

Math 1200 Lecture 14

Oct 20 2026

Topics: 16.2: Vector line integrals, work Name:_____

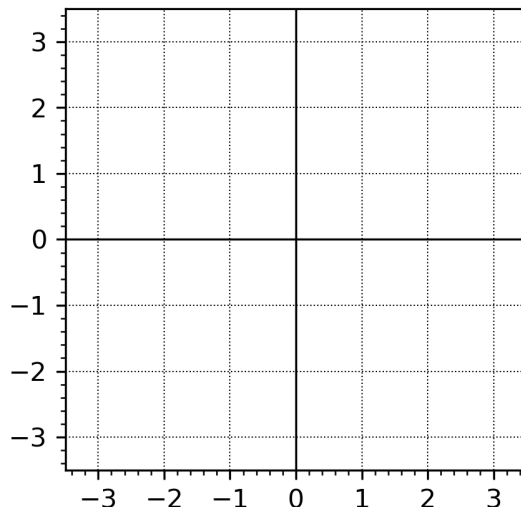
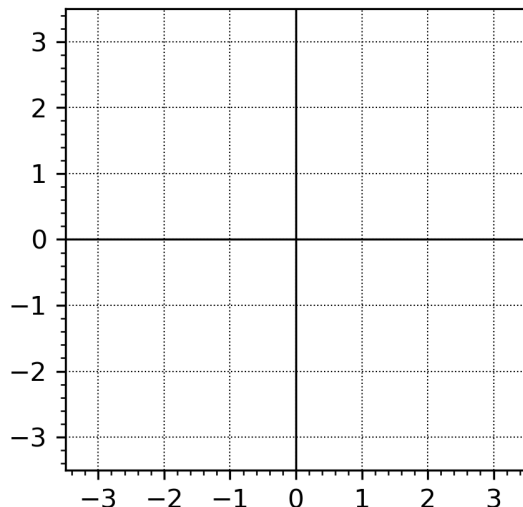
Collaborators:_____

Group work 1 Evaluate the following vector line integrals

a) Evaluate $\int_C \vec{F} \cdot d\vec{r}$ for $\vec{F}(x, y, z) = x^2 y \hat{i} - z \hat{j} + xz \hat{k}$ and C parametrized by $\vec{r}(t) = \langle 2t, t^2, -t \rangle$ for $0 \leq t \leq 1$.

b) Calculate the work W done by the force field $\vec{F}(x, y, z) = \langle x, y, z \rangle$ on a particle traveling along C the directed line segment with unit speed from $(0, 1, 1)$ to $(1, 3, 3)$.

Group work 2 Draw the vector fields $\vec{F}(x, y) = \langle x, y \rangle$ and $\vec{F}(x, y) = \langle -y, x \rangle$. For each, draw directed curves C_+, C_-, C_0 along which $\int_C \vec{F} \cdot d\vec{r}$ is *positive, negative, and zero*.



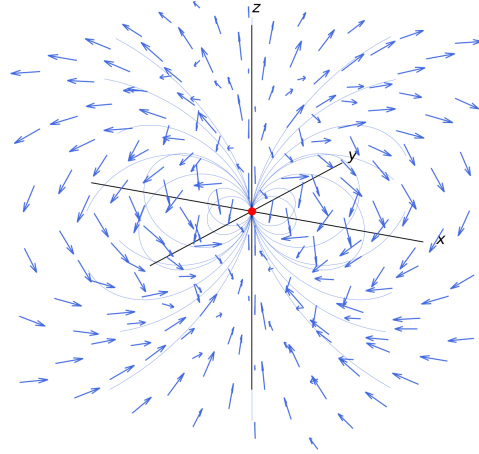
Group work 3 (Discussion) Let C be a parametrized curve and $-C$ the same curve with opposite parametrization. How are $\int_{-C} \vec{F} \cdot d\vec{r}$ and $\int_C \vec{F} \cdot d\vec{r}$ related?

Group work 4 Without doing any calculations, evaluate $\int_C \vec{F} \cdot d\vec{r}$ where $\vec{F} = \hat{j}$ and C is the unit circle parametrized counterclockwise, traversed exactly once.

Group work 5 (Challenge problem) One example of a vector field is the *magnetic field* $B(x, y, z)$ generated, for example, by the earth. As an approximation in some units,

$$B(x, y, z) = \left\langle \frac{xz}{r^5}, \frac{yz}{r^5}, \frac{z^2 - r^2}{r^5} \right\rangle$$

where $r = \sqrt{x^2 + y^2 + z^2}$ is plotted here:



- a) The *Lorentz force law* says that the force exerted by the magnetic field on a charged particle travelling with velocity $\vec{v}(t)$ is

$$\vec{F} = \vec{B} \times \vec{v}.$$

What angle does $\vec{F}$ make with $\vec{v}$?

- b) For a charged interplanetary particle traveling on a curve C between $(1, 0, 0)$ and $(0, 0, 1)$, **what is the work done by the magnetic field?** Hint: you shouldn't have to calculate anything