Exam

Name___________________________________

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Answer the question.

1) Write an "area" word problem for which finding the solution would involve evaluating the double integral 1) ______________

$$\int_0^2 \int_{x^2}^{2x} dy\, dx.$$

Provide an appropriate response.

2) Give a geometric interpretation of the triple integral $\int_0^{2\pi} \int_0^{\sqrt{3}} \int_0^{3-r^2} r\, dz dr d\theta$. 2) ______________

Answer the question.

3) Write a "volume" word problem for which finding the solution would involve evaluating the double integral 3) ______________

$$\int_1^2 \int_4^6 (y + x)\, dx\, dy.$$

4) Write an "area" word problem for which finding the solution would involve evaluating the double integral 4) ______________

$$\int_0^5 \int_0^{x^2} dy\, dx.$$

5) Write a "volume" word problem for which finding the solution would involve evaluating the double integral 5) ______________

$$\int_1^2 \int_4^6 (y + x)\, dy\, dx.$$

Provide an appropriate response.

6) Give a geometric interpretation of the triple integral 6) ______________

$\int_0^{\pi/4} \int_0^{\pi} \int_0^1 \rho^2 \sin\phi\, d\rho d\phi d\theta$. Describe the three-dimensional region associated with this integral in detail.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Write an equivalent double integral with the order of integration reversed.

7) $\int_0^3 \int_0^x dy\, dx$ 7) ________

A) $\int_0^3 \int_3^y dx\, dy$
B) $\int_0^3 \int_y^3 dx\, dy$
C) $\int_0^x \int_0^3 dx\, dy$
D) $\int_0^3 \int_{-3}^y dx\, dy$

Find the volume of the indicated region.

8) The solid cut from the first octant by the surface $z = 25 - x^2 - y$ 8) ________

A) $\frac{12500}{9}$
B) $\frac{2500}{3}$
C) $\frac{6250}{9}$
D) $\frac{3125}{3}$

Solve the problem.

9) Set up the triple integral for the volume of the sphere $\rho = 2$ in rectangular coordinates. 9) ________

A) $\int_0^2 \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} \int_{-\sqrt{4-x^2-y^2}}^{\sqrt{4-x^2-y^2}} dz\, dy\, dx$

B) $\int_{-2}^2 \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} \int_{-\sqrt{4-x^2-y^2}}^{\sqrt{4-x^2-y^2}} dz\, dy\, dx$

C) $8\int_{-2}^2 \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} \int_0^{\sqrt{4-x^2-y^2}} dz\, dy\, dx$

D) $8\int_{-2}^2 \int_0^{\sqrt{4-x^2}} \int_0^{\sqrt{4-x^2-y^2}} dz\, dy\, dx$

10) Write an iterated triple integral in the order dy dz dx for the volume of the region in the first octant enclosed by the cylinder $x^2 + z^2 = 81$ and the plane $y = 2$. 10) _______

A) $\int_{-9}^9 \int_{-\sqrt{81-z^2}}^{\sqrt{81-z^2}} \int_0^{2-z} dy\, dz\, dx$
B) $\int_{-9}^9 \int_{-\sqrt{81-x^2}}^{\sqrt{81-x^2}} \int_0^{z} dy\, dz\, dx$
C) $\int_{-9}^9 \int_{-\sqrt{81-x^2}}^{\sqrt{81-x^2}} \int_0^{2} dy\, dz\, dx$
D) $\int_{-9}^9 \int_{-\sqrt{81-z^2}}^{\sqrt{81-z^2}} \int_0^{2} dy\, dz\, dx$

Find the volume of the indicated region.

11) The region bounded by the paraboloid $z = x^2 + y^2$ and the cylinder $x^2 + y^2 = 16$ 11) _______

A) $\frac{256}{3}\pi$
B) 128π
C) 384π
D) $\frac{1024}{3}\pi$

Evaluate the integral.

