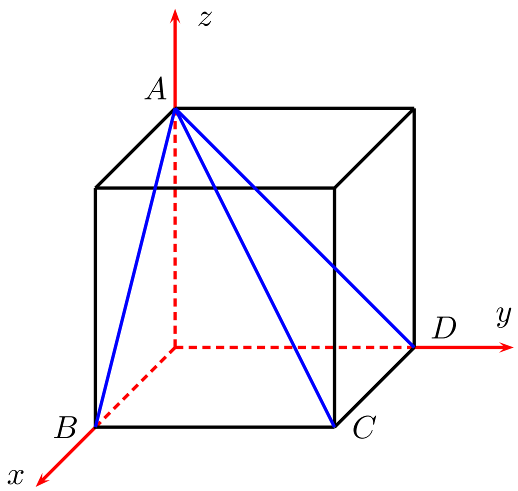
This print-out should have 30 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

CalC13c52a
001 10.0 points

The box shown in



is the unit cube having one corner at the origin and the coordinate planes for three of its adjacent faces.

Determine the projection of $\overrightarrow{AB}$ onto $\overrightarrow{AC}$.

1. projection $= \frac{1}{2}(\mathbf{j} - \mathbf{k})$

2. projection $= -\frac{1}{2}(\mathbf{j} - \mathbf{k})$

3. projection $= \frac{1}{2}(\mathbf{i} - \mathbf{k})$

4. projection $= -\frac{1}{2}(\mathbf{i} - \mathbf{k})$

5. projection $= \frac{2}{3}(\mathbf{i} + \mathbf{j} - \mathbf{k})$

6. projection $= -\frac{2}{3}(\mathbf{i} + \mathbf{j} - \mathbf{k})$

CalC13d04a
002 10.0 points

Which of the following expressions are well-defined for all vectors **a**, **b**, **c**, and **d**?

I $\mathbf{a} \times (\mathbf{b} \times \mathbf{c})$,

II $(\mathbf{a} \times \mathbf{b}) \cdot (\mathbf{c} \times \mathbf{d})$,

III $\mathbf{a} \cdot (\mathbf{b} \times \mathbf{c})$.

1. all of them

2. II and III only

3. III only

4. I and II only

5. I and III only

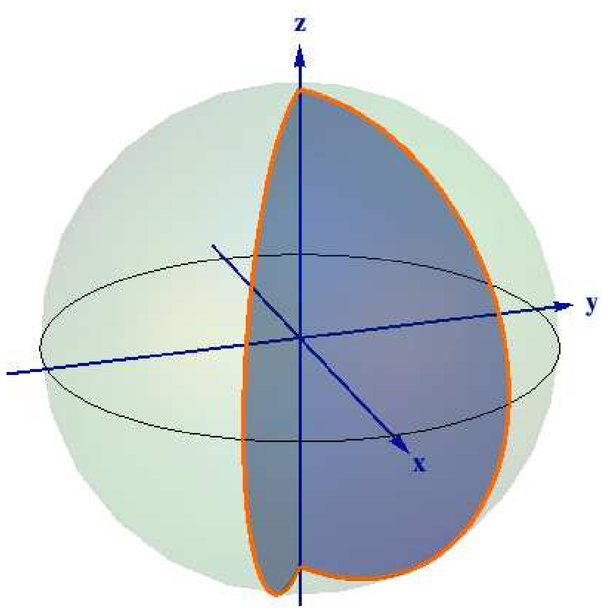
6. none of them

7. I only

8. II only

SphericalCoords05a
003 10.0 points

The spine of the 'math taco' T shown in



lies on the z-axis, while the faces lie in the planes $y = \pm(\tan\alpha)x$ for fixed α .

Use spherical polar coordinates to describe T as a set of points $P(\rho,\, \theta,\, \phi)$ when the taco has radius 4.

