This practice exam is a fair approximation of the first unit test. I would like to draw your attention to the following important remarks.

- I will not provide the solution of this practice exam in a file. The only way you can learn about the solutions is to attend the class on Wednesday Jan. 28 or during the office hours.
- There might still be some typos in the practice test. Please inform them as soon as you find one.
- The exam starts right at 12:35pm (Thursday Jan. 29) at the same room of the class and continues till 1:45pm.
- Calculators are not necessary but there is no restriction in using them. You don’t need to simplify your answers.
- You can bring a note sheet containing all formulas. No problem, example, or solution is allowed on the note sheet. All the note sheets must have names and turned in with your exam sheet at the end of the exam. Any missing note sheet will result in a score of zero in the test.

Start of the practice unit test

1. Find the area triangle $\triangle PQR$ with vertices given by the points $P(1,-3,-2), Q(7,0,4), R(10,-6,-2)$. (3 points)

2. (a) Determine whether the points $A(2,5,1), B(3,9,-3), C(1,3,3)$ lie on a straight line. (2 points)
   (b) Determine whether the points $A(2,5,1), B(3,9,-3), C(1,3,3), D(2,0,5)$ lie on a plane. (2 points)

3. (a) Write the equation of the sphere in standard form. $x^2 + y^2 + z^2 + 6x - 4y - 6z = 3$. (3 points)
   (b) Find an equation of a sphere if one of its diameters has endpoints $(5,2,6)$ and $(7,6,8)$. (2 points)

4. Find the Cosine of the three angles of the triangle with the given vertices: $P(3,0,1), Q(0,2,2), R(5,4,2)$. (3 points)

5. Find the scalar, vector, and orthogonal projection of $a = \mathbf{j} + \mathbf{k}$ onto $b = \mathbf{i} + 7\mathbf{j} - 4\mathbf{k}$. (2 points)

6. Find the volume of the parallelepiped determined by the vectors $a = 6\mathbf{i} + 2\mathbf{j} - 3\mathbf{k}, b = 2\mathbf{j} + 3\mathbf{k}, c = 6\mathbf{i} - \mathbf{j} + 4\mathbf{k}$. (2 points)

7. Find a parametric equation the line obtained from intersection of two planes $x + 2y + z = 1$ and $2x - y - z = 10$. (2 points)

   Find parametric equations and symmetric equations for the line that passes through $(5,2,0)$ and perpendicular to both $\mathbf{i} + \mathbf{j}$ and $\mathbf{j} + \mathbf{k}$. (2 points)

8. Find an equation of the plane that passes through the line of intersection of the planes $x - z = 3$ and $y + 4z = 2$ and is perpendicular to the plane $x + y - 3z = 5$. (3 points)
9. Find the distance between the skew lines with parametric equations \( x = 3 + t, \ y = 2 + 6t, \ z = 2t, \) and \( x = 2 + 2s, \ y = 5 + 15s, \ z = -3 + 6s. \) (2 points)

10. Determine which of the following equations are describing surfaces and which are describing regions. If surface, name the surface that each one is describing.
   (a) \( 81x^2 + y^2 + 8z^2 = 13. \) (1 points)
   (b) \( 7x^2 - 2y^2 + z^2 = 12. \) (1 points)
   (c) \( 3y^2 + z^2 - x - 18y - 6z + 36 = 0. \) (2 points)
   (d) \( x^2 + \frac{z^2}{2} - y^2 - 2x - 4y - 1 = 0 \) and \( y \leq -2. \) (2 points)

11. Match the surface with the equation. There are more surfaces than equations. (2 points)
   (1) \( x - y^2 - \frac{z^2}{4} = 0 \)
   (2) \( -\frac{x^2}{2} + \frac{y^2}{4} + 2z^2 = 0 \)
   (3) \( x^2 + y^2 - z^2 = -1 \)
   (4) \( (x - 2)^2 + \frac{z^2}{4} = \frac{y^2}{4} + 1 \)
Figure 1: Plots for problem 11