MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Physics

Physics 8.01L **Fall 2005**

Problem Set 1: Force and Vectors

Due Friday, September 16 at the start of class at 10am.

Please write your name and recitation number on the top right corner of the first page of your homework solutions. In the future, once you have an assigned seat, you will need to add your table and group number as well. Please place your solutions in the Problem Set Solution hand-in bin at the entrance of the classroom.

Reading:
Young & Freedman Chapter 1 (Sections 1.1 – 1.9)
(Note that you will need the material in sections 1.10 – 1.12 later in the term)
Young & Freedman Chapter 4 (Sections 4.1 – 4.2)
Young & Freedman Chapter 5 (Section 5.1)

Problem 1 Vectors: displacement

At 2 am one morning a person runs 250 m along the infinite corridor at MIT from Mass Ave to the end (almost) of Building 8, turns right at the end of the corridor and runs 178 m to the end of Building 2, and then turns right and runs 30 m down the hall.

a) Construct a vector diagram that represents this motion. Indicate your choice of unit vectors.

b) What is the direction and magnitude of the straight line between start and finish?

c) Whose office door is closest to the finish point?

Problem 2 Combining Vectors
Young & Freedman Problem 1.39 (Page 35)

Problem 3 Combining Forces
Young & Freedman Problem 1.65 (Page 37)

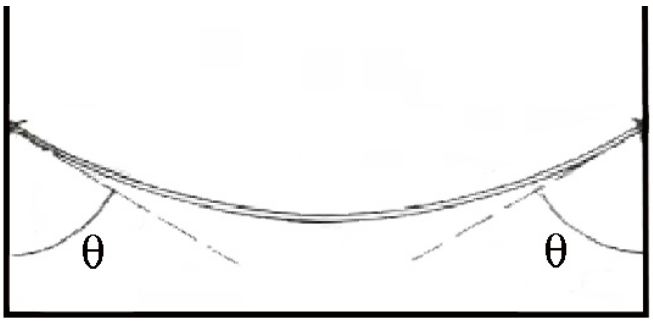
Problem 4 Combining Vectors
Young & Freedman Problem 1.68 (Page 37)

Problem 5 Combining Forces
Young & Freedman Problem 1.76 (Page 38)

Problem 6 Dangerous Crossing
Young & Freedman Problem 5.3 (Page 193)

Problem 7 Moving a Refrigerator
Young & Freedman Problem 5.57 (Page 198)

Problem 8 Static Equilibrium: A challenge
Suppose a rope of mass $m = 0.1\text{kg}$ is connected at the same height to two walls and is allowed to hang under its own weight. At the contact point between the rope and the wall, the rope makes an angle $\theta = 60^\circ$ with respect to the vertical. In order to find the tension in the rope at the end and at the middle of the rope, you will need to think cleverly about what to include as the system in your free body diagram.



a) What is the tension at the ends of the rope where they are connected to the wall? Include in your answer your free body force diagram. Show all the forces acting on the rope and your choice of unit vectors.

b) What is the tension in the rope at the point midway between the walls? Include in your answer your free body force diagram. Show all the forces acting on the rope and your choice of unit vectors.