

Physics 1A, Section 6

October 13, 2008

Homework #2

- There was a typo on the course schedule. (Apologies.)
- Correct assignment is:
 - QP9, QP43
 - Frautschi, Chapter 4, Problems 17 & 20

Week 2 Reading/Lecture Recap

- T.M.U. chapters 3-5 + lectures:
 - derivatives – useful tables on p. 37
 - integrals – useful tables on p. 39 ,47
 - law of inertia (Newton's First Law)
 - reference frames
 - Can solve mechanics problems in any inertial frame (although some choices make calculations easier).
 - projectile motion
 - introduction to components of position, velocity, ...
 - vectors – useful summary on p. 105
 - sum, difference, multiplication by scalar
 - magnitude, components, unit vectors
 - dot product (scalar product)
 - cross product, right-hand rule, determinant of matrix
 - circular motion

Main Purposes of Dot and Cross Products in Mechanics

- Dot product
 - projected components of a vector
 - product where the result is a scalar
energy imparted = **force** · **distance**
- Cross product
 - (area of a parallelogram)
 - vector perpendicular to a plane
 - product where the result is a vector
torque = **radius** × **force**

- Determinant of matrix:

$$\det(A) = \sum_{j=1}^N A_{i,j} (-1)^{i+j} M_{i,j}$$

$M_{i,j}$ = determinant of matrix after removing row i and column j

Quiz

Problem

18

QP 18

Problem 2 (3 points)

What is the angle between two intersecting body diagonals of a cube? Give a numerical answer in degrees. (A *body diagonal* connects two corners and passes through the center of the cube).

Quiz

Problem

18

QP 18

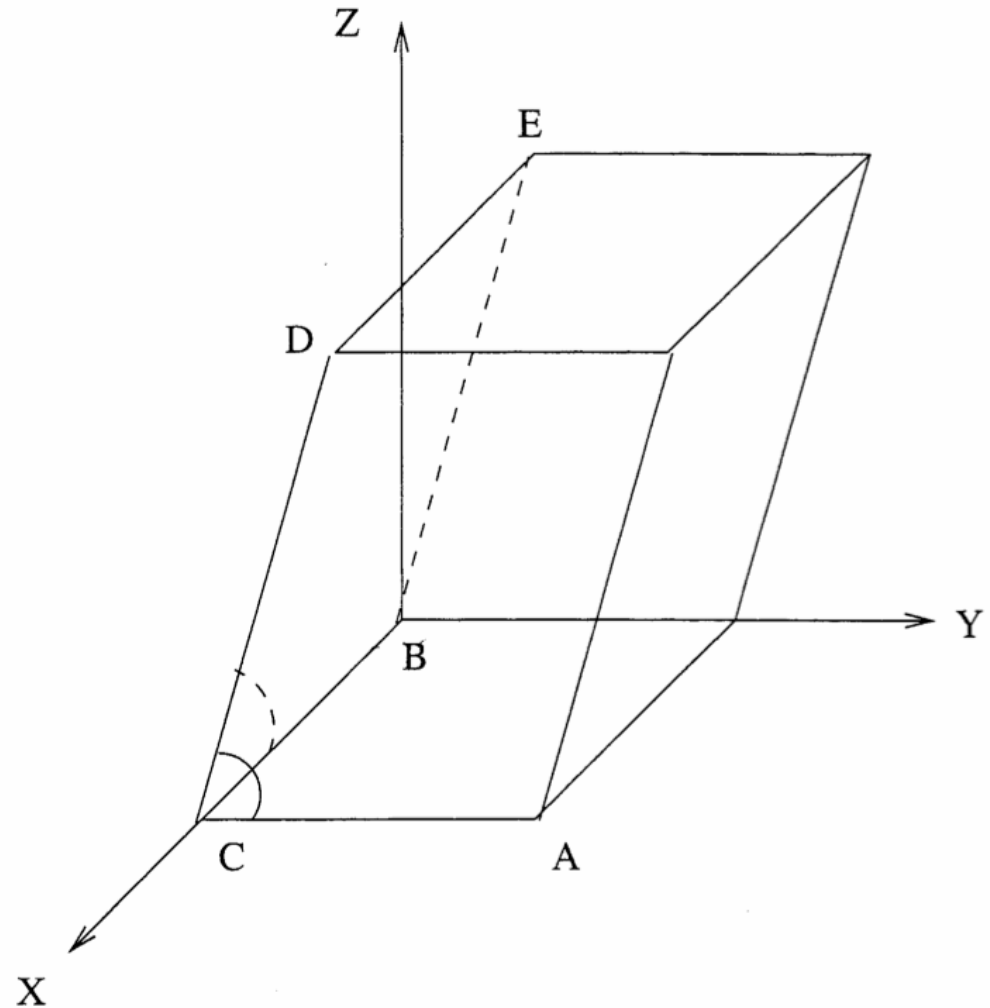
Problem 2 (3 points)

What is the angle between two intersecting body diagonals of a cube? Give a numerical answer in degrees. (A *body diagonal* connects two corners and passes through the center of the cube).

