Chapter 9 Checkpoint, Second Attempt

Directions:

- You will have 30 minutes per question you attempt. When you begin the checkpoint, please write down the current time at the top of your cover page, and leave a space to write the time you finish. When you finish please immediately write the time.
- You may use your notes, the book, and any materials posted on the course website. Also, feel free to ask me clarifying questions or about typos. You may not use any other resource. In particular, you may not use any other resource on the internet, you may not use a computer to assist you with graphing or computations (unless the problem explicitly states otherwise) and you may not discuss the problems with anyone else.
- Each problem corresponds to a standard and specifically asks about that standard. You many complete as many or as few of the problems as you wish.
- If you have a question about any of the problems, or think there is an error please email me immediately. Also, if something occurs during your allotted time or some other special circumstance arises, please email me immediately.

Chapter 9: I can use and interpret multivariable and vector functions.

☐ F.1 I can identify, evaluate and interpret functions of two variables using formulas, tables, graphs, and contour maps.

☐ F.2 I can compute dot products of vectors as well as use dot products to find lengths, angles, and projections. I can compute cross products of vectors and interpret them geometrically.

☐ F.3 I can find equations of lines and planes in space in various forms. I can determine the intersections, angles between, and distance between lines and planes.

☐ F.4 I can draw curves in space and define vector-valued functions for space curves.

☐ F.5 I can evaluate and interpret derivatives and integrals of vector-valued functions.

☐ F.6 ** I can find arc length and curvature of space curves.

F.1 (a) For the surface defined by $z = x^2 - y^2$

i. sketch the contour plot, including at least five labeled level curves.

ii. sketch the surface in 3D on a labeled xyz-axes.

(b) For the surface defined by $z = 2 + x^2 + y$

i. sketch the contour plot, including at least five labeled level curves.

ii. sketch the surface in 3D on a labeled xyz-axes.

F.2 Consider the vectors $\mathbf{u} = \langle 2, 0, -2\rangle$ and $\mathbf{v} = \langle 3, 1, 1\rangle$.

(a) What is the angle between $\mathbf{u}$ and $\mathbf{v}$?

(b) What is the area of the parallelogram determined by $\mathbf{u}$ and $\mathbf{v}$?

(c) Compute the projection of $\mathbf{u}$ onto $\mathbf{v}$.

F.3 (a) Consider the plane given by $3x - 2y + z = 3$. Write the parametric equation for a line that is contained in this plane.

(b) Write an equation for the plane that is orthogonal to the line you found in part (a).

(c) Write the parametric for the line that is the intersection of the planes from parts (a) and (b).

F.4 (a) On an xy-axis sketch the graph of the parametric equation

$$\mathbf{r}(t) = \langle t\cos(-t), t\sin(-t)\rangle$$

(b) In a complete English sentence describe the path in space given by

$$\mathbf{r}(t) = \langle \cos(t), \sin(t), \sin(10\pi t)\rangle$$

F.5 During a complicated Yo-Yo, trick the velocity vector of a Yo-Yo at time t is given by

$$v(t) = \langle 2\cos(t)\sin(t), \cos(t)\rangle.$$

(a) If the Yo-Yo is at position $(0, 0, 0)$ at time $t = 0$, where is the Yo-Yo at time $t = \pi$?

(b) Find a time when the acceleration on the Yo-Yo is entirely in the direction $\langle 1, 0\langle$.

F.6 Find the length of the portion of the curve

$$\mathbf{r}(t) = \langle(\ln(\cos(t)), \cos(t), \sin(t)\rangle$$

for $\frac{\pi}{6} \leq t \leq \frac{\pi/3}{}$.