```
> restart : with(VectorCalculus) : with(LinearAlgebra) :
      SetCoordinates(cylindrical[rho, theta, z]) :
> v1 := VectorField([diff(a·sin(theta)·cos(phi), theta), diff(a·sin(theta)
     ·sin(phi), theta), diff(a·cos(theta), theta)]) :
> v2 := VectorField([diff(a·sin(theta)·cos(phi), phi), diff(a·sin(theta)·sin(phi),
      phi), diff(a·cos(theta), phi)]) :
> cross := CrossProduct(v1, v2)
```

$$cross := \begin{bmatrix} a^2 \sin(\theta)^2 \cos(\phi) \\ a^2 \sin(\theta)^2 \sin(\phi) \\ a^2 \cos(\theta) \cos(\phi)^2 \sin(\theta) + a^2 \cos(\theta) \sin(\phi)^2 \sin(\theta) \end{bmatrix} \quad (1)$$

```
> dS := simplify(sqrt(cross[1]^2 + cross[2]^2 + cross[3]^2)) ;
```

$$dS := \sqrt{\sin(\theta)^2 a^4} \quad (2)$$

```
> M := int(int(k·a·cos(theta)·a^2·sin(theta), theta = 0..Pi/2), phi = 0..2·Pi)
```

$$M := k\, a^3 \pi \quad (3)$$

```
> Mz := 1/M ·int(int(a·cos(theta)·k(a·cos(theta))·a^2·sin(theta), theta = 0..Pi/2),
      phi = 0..2·Pi)
```

$$Mz := \frac{2\left(\int_0^{\frac{\pi}{2}} a^3 \cos(\theta)\, k(a\cos(\theta))\, \sin(\theta)\, d\theta\right)}{k\, a^3} \quad (4)$$

```
> Mz := a/Pi ·int(1, phi = 0..2·Pi)·int(cos^2(theta)·sin(theta), theta = 0..Pi/2)
```

$$Mz := \frac{2\,a}{3} \quad (5)$$

```
>
```