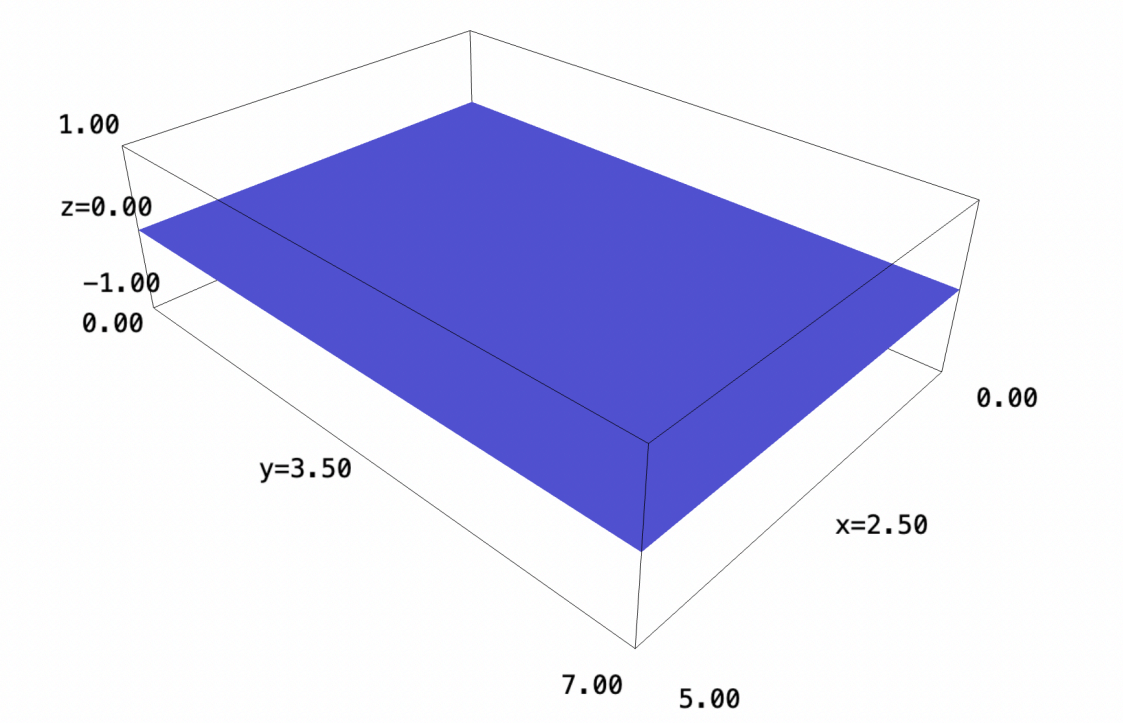
1 | **Rectangle**

```
f(x) = 0
plot3d(f, (x,0,5), (y,0,7))
```