12) $\int_1^2 \int_0^{\ln x} e^y \, dy \, dx$ 12) _______

A) $\frac{1}{4}$ B) $\frac{9}{4}$ C) $\frac{1}{2}$ D) $\frac{9}{2}$

Solve the problem.

13) Find the centroid of the region in the first quadrant bounded by the curve y =5 cos x and the axes. 13) _______

A) $\bar{x} = \frac{\pi - 2}{2}, \bar{y} = \frac{5\pi}{8}$ B) $\bar{x} = \frac{5\pi - 10}{2}, \bar{y} = \frac{25\pi}{8}$

C) $\bar{x} = \frac{5\pi}{8}, \bar{y} = \frac{\pi - 2}{2}$ D) $\bar{x} = \frac{\pi}{2}, \bar{y} = \frac{5\pi}{4}$

Determine the order of integration and then evaluate the integral.

14) $\int_0^1 \int_{x/2}^1 5y^2 \cos xy \, dy \, dx$ 14) _______

A) $5(1 - \cos 2)$ B) $\frac{5}{4}(1 - \cos 2)$ C) $\frac{11}{2}(1 - \cos 2)$ D) $\cos 2 - 1$

Find the volume of the indicated region.

15) The region enclosed by the cone $z^2 = x^2 + y^2$ between the planes z = 5 and z = 7 15) _______

A) $\frac{109}{2}$ B) $\frac{218}{3}$ C) $\frac{218}{3}\pi$ D) $\frac{109}{2}\pi$

Find the average value of the function over the region.

16) $f(r, \theta, z) = r^2$ over the region bounded by the cylinder r = 4 between the planes z = -6 and z = 6 16) _______

A) 8 B) $\frac{8}{3}$ C) $\frac{1}{8}$ D) 768π

Solve the problem.

17) Let D be the region that is bounded below by the cone $\phi = \frac{\pi}{4}$ and above by the sphere $\rho = 4$. Set up the triple integral for the volume of D in cylindrical coordinates. 17) _______

A) $\int_0^{2\pi} \int_0^{4/\sqrt{2}} \int_0^{\sqrt{16 - r^2}} r \, dz \, dr \, d\theta$ B) $\int_0^{2\pi} \int_0^{4} \int_0^{\sqrt{16 - r^2}} r \, dz \, dr \, d\theta$

C) $\int_0^{2\pi} \int_0^{4} \int_r^{\sqrt{16 - r^2}} r \, dz \, dr \, d\theta$ D) $\int_0^{2\pi} \int_0^{4/\sqrt{2}} \int_r^{\sqrt{16 - r^2}} r \, dz \, dr \, d\theta$

Evaluate the integral.

18) $\int_0^{\pi/10} \int_0^{\cos 5x} \sin 5x \, dy \, dx$ 18) _______

A) $\frac{1}{20}$ B) $\frac{\pi}{20}$ C) $\frac{1}{10}$ D) $\frac{\pi}{10}$

Find the average value of F(x, y, z) over the given region.

19) $F(x, y, z) = x^2 + y^2 + z^2$ over the rectangular solid in the first octant bounded by the coordinate planes and the planes x = 4, y = 9, z = 7 19) _______

A) $\frac{178}{3}$ B) $\frac{146}{3}$ C) $\frac{244}{3}$ D) $\frac{308}{3}$

Solve the problem.

20) A solid right circular cylinder is bounded by the cylinder r = 2 and the planes z = 0 and z = 4. Find the radius of gyration about the z-axis if the density is $\delta = 3z$. 20) _______

A) 2 B) 192π C) $\frac{\sqrt{2}}{2}$ D) $\frac{2}{\sqrt{2}}$

Integrate the function f over the given region.

21) $f(x, y) = e^{2x + 3y}$ over the rectangle $0 \le x \le 1$, $0 \le y \le 1$ 21) _______

A) $\frac{1}{6}(e^5 - e^3 - e^2 + 1)$ B) $\frac{1}{4}(e^5 - e^3 - e^2 - 1)$

C) $\frac{1}{6}(e^5 - e^3 - e^2 - 1)$ D) $\frac{1}{4}(e^5 - e^3 - e^2 + 1)$

Solve the problem.