1. $T \;=\; \{P(\rho,\, \theta,\, \phi)\}$ with

$$0 \le \rho \le 4, \quad \theta = \pm\alpha, \quad 0 \le \phi \le \pi\,.$$

2. $T \;=\; \{(\rho,\, \theta,\, \phi)\}$ with

$$0 \le \rho \le 8, \quad \theta = \pm\alpha, \quad 0 \le \phi \le \frac{\pi}{2}\,.$$

3. $T \;=\; \{P(\rho,\, \theta,\, \phi)\}$ with

$$0 \le \rho \le 4, \quad 0 \le \theta \le \frac{\pi}{2}, \quad \phi = \pm\alpha\,.$$

4. $T \;=\; \{P(\rho,\, \theta,\, \phi)\}$ with

$$0 \le \rho \le 8, \quad \theta = \pm\alpha, \quad 0 \le \phi \le \pi\,.$$

5. $T \;=\; \{P(\rho,\, \theta,\, \phi)\}$ with

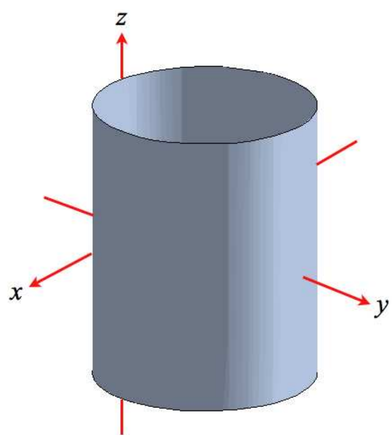
$$0 \le \rho \le 4, \quad 0 \le \theta \le \pi, \quad \phi = \pm\alpha\,.$$

6. $T \;=\; \{P(\rho,\, \theta,\, \phi)\}$ with

$$0 \le \rho \le 8, \quad 0 \le \theta \le \frac{\pi}{2}, \quad \phi = \pm\alpha\,.$$

CalC13f03d
004 10.0 points

Which one of the following equations has graph



when the circular cylinder has radius 2?

1. $y^2 + z^2 + 4y = 0$

2. $y^2 + z^2 - 2z = 0$

3. $x^2 + y^2 - 2y = 0$

4. $y^2 + z^2 - 4z = 0$

5. $y^2 + z^2 + 2y = 0$

6. $x^2 + y^2 - 4y = 0$

CalC15b19s
005 10.0 points

Find $\displaystyle\lim_{(x,y,z)\to(0,0,0)} \frac{xy + 2yz^2 + 3xz^2}{x^2 + y^2 + z^4}$, if it exists.

1. The limit does not exist.

2. 3

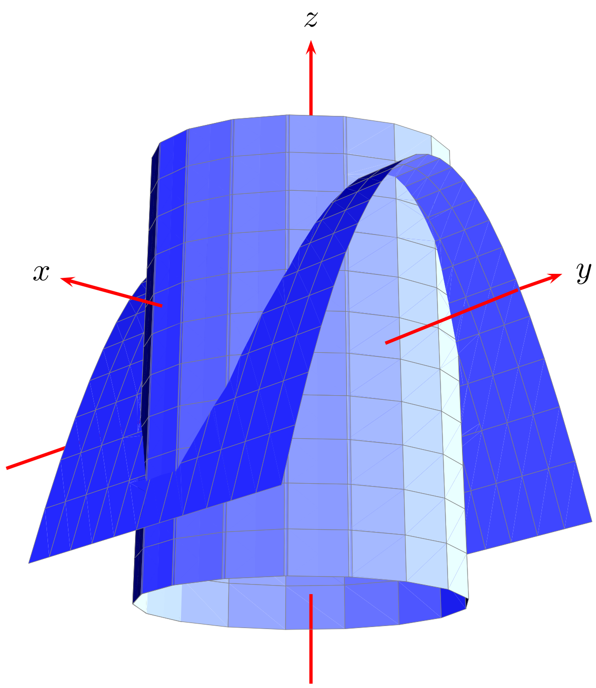
3. 0

4. 5

5. 2

Intersection01a
006 10.0 points

The curve of intersection of the surfaces shown in



is the graph of which of the following vector functions?

