Reading Assignment # 9

Math 13 - Prof. Orellana

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Read Sections 3.3, 3.4 and 5.1

1. Suppose that $c(t)$ is a flow line of a vector field $\mathbf{F}$, what is the relationship between the arrows representing the vector field and the path $c(t)$? Here I want a geometrical explanation, do not give me the defining equation in page 211.

2. Read example 4 and 5 and tell me in general, how I would find the flow lines of a vector field. Find the flow lines of the vector field $\mathbf{F} = 2\mathbf{i} - 5\mathbf{j} + 3\mathbf{k}$.

3. What three operations can be defined using the "del operator"?

4. What type of function do we get when we take the divergence of a vector field?

5. Read the last paragraph on page 215 and tell me what does it mean if the divergence is 0 at a point. How do we call a vector field that has zero divergence at every point?

6. If you compute the curl of a vector field and you do not get the zero vector, what can you conclude from Theorem 4.3? Can you conclude anything if you get the zero vector based on the statement of the theorem?

7. Read Theorem 4.4, suppose that you compute the divergence of a vector field $\mathbf{G}$ and you get 0. Explain why you cannot conclude that $\mathbf{G} = \text{curl } \mathbf{F}$ for some vector field $\mathbf{F}$.

8. Is it true that $\nabla \times (\nabla f) = \mathbf{0}$ for all functions $f : \mathbb{R}^3 \to \mathbb{R}$? Why or why not?

9. What is the objective of section 5.1?

10. Explain why the volume of a function can be computed using an iterated integral.