22) The centers of n nonoverlapping spheres having the same mass are located at the points $(1, i, i^2)$, $1 \le i \le n$. Find their center of mass (assume that each sphere has uniform density). 22) _______

A) $\bar{x} = \frac{n}{2}$, $\bar{y} = \frac{n(n + 1)}{6}$, $\bar{z} = \frac{n(n + 1)(2n + 1)}{24}$ B) $\bar{x} = 1$, $\bar{y} = n$, $\bar{z} = n^2$

C) $\bar{x} = n$, $\bar{y} = \frac{n(n + 1)}{2}$, $\bar{z} = \frac{n(n + 1)(2n + 1)}{6}$ D) $\bar{x} = 1$, $\bar{y} = \frac{n + 1}{2}$, $\bar{z} = \frac{(n + 1)(2n + 1)}{6}$

23) Find the moment of inertia I_z of the rectangular solid of density $\delta(x, y, z) = xyz$ defined by $0 \le x \le 6$, $0 \le y \le 2$, $0 \le z \le 10$. 23) _______

A) 122400 B) 36000 C) 93600 D) 126000

24) Evaluate 24) _______

$$\iiint_R (2x + y - z)(z - x + 8y) \, dV$$

where R is the parallelepiped enclosed by the planes $2x + y - z = 1$, $2x + y - z = 3$, $-x + 8y + z = -2$, $-x + 8y + z = 5$, $x - y + 10z = -1$, $x - y + 10z = 6$.

A) $\frac{5}{4}$ B) $\frac{49}{30}$ C) $\frac{64}{45}$ D) $\frac{9}{5}$

25) Find the average height of the paraboloid $z = 4x^2 + 8y^2$ above the disk $x^2 + y^2 \le 9$ in the xy-plane. 25) _______

A) 45 B) 27 C) 18 D) 36

26) Find the center of mass of a thin infinite region in the first quadrant bounded by the coordinate axes and the curve $y = e^{-8x}$ if $\delta(x, y) = xy$. 26) _______

A) $\bar{x} = \frac{1}{8}, \bar{y} = \frac{2}{9}$ B) $\bar{x} = \frac{1}{12}, \bar{y} = \frac{2}{9}$ C) $\bar{x} = \frac{1}{12}, \bar{y} = \frac{8}{27}$ D) $\bar{x} = \frac{1}{8}, \bar{y} = \frac{8}{27}$

27) Find the average height of the paraboloid $z = x^2 + y^2$ above the disk $x^2 + y^2 \le 49$ in the xy-plane. 27) _______

A) $\frac{49}{2}$ B) $\frac{245}{2}$ C) $\frac{147}{2}$ D) $\frac{49}{3}$

Determine the order of integration and then evaluate the integral.

28) $\displaystyle\int_0^{9\sqrt{\ln 6}} \int_{y/9}^{\sqrt{\ln 6}} e^{x^2}\, dx\, dy$ 28) _______

A) $\frac{63}{2}$ B) 30 C) 24 D) $\frac{45}{2}$

Evaluate the improper integral.

29) $\displaystyle\int_1^{50} \int_2^{731} \frac{dy\, dx}{\sqrt{(x-1)}\,(y-2)^{2/3}}$ 29) _______

A) 189 B) 315 C) 378 D) 252

Solve the problem.

30) Write 30) _______

$$\int_0^4 \int_0^y f(x, y)\, dx\, dy + \int_0^4 \int_y^4 f(x, y)\, dx\, dy$$

as a single iterated integral.

A) $\displaystyle\int_0^4 \int_0^4 f(x, y)\, dx\, dy$ B) $\displaystyle\int_0^4 \int_{-y}^{y} f(x, y)\, dx\, dy$

C) $\displaystyle\int_{-4}^4 \int_{-4}^4 f(x, y)\, dx\, dy$ D) $\displaystyle\int_0^4 \int_{-y/4}^{y/4} f(x, y)\, dx\, dy$

Use the given transformation to evaluate the integral.

