FIRST PRACTICE MIDTERM A
MATH 18.02, MIT, AUTUMN 12

You have 50 minutes. This test is closed book, closed notes, no calculators.

There are 5 problems, and the total number of points is 90. Show all your work. *Please make your work as clear and easy to follow as possible.*

Name:_____

Signature:_____

Student ID #:_____

Recitation instructor:_____

Recitation Number+Time:_____

Problem	Points	Score
1	20	
2	20	
3	20	
4	15	
5	15	
Total	90	

1. (20pts) Let $P = (1, -2, 4)$, $Q = (1, -2, 1)$ and $R = (2, 1, 1)$.
(i) What is the distance between Q and R?

(ii) What is the area of the triangle with vertices P, Q and R?

2. (20pts) (i) Find the determinant of

$$A = \begin{pmatrix} -1 & 0 & -1 \\ 0 & 2 & -1 \\ 1 & 1 & 1 \end{pmatrix}.$$

(ii) Find the inverse of A.

3. (20pts) A ladybug is climbing on a Volkswagen Bug (=VW). In its starting position, the surface of the VW is represented by the unit semicircle $x^2+y^2 = 1$, $y \geq 0$ in the xy-plane. The road is represented as the x-axis. At time $t = 0$ the ladybug starts at the front bumper, $(1, 0)$, and walks counterclockwise around the VW at unit speed relative to the VW. At the same time the VW moves to the right at speed 10.
(i) Find the parametric formula for the trajectory of the ladybug, and find its position when it reaches the rear bumper. (At $t = 0$, the rear bumper is at $(-1, 0)$.)

(ii) Compute the speed of the bug, and find where it is largest and smallest. (*Hint: It is easier to work with the square of the speed*).

4. (15pts) Find the equation of the plane containing the points $P = (1, 1, 1)$, $Q = (2, 1, 3)$ and parallel to the vector $\vec{w} = \langle -1, 2, 3 \rangle$.

5. (15pts) A ladder of length a rests against a wall. Suppose that the bottom of the wall is at the origin and that the ladder is in the first quadrant. The bottom of the ladder moves away from the wall along the floor as the top of the ladder slides down the wall.
Express the position of the centre of the ladder P in terms of the angle θ the ladder makes with the floor.