1. $\mathbf{r}(t) = \langle \cos t, \sin t, \cos 2t \rangle$

2. $\mathbf{r}(t) = \langle \sin t, \cos t, 1 - \cos 2t \rangle$

3. $\mathbf{r}(t) = \langle \cos t, \sin t, 1 - \cos 2t \rangle$

4. $\mathbf{r}(t) = \langle \cos t, \sin t, \cos 2t - 1 \rangle$

5. $\mathbf{r}(t) = \langle \sin t, \cos t, \cos 2t \rangle$

6. $\mathbf{r}(t) = \langle \sin t, \cos t, \cos 2t - 1 \rangle$

CalC15e21s
007 10.0 points

Use the Chain Rule to find the partial derivative $\dfrac{\partial w}{\partial s}$ for

$$w = x^2 + y^2 + z^2, \; x = st,$$

$$y = s\cos t, \; z = s\sin t$$

when $s = 5$, $t = 0$.

1. $\dfrac{\partial w}{\partial s} = 11$

2. $\dfrac{\partial w}{\partial s} = 6$

3. $\dfrac{\partial w}{\partial s} = 8$

4. $\dfrac{\partial w}{\partial s} = 10$

5. $\dfrac{\partial w}{\partial s} = 13$

CalC15f19s
008 10.0 points

Find the directional derivative, $f_{\mathbf{v}}$, of

$$f(x, y) = 3\left(\frac{y}{x}\right)^{1/2}$$

at $P = (3, 3)$ in the direction of the vector $\overrightarrow{PQ}$ when $Q = (6, 7)$.

1. $f_{\mathbf{v}} = \dfrac{1}{5}$

2. $f_{\mathbf{v}} = \dfrac{2}{15}$

3. $f_{\mathbf{v}} = \dfrac{7}{30}$

4. $f_{\mathbf{v}} = \dfrac{1}{10}$

5. $f_{\mathbf{v}} = \dfrac{1}{6}$

CalC15f39s
009 10.0 points

Find the equation of the tangent plane to the surface

$$4x^2 + 4y^2 + 5z^2 = 45$$

at the point $(3, -1, 1)$.

1. $4x - 4y + 5z = 45$

2. $12x - 4y + 5z = 45$

3. $12x + 4y + 5z = 37$

4. $12x + 4y + 5z = 45$

5. $12x - 4y + 5z = 37$

QuadApprox04a
010 10.0 points

Find the quadratic approximation to

$$f(x,\, y) \;=\; e^{x-2y^2}$$

at $P(0,\, 0)$.