31) $u = 2x + y - z$, $v = -x + y + z$, $w = -x + y + 2z$; 31) _______

$$\iiint_R (2x + y - z)(z - x + y)(2z - x + y)\, dx\, dy\, dz,$$

where R is the parallelepiped bounded by the planes $2x + y - z = 7$, $2x + y - z = 10$, $-x + y + z = 7$, $-x + y + z = 8$, $-x + y + 2z = 2$, $-x + y + 2z = 3$

A) $\frac{1275}{2}$ B) $\frac{11475}{16}$ C) $\frac{11475}{8}$ D) $\frac{1275}{8}$

Find the area of the region specified in polar coordinates.

32) The region enclosed by the curve $r = 8 \cos 3\theta$ 32) _______

A) 32π B) $\frac{16}{3}\pi$ C) $\frac{32}{3}\pi$ D) 16π

Solve the problem.

33) Evaluate 33) _______

$$\iiint_R \sqrt{1 - \left(\frac{x^2}{16} + \frac{y^2}{49} + \frac{z^2}{9}\right)}\, dx\, dy\, dz,$$

where R is the interior of the ellipsoid $\frac{x^2}{16} + \frac{y^2}{49} + \frac{z^2}{9} = 1$. Hint: Let $x = 4u$, $y = 7v$, $z = 3w$, and then convert to spherical coordinates.

A) 21π B) $21\pi^2$ C) 28π D) $28\pi^2$

Find the average value of the function f over the region R.

34) $f(x, y) = \frac{1}{xy}$ 34) _______

R: $1 \le x \le 5$, $1 \le y \le 5$

A) $\left(\frac{\ln 5}{5}\right)^2$ B) $\left(\frac{\ln 5}{4}\right)^2$ C) $\frac{\ln 5}{25}$ D) $\frac{\ln 5}{16}$

Solve the problem.

35) Write 35) _______

$$\int_0^4 \int_0^y f(x, y)\, dx\, dy + \int_4^8 \int_0^{8-y} f(x, y)\, dx\, dy$$

as a single iterated integral.

A) $\displaystyle\int_0^4 \int_4^{8-x} f(x, y)\, dy\, dx$ B) $\displaystyle\int_{-4}^4 \int_x^{8-x} f(x, y)\, dy\, dx$

C) $\displaystyle\int_0^4 \int_x^{8-x} f(x, y)\, dy\, dx$ D) $\displaystyle\int_{-4}^4 \int_4^{8-x} f(x, y)\, dy\, dx$

36) Find the radius of gyration about the x-axis of the thin semicircular region of constant density $\delta = 4$ bounded by the x-axis and the curve $y = \sqrt{36 - x^2}$. 36) _______

A) 9 B) 3π C) 3 D) 9π

Provide an appropriate response.

37) What does the graph of the equation $\phi = 0$ look like? 37) _______

A) The yz-plane B) The y-axis C) The xy-plane D) The z-axis

Set up the iterated integral for evaluating

$$\iiint_D f(r, \theta, z)\, dz\, r\, dr\, d\theta$$

over the given region D.

38) D is the solid right cylinder whose base is the region in the xy-plane that lies inside the cardioid $r = 8 - 3 \sin \theta$ and outside the circle $r = 5$, and whose top lies in the plane $z = 5$. 38) _______

A) $\int_0^{2\pi} \int_0^{8 - 3\sin\theta} \int_0^5 f(r, \theta, z)\, dz\, r\, dr\, d\theta$

B) $\int_0^{\pi} \int_5^{8 - 3\sin\theta} \int_0^5 f(r, \theta, z)\, dz\, r\, dr\, d\theta$

C) $\int_0^{\pi} \int_0^{8 - 3\sin\theta} \int_0^5 f(r, \theta, z)\, dz\, r\, dr\, d\theta$

D) $\int_0^{2\pi} \int_5^{8 - 3\sin\theta} \int_0^5 f(r, \theta, z)\, dz\, r\, dr\, d\theta$

Solve the problem.