- Answer:
 - a) $\cos^{-1}(1/3) = 70.5^\circ$

Quiz Problem 27

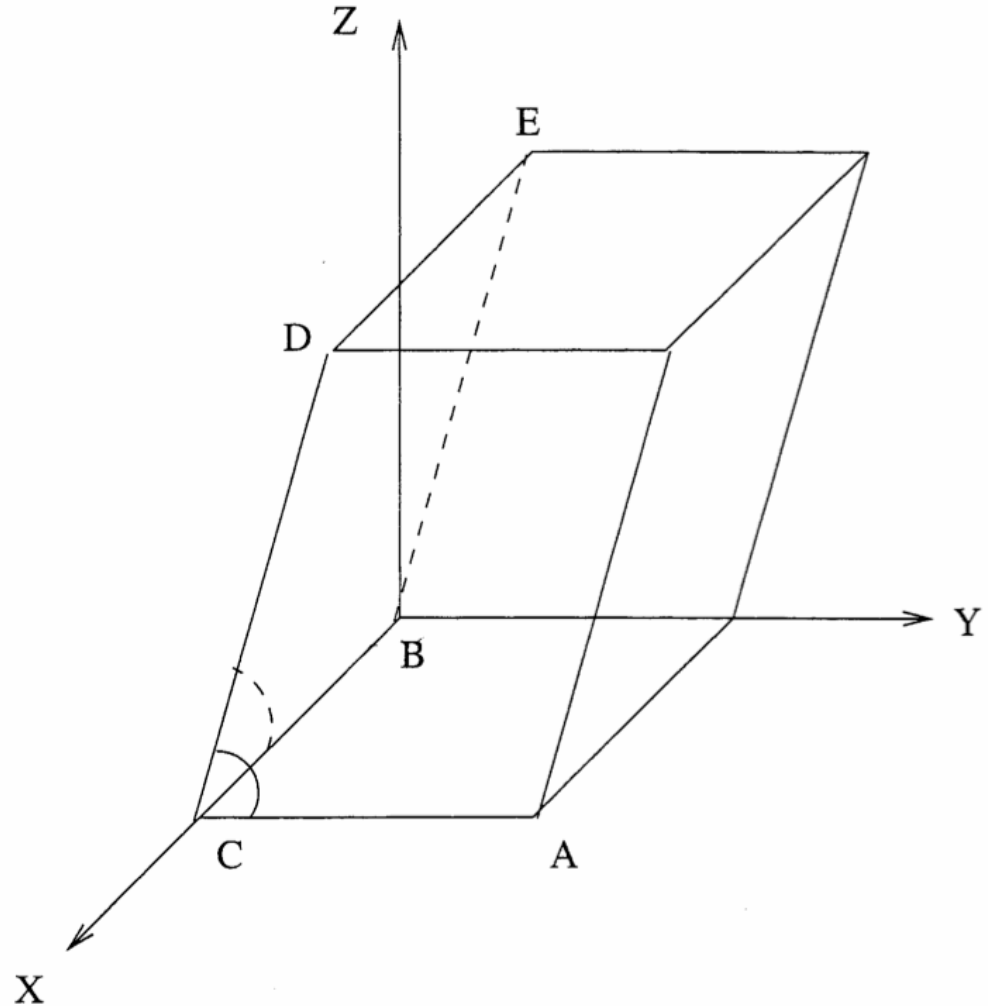
A prism has its square base of side 4 cm in the XY plane. Its top is 10 cm higher than the base, but offset 2 cm in the $\hat{y}$ direction.



- (a) (2 points) What are the two angles, ACD and BCD , between the edges of the prism?
- (b) (1 point) Find the outward unit normal vector to the side $BCDE$.

Quiz Problem 27

A prism has its square base of side 4 cm in the XY plane. Its top is 10 cm higher than the base, but offset 2 cm in the $\hat{y}$ direction.



• Answer:

a) $\cos(\angle ACD) = \sqrt{26} / 26 \Rightarrow$
 $\angle ACD = 78.7^\circ$

$\cos(\angle BCD) = 0 \Rightarrow$
 $\angle BCD = 90^\circ$

b) unit normal =
 $(\sqrt{26} / 26) (0, -5, 1)$

(a) (2 points) What are the two angles, ACD and BCD , between the edges of the prism?

(b) (1 point) Find the outward unit normal vector to the side $BCDE$.

Thursday, October 16:

- T.M.U. Problems 6.1 – 6.6
- Final Problem 9
- *Optional, but helpful, to look at these in advance.*