1. $Q(x,\, y) \;=\; 1 - 2x + \dfrac{1}{2}x^2 - 2y^2$

2. $Q(x,\, y) \;=\; 1 + 2x + \dfrac{1}{2}x^2 + 2y^2$

3. $Q(x,\, y) \;=\; 1 + x + \dfrac{1}{2}x^2 + 2y^2$

4. $Q(x,\, y) \;=\; 1 - 2y - 2xy + \dfrac{1}{2}y^2$

5. $Q(x,\, y) \;=\; 1 + x + \dfrac{1}{2}x^2 - 2y^2$

6. $Q(x,\, y) \;=\; 1 - x + \dfrac{1}{2}xy - 2y^2$

CalC15g06a
011 10.0 points

Locate and classify all the local extrema of

$$f(x, y) = 3x^3 + 3y^3 + 9xy - 6.$$

CalC15g28a
012 10.0 points

Find the absolute maximim value of the function

$$f(x, y) = 8 + xy - x - 3y$$

over the closed triangular region $\mathcal{D}$ having vertices

$$P(1, 0), \quad Q(1, 5), \quad R(6, 0).$$

1. abs max value $= 7$

2. abs max value $= 10$

3. abs max value $= 9$

4. abs max value $= 6$

5. abs max value $= 11$

6. abs max value $= 8$

CalC15h06b
013 10.0 points

Use Lagrange Multipliers to determine the maximum value of

$$f(x, y) = 2xy$$

subject to the constraint

$$g(x, y) = \frac{x^2}{9} + \frac{y^2}{1} - 1 = 0 .$$

1. maximum = 4

2. maximum = 6

3. maximum = 3

4. maximum = 7

5. maximum = 5

CalC14d05s
014 10.0 points

Find the velocity of a particle with the given position function

$$\mathbf{r}(t) = 9e^{8t}\mathbf{i} + 8e^{-4t}\mathbf{j}\,.$$

1. $\mathbf{v}(t) = 72e^{t}\mathbf{i} - 32e^{-t}\mathbf{j}$

2. $\mathbf{v}(t) = 72e^{8t}\mathbf{i} + 32e^{-4t}\mathbf{j}$

3. $\mathbf{v}(t) = 72e^{8t}\mathbf{i} - 32e^{-4t}\mathbf{j}$

4. $\mathbf{v}(t) = 17e^{8t}\mathbf{i} - 12e^{-4t}\mathbf{j}$

5. $\mathbf{v}(t) = 9e^{8t}\mathbf{i} - 8e^{-4t}\mathbf{j}$

CalC14c01s
015 10.0 points

When C is parametrized by

$$\mathbf{c}(t) \;=\; (\sin 4t)\,\mathbf{i} + 3t\,\mathbf{j} + (\cos 4t)\,\mathbf{k}\,,$$

find its arc length between $\mathbf{c}(0)$ and $\mathbf{c}(2)$.

1. arc length $= 6$

2. arc length $= 4$

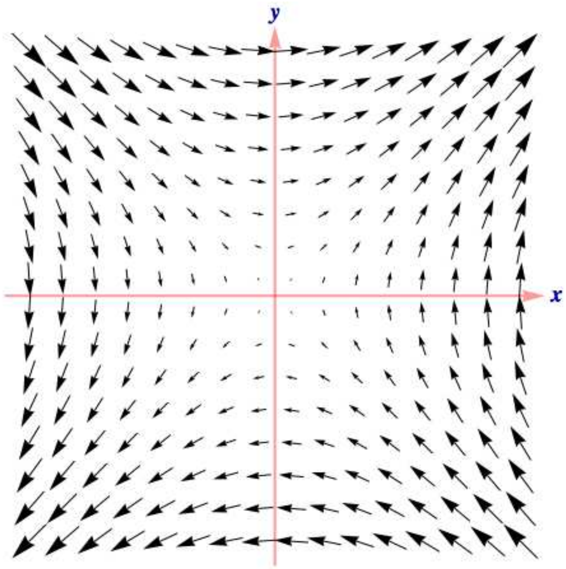
3. arc length $= 10$

4. arc length $= 12$

5. arc length $= 8$

VectorField01e
016 10.0 points

Which vector field $\mathbf{F}$ has graph



1. $\mathbf{F}(x, y) = x\,\mathbf{i} + y\,\mathbf{j}$

2. $\mathbf{F}(x, y = -x\,\mathbf{i} + y\,\mathbf{j}$

3. $\mathbf{F}(x, y = x\,\mathbf{i} - y\,\mathbf{j}$

4. $\mathbf{F}(x, y) = -y\,\mathbf{i} + x\,\mathbf{j}$

5. $\mathbf{F}(x, y = y\,\mathbf{i} - x\,\mathbf{j}$

6. $\mathbf{F}(x, y = y\,\mathbf{i} + x\,\mathbf{j}$

CalC16c16s
017 10.0 points

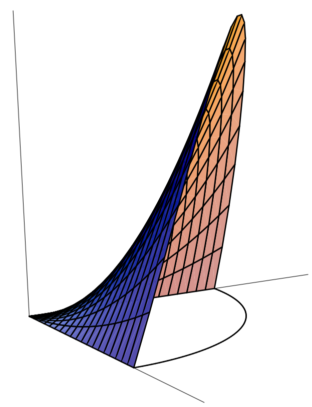
The graph of

$$f(x, y) = xy$$

over the bounded region A in the first quadrant enclosed by

$$y = \sqrt{4 - x^2}$$

and the x, y-axes is the surface



Find the volume of the solid under this graph over the region A.

