When you are done with your homework you should be able to…

- π Use a double integral to find the area of a surface

Warm-up: Find the area of the parallelogram with vertices $A=(2,-3,1)$, $B=(6,5,-1)$, $C=(3,-6,4)$ and $D=(7,2,2)$. Hint: Section 11.4

DEFINITION: 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 given by

$$\text{Surface Area} = \int_R\int dS$$

$$= \int_R\int \sqrt{1+\left[f_x(x,y)\right]^2+\left[f_y(x,y)\right]^2}\,dA$$

Example 1: Find the area of the surface given by $z = f(x, y)$ over the region R.

$$f(x, y) = 15 + 2x - 3y$$

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

Example 2: Find the area of the surface given by $z = f(x, y)$ over the region R.

$$f(x, y) = xy$$

$$R = \{(x, y) \mid x^2 + y^2 \le 16\}$$

Example 3: Find the area of the surface.

The portion of the cone $z = 2\sqrt{x^2 + y^2}$ inside the cylinder $x^2 + y^2 = 4$.

Example 4: Set up a double integral that gives the area of the surface on the graph of $f(x, y) = e^{-x} \sin y,\ R = \{(x, y) \mid 0 \le x \le 4,\ 0 \le y \le x\}$.