

## Divergence theorem

- $\nabla$ (nabla) operator
  - How to define divergence?
  - What are the properties of  $\nabla$  operators?

## Divergence theorem

- What is a divergence of a vector field?
- What is a divergence theorem?
- What is a meaning of divergence of a vector field?

## Homework

- Reading assignment
  - Chapter §3.4 – §4.3.
- Writing assignment (due **Nov. 2nd, 11:59pm**)
 

Let  $\mathbf{F}(x, y, z) = (P(x, y, z), Q(x, y, z), R(x, y, z))$ ,  $\mathbf{G} = (U(x, y, z), V(x, y, z), W(x, y, z))$  are vector fields on  $\mathbf{R}^3$ .

  1. Write the following formula explicitly in terms of  $P, Q, R, U, V, W$ .
    - (a)  $\nabla \cdot (F + G)$
    - (b)  $\nabla \times (F + G)$
    - (c)  $\nabla \cdot (F \times G)$
    - (d)  $\nabla \times (F \cdot G)$
  2. Let  $f : \mathbf{R}^3 \rightarrow \mathbf{R}$  be a differentiable function. Prove the following identity.
    - (a)  $\nabla \cdot (f\mathbf{F}) = f\nabla \cdot \mathbf{F} + \nabla f \cdot \mathbf{F}$
    - (b)  $\nabla \times (f\mathbf{F}) = f\nabla \times \mathbf{F} + \nabla f \times \mathbf{F}$
  3. Explain the meaning of the following statement.
    - (a) A surface is closed.
    - (b) A surface is oriented.
  4. Explain the divergence theorem explicitly. (No need to prove.)