

Department of Mathematics and Statistics
MATH 133: Vectors, Matrices and Geometry

Test 1

Due by 1 pm Friday October 24, 2003

Justify all of your assertions

**Make sure the course number, your name, student number
and instructor's name are at the top of each page**

1. Let $P(1, -2, 3)$, $A(2, 1, -1)$, $B(3, -1, 4)$ be given points in \mathbb{R}^3 and let L be the line passing through A and B .
 - (a) Find parametric equations for the line L ;
 - (b) Find the distance of the point P to the line L ;
 - (c) Find the coordinates of the point Q on L which is closest to P ;
 - (d) Find the equation of the plane perpendicular to L and passing through P .
2. Let $x - 2y + 3z = 2$, $2x + y - 3z = 3$ be given planes in \mathbb{R}^3 and let L be the line of intersection of these two planes.
 - (a) Find parametric equations for L ;
 - (b) Find the equation of the plane containing L and the point $P(1, -1, 1)$;
 - (c) If $ax + by + cz = d$ is the equation of the plane found in 2(b), show that the vector (a, b, c, d) is a linear combination of the vectors $(1, -2, 3, 2)$, $(2, 1, -3, 3)$.
3. Consider the system of equations

$$\begin{aligned}x_1 + cx_2 + 2x_3 + cx_4 &= 1 \\2x_1 + 2cx_2 + 5x_3 + x_4 &= c + 1 \\cx_1 + c^2x_2 + 3cx_3 - 2x_4 &= c + 2\end{aligned}$$

where c is a parameter.

- (a) Find the reduced echelon form of the augmented matrix of the given system;
- (b) What are the values of c for which the given system of equations is consistent;
- (c) Find a parametric description of the solution set of the given system for each value of c found in 3(b).

Note that your answers to 3(a) and 3(c) depend on the value of c .