

**MATH 307, FALL 2020 PRACTICE MIDTERM 1**

SEPTEMBER 28

Each problem is worth 10 points.

**Problem 1.** Determine the distance between  $\begin{pmatrix} 4 \\ 0 \\ 0 \end{pmatrix}$  and the line  $\ell(t) = \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} + t \begin{pmatrix} 2 \\ 0 \\ 1 \end{pmatrix}$ .

**Problem 2.** Express  $u = \begin{pmatrix} 2 \\ 0 \\ 1 \end{pmatrix}$  as a component parallel to  $\begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix}$  and a component perpendicular.

**Problem 3.** For each of the linear systems below, express the system in row-reduced form and give the solution set.

a.

$$\begin{aligned}x + 2z &= 7 \\2x + y + z &= 3 \\y + 2z &= 1.\end{aligned}$$

b.

$$\begin{aligned}x + y + z &= 10 \\2x + y &= 7.\end{aligned}$$

**Problem 4.**

a. Calculate the inverse matrix of

$$\begin{pmatrix} 3 & 1 & 1 \\ 2 & 0 & 1 \\ 1 & 1 & 1 \end{pmatrix}.$$

b. Calculate the determinant

$$\det \begin{pmatrix} 3 & 1 & 1 \\ 2 & 0 & 1 \\ 1 & 1 & 1 \end{pmatrix}.$$

**Problem 5.** Find the equation of the plane through

$$\begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 2 \\ 1 \\ 1 \end{pmatrix}, \begin{pmatrix} 0 \\ 3 \\ 0 \end{pmatrix}.$$

**Problem 6.** Find the equation of the plane tangent to  $2x^2 + 2y^2 - z^2 = 12$   
at  $\begin{pmatrix} 2 \\ 2 \\ 2 \end{pmatrix}$ .



