

## Line Integrals of Vector Fields

In lecture, Professor Auroux discussed the non-conservative vector field

$$\mathbf{F} = \langle -y, x \rangle.$$

For this field:

1. Compute the line integral along the path that goes from  $(0,0)$  to  $(1,1)$  by first going along the  $x$ -axis to  $(1,0)$  and then going up one unit to  $(1,1)$ .
2. Compute the line integral along the path from  $(0,0)$  to  $(1,1)$  that first goes up the  $y$ -axis to  $(0,1)$ .
3. Should you expect your answers to the preceding problems to be the same? Why or why not?
4. Compute the line integral of  $\mathbf{F}$  along a path that runs counterclockwise around the unit circle.
5. Should your answer to the previous problem be 0? Why or why not?

Answer the following questions for the field

$$\mathbf{F} = \langle 0, x \rangle.$$

6. Compute the line integral along the path that goes from  $(0,0)$  to  $(1,1)$  by first going along the  $x$ -axis to  $(1,0)$  and then going up one unit to  $(1,1)$ .
7. Compute the line integral along the path from  $(0,0)$  to  $(1,1)$  which first goes up the  $y$ -axis to  $(0,1)$ .
8. Compute the line integral of  $\mathbf{F}$  along the line segment from  $(0,0)$  to  $(1,1)$ .
9. Is the vector field  $\mathbf{F} = \langle 0, x \rangle$  conservative? How do you know?

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