39) The center of a sphere of mass m is located at the point (2, 0, 0), the center of a sphere of mass 2m is located at the point (0, 6, 0), and the center of a sphere of mass 3m is located at the point (0, 0, 3). Find their center of mass (assume that the spheres are nonoverlapping and that each has uniform density). 39) _______

A) $\overline{x} = \frac{1}{2}, \overline{y} = 2, \overline{z} = 1$ B) $\overline{x} = \frac{3}{2}, \overline{y} = 2, \overline{z} = \frac{1}{3}$

C) $\overline{x} = \frac{1}{3}, \overline{y} = 2, \overline{z} = \frac{3}{2}$ D) $\overline{x} = 1, \overline{y} = 2, \overline{z} = \frac{1}{2}$

Find the Jacobian $\frac{\partial(x, y)}{\partial(u, v)}$ or $\frac{\partial(x, y, z)}{\partial(u, v, w)}$ (as appropriate) using the given equations.

40) $x = 3u \cosh 10v,\ y = 3u \sinh 10v,\ z = 2w$ 40) _______

A) 180u B) 600v C) 600u D) 180v

Use a CAS integration utility to evaluate the triple integral of the given function over the specified solid region.

41) $F(x, y, z) = -2x + 5y^2 + 10z^3$ over the rectangular solid $0 \le x \le 9, 0 \le y \le 8, 0 \le z \le 2$ 41) _______

A) 774 B) 688 C) $\frac{2064}{5}$ D) 516

Find the volume of the indicated region.

42) The region enclosed by the paraboloids $z = x^2 + y^2 - 4$ and $z = 28 - x^2 - y^2$ 42) _______

A) 1024π B) 256π C) 768π D) 512π

Solve the problem.

43) Evaluate 43) _______

$$\int_{-8}^{8} \int_{-\sqrt{64 - x^2}}^{\sqrt{64 - x^2}} \int_{\sqrt{x^2 + y^2}}^{8} dz\, dy\, dx$$

by transforming to cylindrical or spherical coordinates.

A) 256π B) 128π C) $\frac{512}{3}\pi$ D) $\frac{256}{3}\pi$

Evaluate the cylindrical coordinate integral.

44) $\int_0^{8\pi} \int_0^7 \int_0^r (5r^2 + 7z^2)\, dz\, r\, dr\, d\theta$ 44) _______

A) $\frac{739508}{3}\pi$ B) $\frac{1479016}{5}\pi$ C) $\frac{2958032}{9}\pi$ D) $\frac{2958032}{15}\pi$

Evaluate the integral.

45) $\int_1^3 \int_0^y x^2y^2\, dx\, dy$ 45) _______

A) $\frac{350}{3}$ B) $\frac{364}{3}$ C) $\frac{350}{9}$ D) $\frac{364}{9}$

Use the given transformation to evaluate the integral.

46) $u = -2x + y,\ v = 6x + y;$ 46) _______

$$\iint_R (y - 2x)\, dx\, dy,$$

where R is the parallelogram bounded by the lines $y = 2x + 9$, $y = 2x + 10$, $y = -6x + 7$, $y = -6x + 9$

A) 152 B) $\frac{19}{4}$ C) 304 D) $\frac{19}{8}$

Find the volume of the indicated region.

47) The region that lies under the plane $z = 2x + 7y$ and over the triangle with vertices at (1, 1), (2, 1), and (1, 2) 47) _______

A) $\frac{32}{3}$ B) 6 C) $\frac{22}{3}$ D) 12

Solve the problem.

