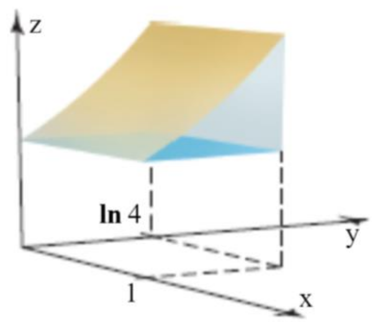
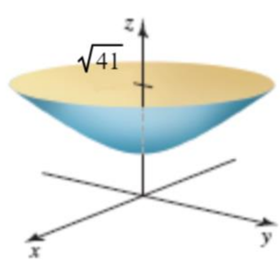
1. Write an iterated integral for $\iiint_D f(x,y,z)\,dV$ where D is a sphere of radius 9 centered at $(0,0,0)$ using the order $dzdxdy$.
2. Evaluate the integral $\int_{-1}^{3}\int_{2}^{5}\int_{1}^{e}\frac{x^2y^2}{z}dzdxdy$.
3. Set up and then use a triple integral to find the volume of the solid bounded by the surfaces $z=2e^y$ and $z=2$ over the rectangle $\{(x,y)|0\le x\le 1, 0\le y\le \ln 4\}$.



4. Evaluate the integral $\int_0^1\int_0^3\int_{4y}^{12}\frac{4\cos(x^2)}{5\sqrt{z}}dxdydz$ by rewriting the order of integration inn an appropriate way.
5. Evaluate the following integral in cylindrical coordinates $\int_0^2\int_0^{\frac{3\sqrt{2}}{2}}\int_x^{\sqrt{9-x^2}}e^{-x^2-y^2}dydxdz$.
6. Use cylindrical coordinates to find the volume of the region bounded by the plane $z=\sqrt{41}$ and the hyperboloid $z=\sqrt{25+x^2+y^2}$.

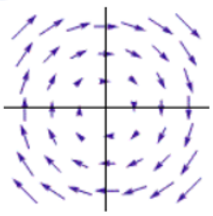


7. Find the mass of the ball of radius 2 centered at the origin with a density of $f(\rho,\varphi,\theta)=7e^{-\rho^3}$.
8. Find the center of mass of the triangular plate in the first quadrant bounded by $y=x$, $x=0$, and $y=2-x$ with $\rho(x,y)=18x+6y+9$.

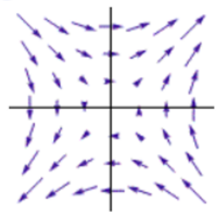
9. Find the center of mass for the interior of the prism formed by $z = x, x = 4, y = 1$ and the coordinate planes with density $\rho(x, y, z) = 3 + y.$

10. Which of the following is a vector field for $\mathrm{F} = \langle 2y, 2x \rangle$?

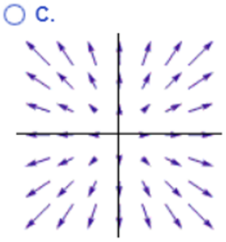
A.



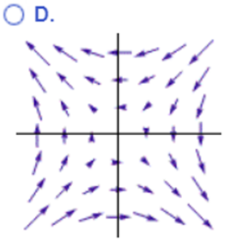
B.



C.



D.



11. Give an example of a component vector field F on $\mathbb{R}^2$ where F is everywhere normal to the line $y = 3.$

12. Find the gradient field $\mathrm{F} = \nabla\varphi$ for the potential function $\varphi(x, y, z) = \ln\left(4x^2 + y^2 + 4z^2\right).$

13. Integrate the line integral $\int_C (y - z)\, ds$ where C is the helix $\langle 8\cos t, 8\sin t, t \rangle$ with $-2\pi \le t \le 0.$

14. Integrate the line integral $\int_C \frac{x}{x^2 + y^2}\, ds$ where C is the line segment from $(1,1)$ to $(33,33).$

15. Consider the vector field $\mathrm{F} = \langle y - x, x \rangle$ and the curve $C : \mathbf{r}(t) = \langle 5\cos t, 5\sin t \rangle$ for $0 \le t \le 2\pi.$ Find the circulation and the flux.

16. Determine if $\mathrm{F} = \langle 2yz, 2xz, 2xy \rangle$ is a conservative vector field on $\mathbb{R}^3$. If so, find the potential function $\varphi(x, y, z)$.

17. Evaluate the line integral $\int_C \nabla\varphi \bullet d\mathbf{r}$ using the Fundamental Theorem for line integrals where

$\varphi(x, y) = xy$ and $C : \mathbf{r}(t) = \langle \sin t, \cos t \rangle$ for $0 \le t \le \frac{\pi}{3}.$

18. Evaluate the line integral $\int_C \nabla\varphi \bullet d\mathbf{r}$ using the Fundamental Theorem for line integrals where

$\varphi(x,y,z)=\dfrac{x^2+y^2+z^2}{2}$ and $C:\mathbf{r}(t)=\left\langle \cos t,\sin t,\dfrac{t}{\pi}\right\rangle$ for $\dfrac{\pi}{6}\le t\le\dfrac{3\pi}{2}$.

19. Evaluate $\oint_C \mathrm{F}\bullet d\mathbf{r}$ for the vector field $\mathrm{F}=\langle -x-z,y+z,y-x\rangle$ and the closed curve

$C:\mathbf{r}(t)=\langle -\sin t,-\sin t,\cos t\rangle$ for $0\le t\le 2\pi.$.

20. Assume C is a circle centered at the origin, oriented counterclockwise, that encloses disk R in the plane. Find both the two-dimensional curl of F and the two-dimensional divergence of F given $\mathrm{F}=\left\langle 6x^6y,8xy^3+8x^7\right\rangle$.

21. Use Green's Theorem circulation form to evaluate $\oint_C \mathrm{F}\bullet d\mathbf{r}$, where $\mathrm{F}=\left\langle 4xy^2,6x^3+y\right\rangle$ and C is oriented counterclockwise and is the boundary of $\{(x,y)|0\le y\le\sin x,\, 0\le x\le\pi\}$.

22. Compute the outward flux of $\mathrm{F}=\langle y\cos x,-\sin x\rangle$ across the boundary of R which is oriented counterclockwise. R is the square $\left\{(x,y)\middle|0\le x\le\dfrac{\pi}{2},0\le y\le\dfrac{\pi}{2}\right\}$.

23. Find div F for the vector field $\mathrm{F}=\left\langle 2x^2yz,-2xy^2z,-2xyz^2\right\rangle$.

24. Compute the curl of $\mathrm{F}=\left\langle 2x^2-y^2,2xy,z\right\rangle$