

Math 2568 Homework 2

Math 2568 Due: Wednesday, September 4, 2019

Problem 1

Determine whether the given pair of vectors is perpendicular.

§1.4, Exercise 8. $x = (2, 1, 4, 5)$ and $y = (1, -4, 3, -2)$.

Problem 2

§2.1, Exercise 7.

- (a) Find a quadratic polynomial $p(x) = ax^2 + bx + c$ satisfying $p(0) = 1$, $p(1) = 5$, and $p(-1) = -5$.

Problem 3

§2.2, Exercise 5.

- (a) Find a vector u normal to the plane $2x + 2y + z = 3$.
- (b) Find a vector v normal to the plane $x + y + 2z = 4$.
- (c) Find the cosine of the angle θ between the vectors u and v .

Problem 4

Determine whether the given matrix is in reduced echelon form.

§2.3, Exercise 1. $\begin{pmatrix} 1 & -1 & 0 & 1 \\ 0 & 1 & 0 & -6 \\ 0 & 0 & 1 & 0 \end{pmatrix}$.

Problem 5

We list the reduced echelon form of an augmented matrix of a system of linear equations. Which columns in these augmented matrices contain pivots? Describe all solutions to these systems of equations in the form of (2.3.14).

§2.3, Exercise 4. $\left(\begin{array}{ccc|c} 1 & 4 & 0 & 0 \\ 0 & 0 & 1 & 5 \\ 0 & 0 & 0 & 0 \end{array} \right).$

Problem 6

§2.3, Exercise 9. Use row reduction and back substitution to solve the following system of two equations in three unknowns:

$$\begin{array}{rclcl} x_1 & - & x_2 & + & x_3 & = & 1 \\ 2x_1 & + & x_2 & - & x_3 & = & -1 \end{array}$$

Is $(1, 2, 2)$ a solution to this system? If not, is there a solution for which $x_3 = 2$?

Problem 7

Determine the augmented matrix and all solutions for each system of linear equations

§2.3, Exercise 11. $\begin{array}{rcl} 2x - y + z + w & = & 1 \\ x + 2y - z + w & = & 7 \end{array}.$

Problem 8

Consider the augmented matrices representing systems of linear equations, and decide

- (a) if there are zero, one or infinitely many solutions, and
- (b) if solutions are not unique, how many variables can be assigned arbitrary values.

§2.3, Exercise 14. $\left(\begin{array}{ccc|c} 1 & 0 & 2 & 1 \\ 0 & 5 & 0 & 2 \\ 0 & 0 & 4 & 3 \end{array} \right).$

Problem 9 (MATLAB)

Use elementary row operations and MATLAB to put each of the given matrices into row echelon form. Suppose that the matrix is the augmented matrix for a system of linear equations. Is the system consistent or inconsistent?

§2.3, Exercise 24.(MATLAB)

$$\left(\begin{array}{cccc} -2 & 1 & 9 & 1 \\ 3 & 3 & -4 & 2 \\ 1 & 4 & 5 & 5 \end{array} \right).$$

Problem 10

§2.4, Exercise 4. The augmented matrix of a consistent system of five equations in seven unknowns has rank equal to three. How many parameters are needed to specify all solutions?

Problem 11 (MATLAB)

Use `rref` on the given augmented matrices to determine whether the associated system of linear equations is consistent or inconsistent. If the equations are consistent, then determine how many parameters are needed to enumerate all solutions.

§2.4, Exercise 7.(MATLAB)

$$A = \left(\begin{array}{ccccc|c} 2 & 1 & 3 & -2 & 4 & 1 \\ 5 & 12 & -1 & 3 & 5 & 1 \\ -4 & -21 & 11 & -12 & 2 & 1 \\ 23 & 59 & -8 & 17 & 21 & 4 \end{array} \right) \quad (1^*)$$

Problem 12 (MATLAB)

Compute the rank of the given matrix.

§2.4, Exercise 12.(MATLAB) $\left(\begin{array}{cccc} 2 & 1 & 0 & 1 \\ -1 & 3 & 2 & 4 \\ 5 & -1 & 2 & -2 \end{array} \right).$