$$dA = \sqrt{1} = 1 \tag{1}$$

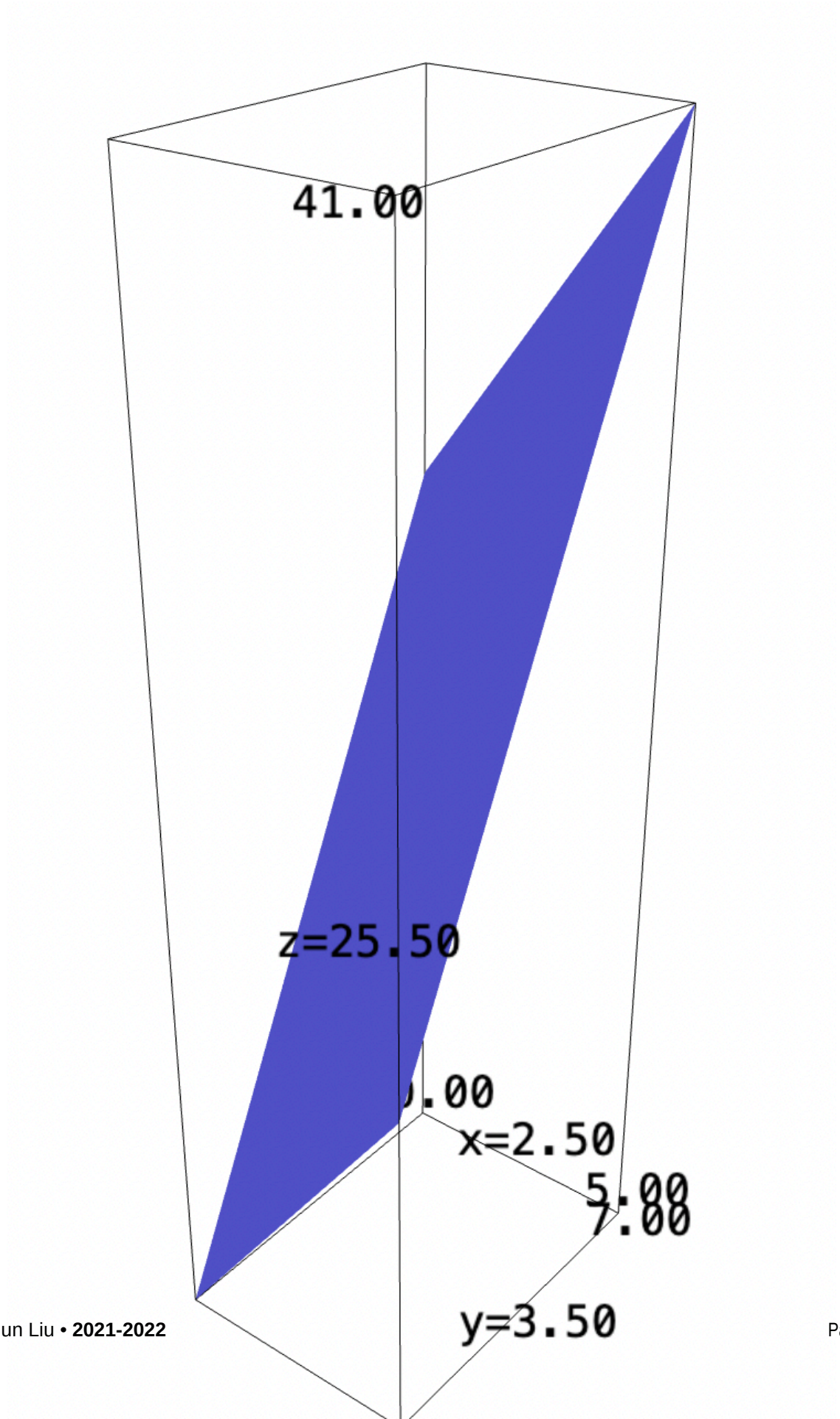
$$\iint_V 1 dV \tag{2}$$

$$\Rightarrow \int_0^5 \int_0^7 1 dy\, dx \tag{3}$$

$$\Rightarrow 35 \tag{4}$$

2 | **Area of a Plane**

```
f(x,y) = 2*x+3*y+10
plot3d(f, (x,0,5), (y,0,7))
```


41.00
z=25.50
.00
x=2.50
5.00
7.00
y=3.50

$$dA = \sqrt{1 + \left(\frac{\partial f}{\partial x}\right)^2 + \left(\frac{\partial f}{\partial y}\right)^2}\, dV \tag{5}$$