48) Let D be the region bounded below by the xy-plane, above by the sphere $x^2 + y^2 + z^2 = 100$, and on the sides by the cylinder $x^2 + y^2 = 9$. Set up the triple integral in cylindrical coordinates that gives the volume of D using the order of integration $d\theta\, dz\, dr$. 48) _______

A) $\int_0^3 \int_0^{\sqrt{100 - r^2}} \int_0^{2\pi} r\, d\theta\, dz\, dr$ B) $\int_0^{2\pi} \int_0^{\sqrt{100 - r^2}} \int_0^{10} r\, d\theta\, dz\, dr$

C) $\int_0^{2\pi} \int_0^{\sqrt{100 - r^2}} \int_0^3 r\, d\theta\, dz\, dr$ D) $\int_0^{10} \int_0^{\sqrt{9 - r^2}} \int_0^{2\pi} r\, d\theta\, dz\, dr$

49) A cubical box in the first octant is bounded by the coordinate planes and the planes $x = 5$, $y = 6$, $z = 7$. The box is filled with a liquid of density $\delta(x, y, z) = x + y + z + 1$. Find the work done by (constant) gravity g in moving the liquid in the container down to the the xy-plane. 49) _______

A) $\frac{16415}{2}g$ B) $\frac{32830}{3}g$ C) $\frac{49245}{4}g$ D) $6566g$

Provide an appropriate response.

50) What does the graph of the equation $\phi = \frac{\pi}{3}$ look like? 50) _______

A) A cylinder B) A cone C) A plane D) A line

Find the area of the region specified in polar coordinates.

51) The region inside both $r = 10 \sin \theta$ and $r = 10 \cos \theta$ 51) _______

A) $25(\pi - 1)$ B) $25(\pi - 2)$ C) $\frac{25}{2}(\pi - 1)$ D) $\frac{25}{2}(\pi - 2)$

Solve the problem.

52) Find the center of mass of the thin semicircular region of constant density $\delta = 4$ bounded by the x-axis and the curve $y = \sqrt{121 - x^2}$. 52) _______

A) $\bar{x} = 0, \bar{y} = \frac{88}{3\pi}$ B) $\bar{x} = 0, \bar{y} = \frac{44}{3\pi}$ C) $\bar{x} = 0, \bar{y} = \frac{22}{3\pi}$ D) $\bar{x} = 0, \bar{y} = \frac{11}{3\pi}$

Evaluate the integral.

53) $\displaystyle\int_0^{\pi}\int_0^{\pi}\int_0^{10 \sin \phi} \rho^2 \sin \phi \, d\rho \, d\theta \, d\phi$ 53) _______

A) $\frac{500}{3}\pi^2$ B) $125\pi^2$ C) $\frac{1000}{9}\pi^2$ D) $\frac{1000}{3}\pi^2$

Determine the order of integration and then evaluate the integral.

54) $\displaystyle\int_0^{72}\int_{y/9}^{8} \frac{\cos x}{x} \, dx \, dy$ 54) _______

A) $8 \sin 9$ B) $9 \sin 8$ C) $9 \cos 8$ D) $8 \cos 9$

Evaluate the cylindrical coordinate integral.

55) $\displaystyle\int_7^{9}\int_8^{10}\int_0^{4r} z \, dz \, r \, dr \, d\theta$ 55) _______

A) 23616 B) 15744 C) 236160 D) 129888

Solve the problem.

56) Find the mass of the region of density $\delta(x, y, z) = \frac{1}{64 - x^2 - y^2}$ bounded by the hemisphere $z = \sqrt{64 - x^2 - y^2}$ and the xy-plane. 56) _______

A) 64π B) 8π C) 16π D) 32π

57) What domain D in $\mathcal{R}^3$ minimizes the value of the integral 57) _______

$$\iiint_D \left(1 - \frac{x^2}{9} - \frac{y^2}{9} - \frac{z^2}{9}\right) dV?$$

A) $D = \mathcal{R}^3$

B) D = the boundary of the sphere $x^2 + y^2 + z^2 = 9$.