1. Volume $= \dfrac{1}{2}$ cu. units

2. Volume $= \dfrac{4}{3}$ cu. units

3. Volume $= 1$ cu. units

4. Volume $= 4$ cu. units

5. Volume $= 2$ cu. units

5. $I = \dfrac{9}{4}$

CalC16g07a
018 10.0 points

Evaluate the triple integral

$$I = \int\int\int_E 2\,x\,dxdydz$$

when E is the set of points (x, y, z) in 3-space such that

$$0 \leq x \leq \sqrt{4-y^2}\,, \quad 0 \leq z \leq y \leq 1\,.$$

1. $I = \dfrac{7}{4}$

2. $I = \dfrac{5}{2}$

3. $I = 2$

4. $I = \dfrac{11}{4}$

CalC16i04a
019 10.0 points

Find the Jacobian of the transformation

$$T : (u,\, v) \longrightarrow (x,\, y)$$

when

$$x = 2u\sin v\,, \quad y = 3u\cos v\,.$$

1. $\dfrac{\partial(x,\, y)}{\partial(u,\, v)} = 5u\cos v$

2. $\dfrac{\partial(x,\, y)}{\partial(u,\, v)} = -6u$

3. $\dfrac{\partial(x,\, y)}{\partial(u,\, v)} = 5u\sin v\cos v$

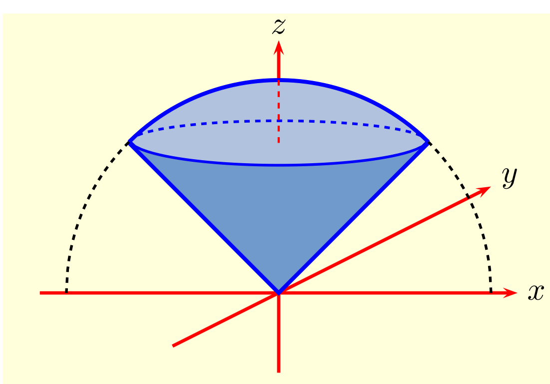
4. $\dfrac{\partial(x,\, y)}{\partial(u,\, v)} = -5u$

5. $\dfrac{\partial(x,\, y)}{\partial(u,\, v)} = -6u\sin v$

6. $\dfrac{\partial(x,\,y)}{\partial(u,\,v)} \;=\; 6u$

CalC16d25s
020 10.0 points

Use polar coordinates to find the volume of the solid shown in



above the cone

$$z \;=\; \sqrt{x^2+y^2}$$

and below the sphere

$$x^2+y^2+z^2 \;=\; 16\,.$$

1. $V \;=\; \dfrac{16\pi}{3}\left(2-\sqrt{2}\right)$

2. $V \;=\; \dfrac{64\pi}{3}\sqrt{2}$

3. $V \;=\; \dfrac{16\pi}{3}\sqrt{2}$

4. $V \;=\; \dfrac{256\pi}{3}\left(2-\sqrt{2}\right)$

5. $V \;=\; \dfrac{256\pi}{3}\sqrt{2}$

6. $V \;=\; \dfrac{64\pi}{3}\left(2-\sqrt{2}\right)$

CalC16i11a

021 10.0 points

Use the transformation $T : (u, v) \to (x, y)$ with

$$x = \frac{1}{3}(u+v), \qquad y = \frac{1}{3}(v-2u),$$

to evaluate the integral

$$I = \int\int_D (3x+2y)\,dxdy$$

when D is the region bounded by the lines

$$y = x, \qquad y = x-2$$

and

$$y+2x = 0, \qquad y+2x = 3.$$

1. $I = \dfrac{14}{3}$

2. $I = \dfrac{13}{3}$

3. $I = 4$

4. $I = \dfrac{10}{3}$

5. $I = \dfrac{11}{3}$

SphTripleInt01a
022 10.0 points

Use spherical coordinates to evaluate the integral

$$I = \int\int\int_B x^2 + y^2 + z^2 \, dV$$

when B is the ball

$$x^2 + y^2 + z^2 \leq 4 \, .$$

1. $I = \dfrac{128\pi}{5}$

2. $I = 32\pi$

3. $I = 16\pi$

4. $I = 128\pi$

5. $I = \dfrac{32\pi}{3}$

ScalarLineInt03a
023 10.0 points

Evaluate the integral

$$I = \int_C 2xe^{yz} \, ds$$

when C is the line segment from (0, 0, 0) to (2, 2, 1).

