

Physics 3513, Homework #4 (due 9/24)

The numbers in parentheses after the problem number indicate points for each problem.

P1(10) (Boas 5.10) Find symmetric and parametric equations of a line through $(3, 4, -1)$ and parallel to $2\mathbf{i} - 3\mathbf{j} + 6\mathbf{k}$.

P2(10) (Boas 5.35) Find the distance from $(2, 5, 1)$ to the line in the previous problem.

P3(10) (Boas 5.30) Find the distance from the origin to the plane $3x - 2y - 6z = 7$.

P4(10) (Boas 7.27) Show that the matrix $\frac{1}{\sqrt{2}} \begin{pmatrix} -1 & -1 \\ 1 & -1 \end{pmatrix}$ is orthogonal, find its determinant, and find the rotation angle or the line of reflection.

P5(10) Calculate the Wronskian of the functions

(a) $f_1(x) = \cos x$, $f_2(x) = \sin x$;

(b) $f_1(x) = \cosh x$, $f_2(x) = \sinh x$,

to show that they are linearly independent.

P6(10) (Boas 8.18) Solve
$$\begin{cases} 2x & + & 3z & = & 0 \\ 4x & + & 2y & + & 5z & = & 0 \\ x & - & y & + & 2z & = & 0 \end{cases}.$$

P7(10) (Boas 11.14) Find the eigenvalues and eigenvectors of $\begin{pmatrix} 3 & -2 \\ -2 & 0 \end{pmatrix}$.

P8(10) Find the eigenvalues and eigenvectors of

(a) $\begin{pmatrix} 1 & \varepsilon \\ \varepsilon & 1 \end{pmatrix}$, (b) $\begin{pmatrix} 1 & \varepsilon^2 \\ 1 & 1 \end{pmatrix}$.

In both cases, find the angle between the two eigenvectors as $\varepsilon \rightarrow 0$.

P9(20) Find the eigenvalues of

(a) $\begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix}$, (b) $\begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$.