C) D = the boundary and interior of the sphere $x^2 + y^2 + z^2 = 9$.

D) No such maximum domain exists.

Provide an appropriate response.

58) What does the graph of the equation $\theta = 0$ look like? 58) _______

A) The yz-plane B) The x-axis C) The y-axis D) The xz-plane

Solve the problem.

59) Find the mass of the rectangular solid of density $\delta(x, y, z) = xyz$ defined by $0 \le x \le 3$, $0 \le y \le 7$, $0 \le z \le 5$. 59) _______

A) $\frac{3675}{4}$ B) 735 C) $\frac{11025}{8}$ D) $\frac{3675}{2}$

60) Let R be a thin triangular region cut off from the first quadrant by the line $x + y = c$, where $c > 0$. If the density of R is given by $\delta(x, y) = 4x + 2y$, for what value of c will the mass of R be the same as that of an identical region with constant density $\delta(x, y) = 1$? 60) _______

A) $\frac{1}{2}$ B) $\frac{3}{10}$ C) $\frac{1}{4}$ D) $\frac{3}{8}$

Use the given transformation to evaluate the integral.

61) $u = x + y$, $v = -2x + y$; 61) _______

$$\iint_R (5x - 5y) \, dx \, dy,$$

where R is the parallelogram bounded by the lines $y = -x + 1$, $y = -x + 4$, $y = 2x + 2$, $y = 2x + 5$

A) $-\frac{75}{4}$ B) $-\frac{75}{2}$ C) $-\frac{95}{2}$ D) $-\frac{95}{4}$

Find the average value of the function over the region.

62) $f(r, \theta, z) = r$ over the region bounded by the cylinder $r = 6$ between the planes $z = -3$ and $z = 3$ 62) _______

A) 9 B) 864π C) 6 D) 4

Use the given transformation to evaluate the integral.

63) $u = -2x + y$, $v = 9x + y$; 63) _______

$$\iint_R (y - 2x)(9x + y) \, dx \, dy,$$

where R is the parallelogram bounded by the lines $y = 2x + 6$, $y = 2x + 7$, $y = -9x + 5$, $y = -9x + 6$

A) $\frac{1573}{2}$ B) $\frac{13}{2}$ C) $\frac{1573}{4}$ D) $\frac{13}{4}$

Evaluate the cylindrical coordinate integral.

64) $\displaystyle\int_0^{\pi/2}\int_9^{18}\int_{1/r^2}^{1/r} \cos\theta \, dz\, r\, dr\, d\theta$ 64) _______

A) $18 - \ln 2$ B) $9\pi + \ln 2$ C) $9 - \ln 2$ D) $18\pi + \ln 2$

Find the volume of the indicated region.

65) The region bounded by the paraboloid $z = x^2 + y^2$, the cylinder $x^2 + y^2 = 36$, and the xy–plane 65) _______

A) 324π B) 216π C) 648π D) 432π

Determine the order of integration and then evaluate the integral.

66) $\displaystyle\int_0^1\int_{5y}^{5} x^4 e^{x^2 y}\, dx\, dy$ 66) _______

A) $\dfrac{5e^{25} - 130}{3}$ B) $5e^{25} - 130$ C) $e^{25} - 1$ D) $e^{25} - \dfrac{130}{3}$

Use the given transformation to evaluate the integral.

67) $u = x + y, v = -2x + y;$ 67) _______

$$\iint_R -5x\, dx\, dy,$$

where R is the parallelogram bounded by the lines $y = -x + 1$, $y = -x + 4$, $y = 2x + 2$, $y = 2x + 5$

A) 10 B) -10 C) -5 D) 5

Determine the order of integration and then evaluate the integral.

68) $\displaystyle\int_0^2\int_{\sqrt{x/2}}^{1} e^{y^3}\, dy\, dx$ 68) _______

A) $\frac{2}{3}(2e - 1)$ B) $\frac{2}{3}(e - 1)$ C) $\frac{1}{3}(e - 1)$ D) $\frac{1}{3}((2e - 1)$

Solve the problem.