1. $I = 6(e^2 - 1)$

2. $I = 3e^2$

3. $I = 3e$

4. $I = 3(e^2 - 1)$

5. $I = 6e^2$

6. $I = 6(e - 1)$

LineIntegral01a
024 10.0 points

Evaluate the integral

$$I = \int_C (4xe^y\, dx + 2e^x\, dy)$$

when C is the parabola parametrized by

$$\mathbf{c}(t) = (t,\ t^2), \quad 0 \le t \le 1 .$$

1. $I = 4e - 2$

2. $I = 2e + 1$

3. $I = 4e - 1$

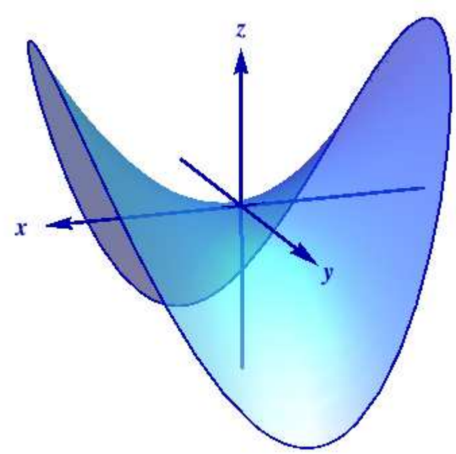
4. $I = 2e - 2$

5. $I = 2e + 2$

6. $I = 4e + 2$

SurfaceArea01a
025 10.0 points

The surface S shown in



is the portion of the graph of

$$z = f(x,\, y) = x^2 - y^2$$

lying inside the cylinder

$$x^2 + y^2 = 2$$

Determine the surface area of S.

1. Surface Area $= \dfrac{14}{3}\pi$ sq. units

2. Surface Area $= \dfrac{16}{3}\pi$ sq. units

3. Surface Area $= \dfrac{13}{3}\pi$ sq. units

4. Surface Area $= 5\pi$ sq. units

5. Surface Area $= \dfrac{17}{3}\pi$ sq. units

SurfaceInt04a
026 10.0 points

Evaluate the integral

$$I = \frac{1}{4}\int_S dS$$

when S is the surface given parametrically by

$$\mathbf{\Phi}(u, v) = (2uv, u + v, u - v)$$

for $u^2 + v^2 \leq 4$.