$$= \sqrt{1 + 2^2 + 3^2} dV \tag{6}$$

$$= \sqrt{1 + 4 + 9} dV \tag{7}$$

$$= \sqrt{14} dV \tag{8}$$

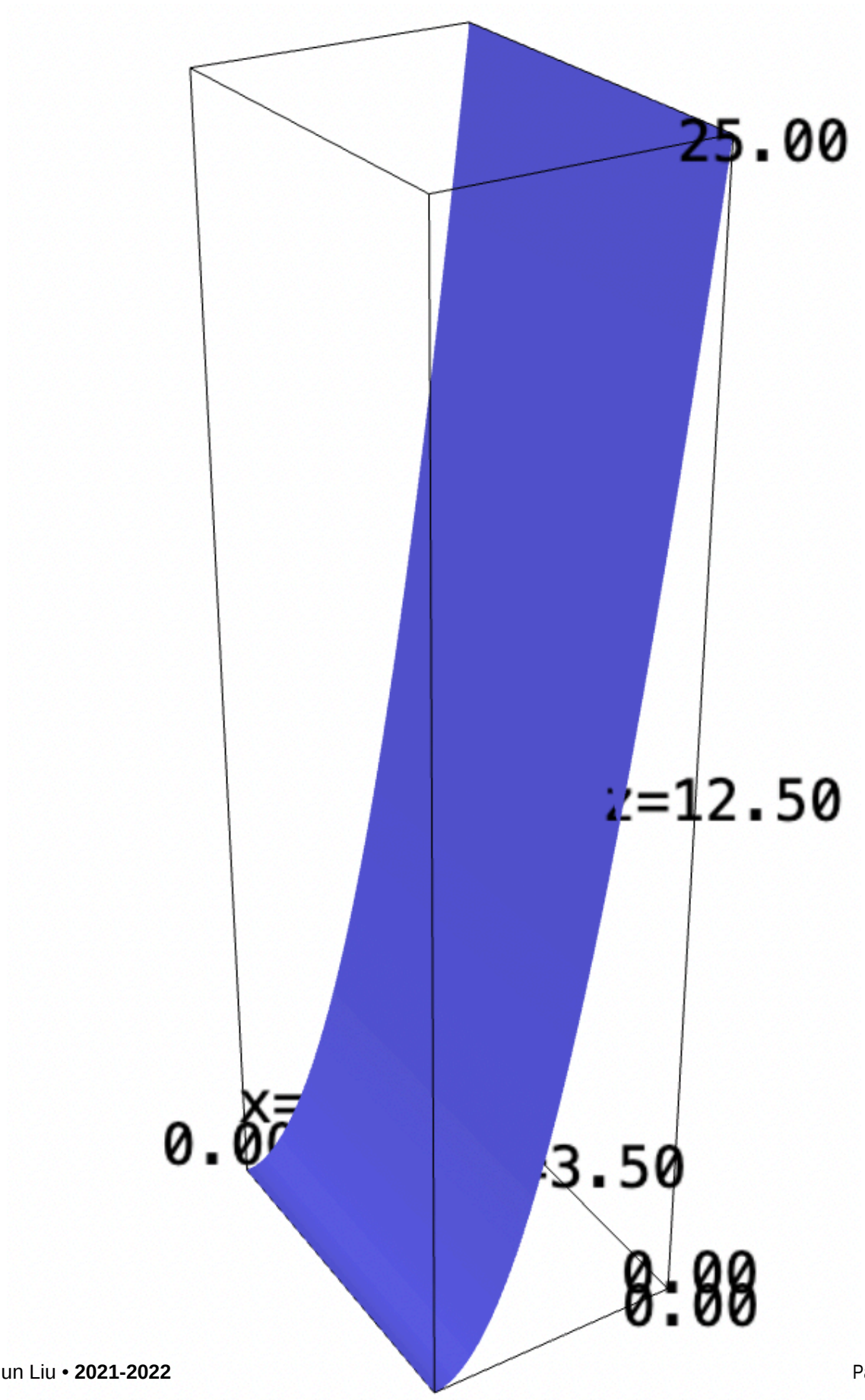
$$\iint_V \sqrt{14} dV \tag{9}$$

$$\Rightarrow \int_0^5 \int_0^7 \sqrt{14} dy\, dx \tag{10}$$

$$\Rightarrow 35\sqrt{14} \tag{11}$$

3 | **Parabola**

```
f(x,y) = x^2
plot3d(f, (x,0,5), (y,0,7))
```


25.00
z=12.50
0.00
0.00

$$dA = \sqrt{1 + \left(\frac{\partial f}{\partial x}\right)^2 + \left(\frac{\partial f}{\partial y}\right)^2}\, dV \tag{12}$$

