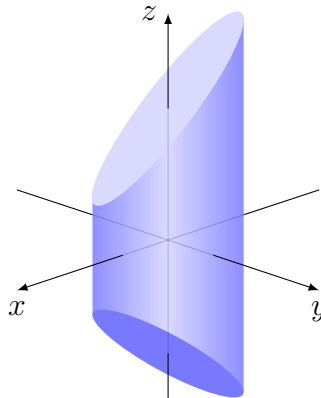


1. 10 pts. Find the volume of the wedge of the cylinder  $x^2 + 4y^2 = 16$  created by the planes  $z = 5 - x$  and  $z = x - 5$ .



2. 10 pts. Evaluate the triple integral

$$\int_1^6 \int_0^{4-2y/3} \int_0^{12-2y-3z} \frac{1}{y} dx dz dy$$

3. 15 pts. Find the volume of the region  $D$  bounded by the paraboloid  $z = x^2 + y^2$  and the plane  $z = 36$ .

4. 10 pts. Evaluate the integral in spherical coordinates:

$$\iiint_D e^{-(x^2+y^2+z^2)^{3/2}} dV,$$

where  $D$  is the unit ball.

5. 5 pts. Specify the component functions of a vector field  $\mathbf{F}$  in  $\mathbb{R}^2$  that is everywhere normal to the line  $y = 3x$ .

6. Let  $C$  be the curve  $y = x^2$  for  $0 \leq x \leq 8$ .

(a) 5 pts. Find a parametric description for  $C$  in the form  $\mathbf{r}(t) = \langle x(t), y(t) \rangle$ .

(b) 10 pts. Evaluate the line integral

$$\int_C (xy)^{1/3} ds.$$

7. 10 pts. Evaluate the integral  $\int_C \mathbf{F} \cdot d\mathbf{r}$ , where  $\mathbf{F}(x, y) = \langle -y, x \rangle$ , and the curve  $C$  is the semicircle  $\mathbf{r}(t) = \langle 4 \cos t, 4 \sin t \rangle$  for  $0 \leq t \leq \pi$ .

8. 10 pts. Show that the vector field  $\mathbf{F}(x, y, z) = \langle 2xy^3z^4, 3x^2y^2z^4, 4x^2y^3z^3 \rangle$  is conservative on  $\mathbb{R}^3$ , and then determine a potential function.

9. 10 pts. Evaluate

$$\int_C \nabla(e^{-x} \cos y) \cdot d\mathbf{r},$$

where  $C$  is the line segment from  $(0, 0)$  to  $(\ln 2, 2\pi)$ .