1. $I = 3\pi$

2. $I = 4\pi$

3. $I = \dfrac{11}{3}\pi$

4. $I = \dfrac{10}{3}\pi$

5. $I = \dfrac{13}{3}\pi$

StewartC5 17 07 19
027 10.0 points

Evaluate the integral

$$I = \int\int_S \mathbf{F} \cdot d\mathbf{S}$$

for the vector field

$$\mathbf{F} = 3x\,\mathbf{i} - y\,\mathbf{j} + z\mathbf{k}$$

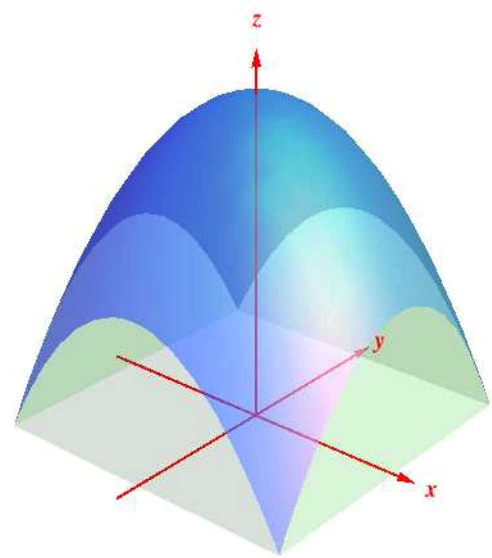
when S is the part of the paraboloid

$$z = 2 - x^2 - y^2\,,$$

oriented upwards, lying above the square

$$-1 \leq x \leq 1\,, \quad -1 \leq y \leq 1\,,$$

as shown in



1. $I = \dfrac{8}{3}$

2. $I = 4$

3. $I = \dfrac{16}{3}$

4. $I = \dfrac{32}{3}$

5. $I = 8$

GreensThm01a
028 10.0 points

Use Green's Theorem to evaluate the integral

$$I = \int_C (3xy^2 dx + x^3 dy)$$

when C is is the rectangle in the xy-plane having vertices at

$$(0,\,0), \quad (1,\,0), \quad (1,\,2), \quad (0,\,2)\,.$$

1. $I = -5$

2. $I = -4$

3. $I = -6$

4. $I = -7$

5. $I = 3$

StokesThm02a
029 10.0 points

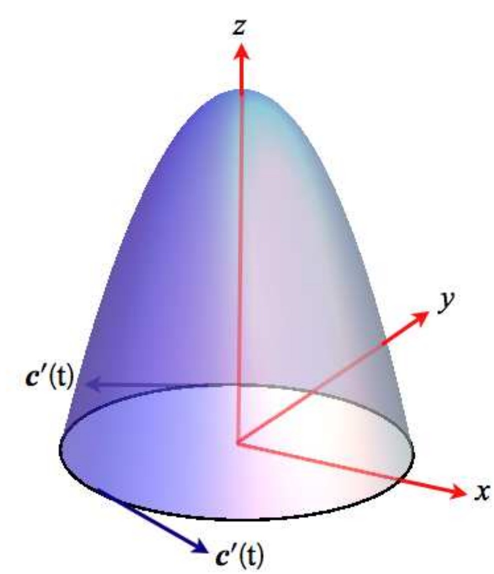
Use Stokes' theorem to evaluate the integral

$$I = \int\int_S \operatorname{curl} \mathbf{F} \cdot d\mathbf{S}$$

when $\mathbf{F}$ is the vector field

$$\mathbf{F} = 3zx\,\mathbf{i} - 2xy\,\mathbf{j} - yz\,\mathbf{k}$$

and S is the surface shown in



whose boundary is the circle

$$\mathbf{c}(t) \;=\; \cos t\,\mathbf{i} + \sin t\,\mathbf{j}$$

in the xy-plane.

1. $I \;=\; 4$

2. $I \;=\; 2$

3. $I \;=\; 1$

4. $I \;=\; 3$

5. $I \;=\; 0$

DivThm02a
030 10.0 points

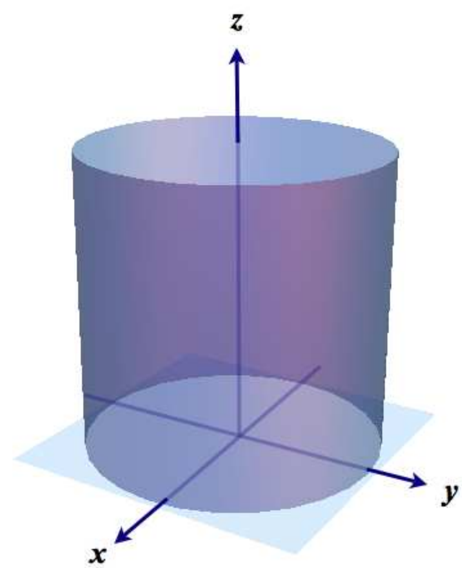
Evaluate the integral

$$I \;=\; \int\!\!\int_{\partial W} \mathbf{F}\cdot d\mathbf{S}$$

when

$$\mathbf{F}(x,\, y,\, z) \;=\; y\,\mathbf{i} - 2yz\,\mathbf{j} + 3z^2\,\mathbf{k}$$

and ∂W is the boundary of the solid W shown in



enclosed by the cylinder

$$x^2 + y^2 \;=\; 4\,,$$

the xy-plane, and the plane $z = 1$.