$$= \sqrt{1 + (2x)^2} dV \tag{13}$$

$$= \sqrt{1 + 4x^2} dV \tag{14}$$

$$\iint_V \sqrt{1 + 4x^2} dV \tag{15}$$

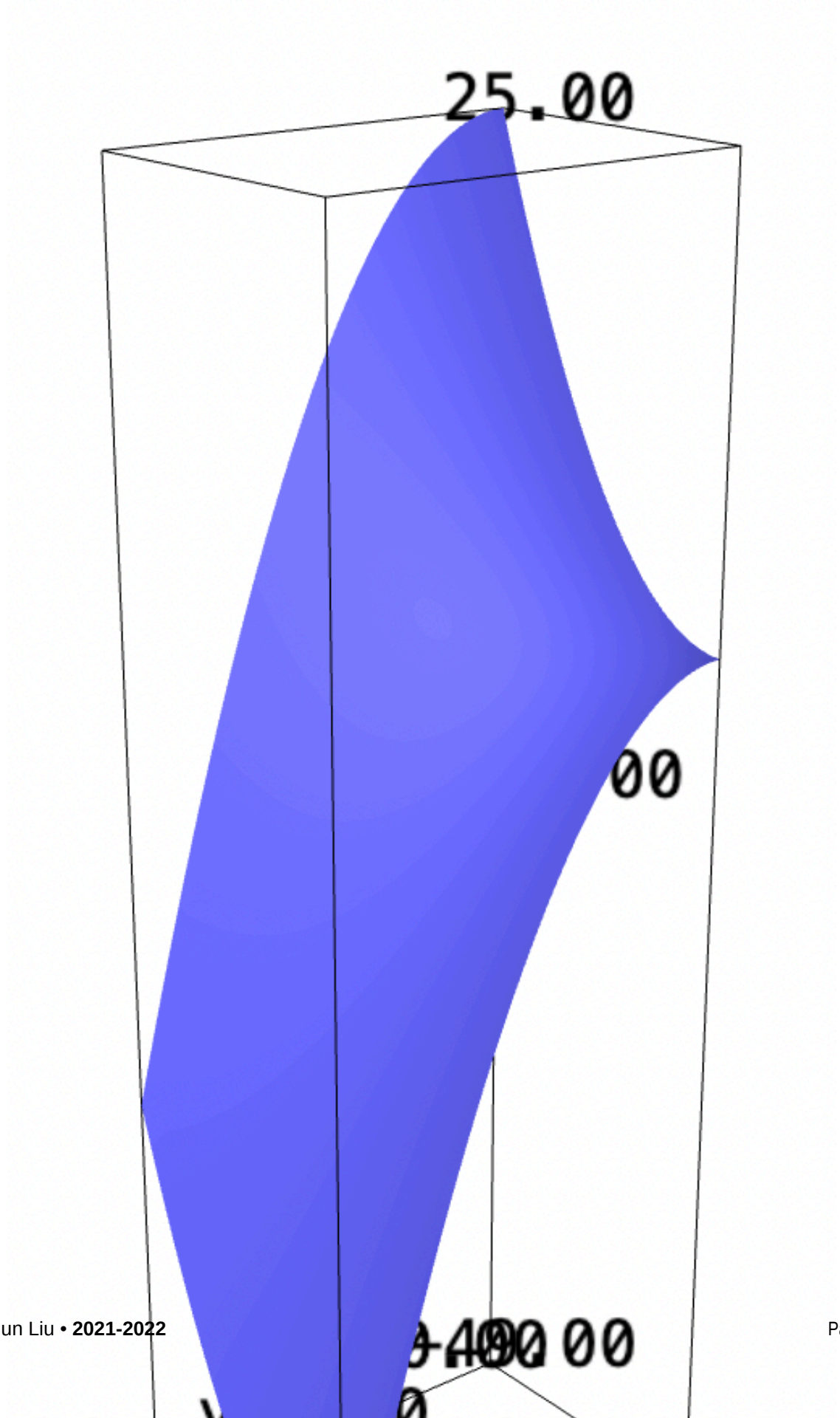
$$\Rightarrow \int_0^5 \int_0^7 \sqrt{1 + 4x^2}\; dy\; dx \tag{16}$$

$$\Rightarrow \frac{35}{2}\sqrt{101} + \frac{7}{4} arcsinh(10) \tag{17}$$

```
f(x,y) = sqrt(1+4*x^2)
f.integrate(y, 0,7).integrate(x, 0,5)
```

4 | **Hyperbolic Parabaloid**

```
f(x,y) = x^2-y^2
plot3d(f, (x,0,5), (y,0,7))
```


25.00
00
00 00

$$\vec{v}(x,y) = x\hat{i} + y\hat{j} + (x^2 - y^2)\hat{k} \tag{18}$$

$$\frac{\partial \vec{v}}{\partial x} = \hat{i} + 2x\hat{k} \tag{19}$$

$$\frac{\partial \vec{v}}{\partial y} = \hat{j} - 2y\hat{k} \tag{20}$$