Initial Survey

Name: __________________________________________

Department: __________________________________________

E-mail address: __________________________________________

Circle the best description of your involvement in this course:

For Credit  Regular auditor  Not sure yet

Briefly sketch your background in

1. Mathematics

2. Computer programming (any language)

What do you want to get out of this course? Are there specific topics that you would like to see covered?
Please answer these questions quickly, if the answer is obvious to you. If not, leave the answer blank. I don’t assume that you should know all of this material as a prerequisite for taking this course. The purpose of the quiz is for me to be be able to determine where people are starting from.

1. The distance from $(0, 0)$ to $(x, y)$ is
   
   (a) $x + y$
   (b) $xy$
   (c) $x^2 + y^2$
   (d) $(x^2 + y^2)^{1/2}$
   (e) $\log_2(2^x + 2^y)$

2. $\sin^2(x) + \cos^2(x) =$
   
   (a) 1
   (b) $e^{2x}$
   (c) $\pi$
   (d) 0
   (e) $e$

3. The product of the complex numbers $2 + 3i$ and $3 + 2i$ is
   
   (a) 13
   (b) $-1 + i$
   (c) $6 + 6i$
   (d) $5 + 5i$
   (e) $13i$

4. $e^{i\theta} =$
   
   (a) 1
   (b) $\cos \theta + i\sin \theta$
   (c) $\pi$
   (d) 0
   (e) $\sin \theta + i\cos \theta$
5. If \( A \) is a matrix \[
\begin{pmatrix}
1 & 2 \\
3 & 4
\end{pmatrix}
\] then \( A^2 \) is

(a) 29
(b) \[
\begin{pmatrix}
7 & 10 \\
15 & 22
\end{pmatrix}
\]
(c) \[
\begin{pmatrix}
1 & 4 \\
9 & 16
\end{pmatrix}
\]
(d) \[
\begin{pmatrix}
1 & 2 & 1 & 2 \\
3 & 4 & 3 & 4
\end{pmatrix}
\]

6. Which (plural) of the systems indicated by the following equations are linear?

(a) \( y[n] = 2x[n] \)
(b) \( y[n] = (x[n])^2 \)
(c) \( y[n] = MAX(\ x[n],\ 10) \)
(d) \( y[n] = \frac{1}{2M+1} \sum_{k=-M}^{M} x[n-k] \)
(e) \( y[n] = x[n] - x[n+1] \)

7. Two vectors are orthogonal iff

(a) their inner product is one.
(b) their inner product is zero.
(c) their sum is one.
(d) their sum is zero.
(e) none of the above.

8. Which of these functions is its own Fourier transform?

(a) an impulse
(b) a sine wave
(c) a gaussian
(d) a decaying exponential
(e) a step function
9. The $z$-transform of $x[n] = a^n u[n]$ is

(a) $z/(z - a), \ |z| > |a|$
(b) $(z - a)/z, \ |a| > |z|$
(c) $a^z, \ |a| > 1$
(d) $z^a, \ |a| < 1$

10. Write down the following products of a matrix times a vector. Circle each of the given vectors (one or more) that is an eigenvector of the given matrix.

(a) \[
\begin{pmatrix}
4 & -5 \\
2 & -3
\end{pmatrix}
\begin{pmatrix}
5 \\
2
\end{pmatrix}
\]
(b) \[
\begin{pmatrix}
4 & -5 \\
2 & -3
\end{pmatrix}
\begin{pmatrix}
0 \\
2
\end{pmatrix}
\]
(c) \[
\begin{pmatrix}
4 & -5 \\
2 & -3
\end{pmatrix}
\begin{pmatrix}
1 \\
-1
\end{pmatrix}
\]
(d) \[
\begin{pmatrix}
4 & -5 \\
2 & -3
\end{pmatrix}
\begin{pmatrix}
1 \\
1
\end{pmatrix}
\]