Surface Area

Definition of Surface Area

If f and its first partial derivatives are continuous on the closed region R in the xy-plane, then the area of the surface S given by z = f(x, y) over R is defined as:

$$\text{Surface area} = \iint_R \sqrt{1 + [f_x(x, y)]^2 + [f_y(x, y)]^2}\, dA$$

1. Find the area of the surface given by z = f(x, y) over the region R (Hint: Some of the integrals are simpler in polar coordinates) (Similar to p.1025 #1-14)

$$f(x, y) = 3x + 3y$$

$$\text{R : triangle with vertices } (0,0), (7,0), (0,3)$$

2. Find the area of the surface given by z = f(x, y) over the region R (Hint: Some of the integrals are simpler in polar coordinates) (Similar to p.1025 #1-14)

$$f(x, y) = 3x + 4y + 5$$

$$\text{R} = \{(\text{x}, \text{y}) : \text{x}^2 + y^2 \le 9\}$$

3. Find the area of the surface given by z = f(x, y) over the region R (Hint: Some of the integrals are simpler in polar coordinates) (Similar to p.1025 #1-14)

$$f(x, y) = 4 - x^2$$

$$\text{R : rectangle with vertices } (0,0), (0,2), (5,0), (5,2)$$

4. Find the area of the surface given by z = f(x, y) over the region R (Hint: Some of the integrals are simpler in polar coordinates) (Similar to p.1025 #1-14)

$$f(x, y) = \sqrt{x^2 + y^2}$$

$$\text{R} = \{(\text{x}, \text{y}) : 0 \le \text{f}(\text{x}, \text{y}) \le 4\}$$

5. Find the area of the surface
(Similar to p.1025 #15-18)

The portion of the plane $z = 10 - 5x - 2y$
in the first octant

Hint : For the region R, let z equal 0 and find your x and y intercepts, then find the equation of the line

6. Set up a double integral that gives the area of the surface on the graph of f over the region R
(Similar to p.1025 #29-34)

$f(x, y) = 4x^2 - 5xy + y^5$

R : Rectangle with vertices

$(-3, -5), (-3, 7), (4, -5), (4, 7)$