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 Feb. 18 or come to 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 12:30pm (Thursday Feb. 19) at the same room of the class and continues for 75 minutes.
- Using a calculator is not necessary but I will not stop you from using it.
- You can bring a note sheet as in the previous exams. No equation, problem, example, or solution is allowed on the note sheet. As before, all the note sheets must have names and turned in with your exam sheet at the end of the exam. Any violation of the note sheet rules will result a score of zero in the test.

Start of the practice unit test

1. Match the parametric equation of the curves with the graph. (More graphs than equations and there could be no match)
   
   (a) $r(t) = \langle t, 1 - t, 2 - 2t \rangle$
   (b) $r(t) = \langle \sin(t), \cos(t), t \rangle$
   (c) $r(t) = \langle \sin(t), -\cos(t), t \rangle$
   (d) $r(t) = \langle \sin(t), t, \cos(t) \rangle$
   (e) $r(t) = \langle \sin(t), .5t, \cos(t) \rangle$
2. A particle has velocity vector given by \( v(t) = \langle 3t^2, 2\sqrt{3}t, 2 \rangle \) where \( t \geq 0 \) and represents time.

(a) Find the position vector \( r(t) \) if \( r(1) = \langle 1, 2, 3 \rangle \).

(b) Find the acceleration \( a(t) \).

(c) Find when the particle speeds up and when it slows down.

(d) Find the (exact) arclength from \( t = 1 \) to \( t = 1.5 \).

(e) Find \( a_T \), the tangential and \( a_N \) the normal components of acceleration.

(f) Find the domain of the function \( z = \sqrt{1 - x^2 - y^2} + \frac{2x-xy^2-y^7}{x^2+y^2} \).

3. Find the vectors \( T \), \( N \), and \( B \) for the curve \( r(t) = \langle t, 2\cos(9t), 2\sin(9t) \rangle \) at the point \( (\pi/18, 0, 2) \).

4. Consider the function below

\[
 f(x, y) = \begin{cases} 
 \frac{xy}{\sqrt{x^2+y^2}} & (x, y) \neq (0, 0) \\
 a & (x, y) = (0, 0) 
\end{cases}
\]

(a) Find the limit \( \lim_{(x,y) \to (0,0)} f(x, y) \). If the limit exists provide a reason, if not determine two paths along which the limit is different.

(b) Find the value for \( a \) such that \( f \) becomes continuous at all points of its domain.

(c) Find the partial derivatives \( f_x \) and \( f_y \).

5. Find the equation of tangent plane to surface \( z = 4 - x^2 - y \) at point \( (1, 3, 0) \). Find the symmetric equation of the line parallel to \( xz \)-plane and tangent to this surface at point \( (1, 3, 0) \).

6. We measure the radius of base and height of a cylindrical container respectively by 2” and 5”. If the measurement error is .1”, how much error we (approximately) make in calculating the volume by using this measurements?