

Assignment no. 2

20 March 2020 – 5 April 2020

1. **1pt** Compute the surface area of a surface $\mathcal{T} := \mathcal{S} \cap \mathcal{P}_1 \cap \mathcal{P}_2 \cap \mathcal{P}_3$, where

$$\begin{aligned}\mathcal{S} &:= \{(x, y, z)^\top \in \mathbb{R}^3 \mid x^2 + (y + 1)^2 + (z - 1)^2 - 9 = 0\}, \\ \mathcal{P}_1 &:= \{(x, y, z)^\top \in \mathbb{R}^3 \mid z \geq 2\}, \\ \mathcal{P}_2 &:= \{(x, y, z)^\top \in \mathbb{R}^3 \mid z \leq 3\}, \\ \mathcal{P}_3 &:= \{(x, y, z)^\top \in \mathbb{R}^3 \mid y \geq -1\}.\end{aligned}$$

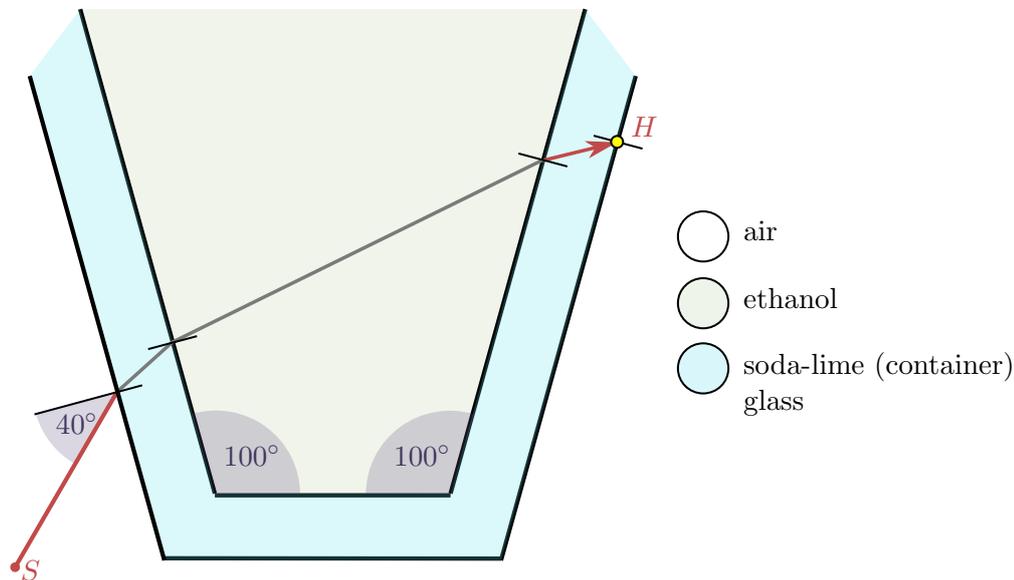
2. **1.5pts** Consider a scene with a sun which shines on a saddle-shaped terrain. The sun is represented by a point light source given by $L = (7, 1, 3)^\top$ and the terrain is given as the set of all points $(x, y, z)^\top \in \mathbb{R}^3$ such that

$$x^2 - \frac{y^2}{4} + z = 0.$$

Find all points on the terrain with maximal possible light intensity if the terrain is shaded using the Lambertian reflectance.

The assignment continues on the second page!

3. **1.5pts** Consider an infinite glass (i. e. a glass with a bottom but no finish) made of soda-lime glass, which is filled with alcohol (ethanol) and placed in the air. Now consider a ray starting in a point S which travels through the scene until it strikes the surface at the point H , as seen in the figure.



Compute the angle of reflection at the point H . Also, decide if the ray at the point H is refracting. If it is, compute the angle of refraction or provide an argument otherwise.

All the additional info is given in the figure. The measures in the figure are wrong on purpose. Use online sources to find the most precise values of the suitable properties of materials.

Instructions on the assignment

To obtain maximum points, include all your computations, comment them richly and illustrate them with pictures, where necessary.

To get the correct answers you may need to use the calculator or the computational software. Round the numbers to **three** decimal places throughout your computations.

Your solution is submitted by the form on the website. You may submit it as a set of photographs of sufficient resolution and sharpness (it needs to be easy to read), or you may write your solutions in LaTeX.