

Box # _____

Math 60

HW 12

Due June 2, 2016

Problems: 7.2.{6, 14, 22, 28}, 7.3.{4, 6}, T/F(pg.522){6, 10, 18}

Problem 7.2.6

Find $\iint_S (x^2 + y^2) \, ds$, where S is the lateral surface of the cylinder of radius a and height h whose axis is the z -axis.

Problem 7.2.14

In Exercises 10-18, let S denote the closed cylinder with bottom given by $z = 0$, top given by $z = 4$, and lateral surface given by the equation $x^2 + y^2 = 9$. Orient S with outward normals. Determine

$$\iint_S [x, \ y] \cdot d\mathbf{s}$$

Problem 7.2.22

In Exercises 19-22, find the flux of the given vector field \mathbf{F} across the upper hemisphere $x^2 + y^2 + z^2 = a^2, z \geq 0$. Orient the hemisphere with an upward-pointing normal.

$$\mathbf{F} = [x^2, \ xy, \ xz]$$

Problem 7.2.28

The glass dome of a futuristic greenhouse is shaped like the surface $z = 8 - 2x^2 - 2y^2$. The greenhouse has a flat dirt floor at $z = 0$. Suppose that the temperature T , at points in and around the greenhouse, varies as

$$T(x, y, z) = x^2 + y^2 + 3(z - 2)^2.$$

Then the temperature gives rise to a **heat flux density field** \mathbf{H} given by $\mathbf{H} = -k\nabla T$. (Here k is a positive constant that depends on the insulating properties of the particular medium.) Find the total heat flux outward across the dome and the surface of the ground if $k = 1$ on the glass and $k = 3$ on the ground.

Problem 7.3.4

Verify Stokes's theorem for the surface and vector field

S is defined by $x^2 + y^2 + z^2 = 4$, $z \leq 0$, oriented by downwards normal;

$$\mathbf{F} = [2y - z, \quad x + y^2 - z, \quad 4y - 3x]$$

Problem 7.3.6

In Exercises 6-9, verify Gauss's theorem for the given three-dimensional region D and vector field \mathbf{F} .

$$\mathbf{F} = [x, \ y, \ z],$$

$$D = \{(x, y, z) \mid 0 \leq z \leq (9 - x^2 - y^2)\}$$

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- 6. If S is the unit sphere centered at the origin, then $\iint_S x^3 \, dS = 0$.
- 10. $\iint_S [-y, \ x] \cdot \mathbf{ds} = 0$, where S is the cylinder $x^2 + y^2 = 9$, $0 \leq z \leq 5$.
- 18. $\iint_S \nabla \times \mathbf{F} \cdot \mathbf{ds}$ has the same value for all piecewise smooth, oriented surfaces S that have the same boundary curve C . *Hint:* think about what the field is doing.