ,  $|\vec{A} \times \vec{D}|$ , and a unit vector perpendicular to both  $\vec{A}$  and  $\vec{D}$ .
- 4. For two vectors  $\vec{A} = A_x \hat{i} + A_y \hat{j} + A_z \hat{k}$  and  $\vec{B} = B_x \hat{i} + B_y \hat{j} + B_z \hat{k}$ , show that  $(\vec{A} \times \vec{B}) \cdot \vec{B} = 0$



- 5. For the figure above, find the direction towards which a positive charge would be moving in the various magnetic fields.
- 6. A charged particle of mass twice that of an electron and a charge of  $-3.2 \times 10^{-19}$ C is moving about a circular trajectory of radius 20cm in a uniform  $3.5 \times 10^3$ G magnetic field that is perpendicular to the velocity of the charge. What is the velocity of the charge?
- 7. An electron moving at a speed of 0.7c through a magnetic field of 2.0T experiences a magnetic force of  $2.2 \times 10^{-14}$ N. What is the angle between the electron's velocity and the magnetic field?

### **Advanced Problems**

- 8. A uniform magnetic field of magnitude 1.2 T is directed along the negative y axis. An electron moving at a speed of 0.2c makes an angle of  $60^0$  with the y axis. Answer the following questions.
  - (I) What is the expected trajectory of the electron?
  - (II) Calculate the radius & pitch of the trajectory.