Example: Exercise 17, Section 16.9

```
> #Define the vector field:
> with(VectorCalculus): with(Student[VectorCalculus]): with
  (plots):
> F:=VectorField(<x*z^2, (1/2)*y^3+tan(z), x^2*z+y^2>);
```

$$F := (x z^2)\,\bar{e}_x + \left(\frac{1}{2} y^3 + \tan(z)\right)\bar{e}_y + (x^2 z + y^2)\,\bar{e}_z \qquad (1)$$

```
> #Define the surface:
> S:=<sin(v)*sin(u),sin(v)*cos(u), cos(v)>;  # u is between 0 and
  2pi, v is 0 to Pi/2
```

$$S := (\sin(v)\sin(u))\,e_x + (\sin(v)\cos(u))\,e_y + (\cos(v))\,e_z \qquad (2)$$

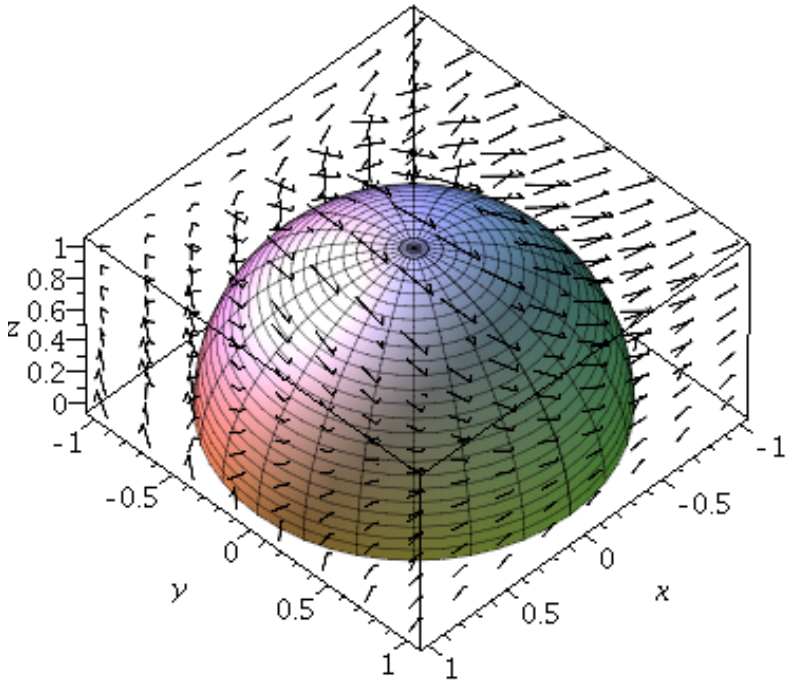
```
> A:=fieldplot3d(F,x=-1..1,y=-1..1,z=0..1,color=black,
  fieldstrength=fixed);
```

$$A := PLOT3D(\ldots) \qquad (3)$$

```
> B:=plot3d(S,u=0..2*Pi,v=0..Pi/2);
```

$$B := PLOT3D(\ldots) \qquad (4)$$

```
> display3d(A,B,scaling=constrained);
```




```
> #Compute the divergence (we're converting to spherical
  coordinates as well):
```

```
> dF:=Divergence(F);
```

$$dF := z^2 + \frac{3}{2}\, y^2 + x^2 \tag{5}$$

```
> dG:=subs({x=r*sin(v)*cos(u),y=r*sin(v)*sin(u),z=r*cos(v)},dF);
```

$$dG := r^2 \cos(v)^2 + \frac{3}{2}\, r^2 \sin(v)^2 \sin(u)^2 + r^2 \sin(v)^2 \cos(u)^2 \tag{6}$$

```
> int(int(int(dG*r^2*sin(v),r=0..1),u=0..2*Pi),v=0..Pi/2);
```

$$\frac{7}{15}\,\pi \tag{7}$$