Math 10C, Spring 2001 April 11, 2001
Prof. Tesler

Homework #3, Due April 19

Chapter 9.4# 31, 33, 35. Draw a picture for problem 33.
Chapter 10.1# 1
and the problems below.

Problem H-1.

In the xy plane, a vector has length 3 and is 35° counterclockwise from the positive x-axis. (The length and angle form is called the *polar coordinates* form.)

Write the vector in the *Cartesian coordinates* form: $\begin{bmatrix} x \\ y \end{bmatrix}$ (see page 472).

Problem H-2.

Let c and d be scalars; $\vec{p}$ and $\vec{q}$ be 2-dimensional vectors; and $\vec{r}$ and $\vec{s}$ be 3-dimensional vectors. State whether each formula results in a scalar; a 2-dimensional vector; a 3-dimensional vector; or is an invalid formula (and why it's invalid).

(i) $c(3\vec{r} - 2\vec{s})$ (ii) $d(\vec{r} \cdot \vec{p})$ (iii) $c \cdot \vec{r}$ (iv) $|\vec{p}|^2$

Problem H-3.

A triangle has vertices at coordinates $P = (2, 2, 3)$, $Q = (1, 5, 3)$, $R = (1, 2, 7)$.

(i) Compute the lengths of all three sides. Your answers should have the form, "the length of PQ is $\sqrt{10}$," etc.

(ii) Compute all three angles, in both radians AND in degrees. Your answers should have the form, "the angle at P is 1.494 radians, or 85.60°" etc.

Parts (iii)–(v) are based on the lecture planned for Friday April 13.

(iii) Give a vector parametric equation for the line through P and Q. Your answer should have the form "$\vec{r} = \vec{r}_0 + t\vec{v}$" where the *position vector* is $\vec{r} = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$ and $\vec{r}_0$ and $\vec{v}$ are vectors given with specific numbers.

(iv) For the line in part (iii), what value of t, if any, corresponds to the point P? The point Q? The point R?

(v) Give the ordinary parametric equations of the line through P and Q. Your answer should be three equations: "$x = a\,t + x_0$, $y = b\,t + y_0$, $z = c\,t + z_0$" (with specific numbers given for a, b, c and x_0, y_0, z_0).

Part (vi) is based on the lecture planned for Wednesday April 11.

(vi) On the line through P and Q, compute the coordinates of the point S that is closest to R, and also the distance from R to the line (i.e., $|\overrightarrow{SR}|$).