69) Find the center of mass of the solid enclosed between the cone with equation $z = \frac{4}{3}\sqrt{x^2 + y^2}$ and the plane with equation $z = 4$ if the density at any point is proportional to the distance from that point to the axis of the cone. 69) _______

A) $(\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{8}{3}\right)$ B) $(\bar{x}, \bar{y}, \bar{z}) = (0, 0, 3)$

C) $(\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{5}{2}\right)$ D) $(\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{16}{5}\right)$

70) Evaluate 70) _______

$$\iiint_R (5x + y - z)\, dV$$

where R is the parallelepiped enclosed by the planes $5x + y - z = 1$, $5x + y - z = 3$, $-x + 6y + z = -2$, $-x + 6y + z = 5$, $x - y + 10z = -1$, $x - y + 10z = 6$.

A) $\frac{196}{321}$ B) $\frac{75}{107}$ C) $\frac{176}{321}$ D) $\frac{72}{107}$

Determine the order of integration and then evaluate the integral.

71) $\displaystyle\int_0^{56}\int_{y/8}^{7} e^{x^2}\, dx\, dy$ 71) _______

A) $4\, e^{49}$ B) $4(e^{49} - 1)$ C) $2(e^{49} - 1)$ D) $2\, e^{49}$

Solve the problem.

72) Let D be the region bounded below by the cone $z = \sqrt{x^2 + y^2}$ and above by the sphere $z = \sqrt{81 - x^2 - y^2}$. Set up the triple integral in cylindrical coordinates that gives the volume of D using the order of integration $dr\, dz\, d\theta$. 72) _______

A) $\displaystyle\int_0^{2\pi}\int_0^{9/\sqrt{2}}\int_0^{z} r\, dr\, dz\, d\theta + \int_0^{2\pi}\int_{9/\sqrt{2}}^{9}\int_0^{\sqrt{162 - z^2}} r\, dr\, dz\, d\theta$

B) $\displaystyle\int_0^{2\pi}\int_0^{9/2}\int_0^{z} r\, dr\, dz\, d\theta + \int_0^{2\pi}\int_{9/2}^{9}\int_0^{\sqrt{81 - z^2}} r\, dr\, dz\, d\theta$

C) $\displaystyle\int_0^{2\pi}\int_0^{9/\sqrt{2}}\int_0^{z} r\, dr\, dz\, d\theta + \int_0^{2\pi}\int_{9/\sqrt{2}}^{9}\int_0^{\sqrt{81 - z^2}} r\, dr\, dz\, d\theta$

D) $\displaystyle\int_0^{2\pi}\int_0^{9/2}\int_0^{z} r\, dr\, dz\, d\theta + \int_0^{2\pi}\int_{9/2}^{9}\int_0^{\sqrt{162 - z^2}} r\, dr\, dz\, d\theta$

Use a spherical coordinate integral to find the volume of the given solid.

73) The solid between the sphere $\rho = \cos\phi$ and the hemisphere $\rho = 5$, $z \ge 0$ 73) _______

A) $\frac{499}{6}\pi$ B) $\frac{499}{4}\pi$ C) $\frac{499}{2}\pi$ D) $\frac{499}{3}\pi$

Solve the problem.

74) Evaluate 74) _______

$$\int_0^{\infty} \frac{e^{-2x} - e^{-4x}}{x}\, dx$$

by writing the integrand as an integral.

A) $\ln 2$ B) $\frac{\ln 4}{\ln 2}$ C) $\frac{\ln 2}{\ln 4}$ D) $\ln \frac{1}{2}$

Use the given transformation to evaluate the integral.

75) $u = x + y, v = -2x + y;$ 75) _______

$$\iint_R 5y\, dx\, dy,$$

where R is the parallelogram bounded by the lines $y = -x + 1$, $y = -x + 4$, $y = 2x + 2$, $y = 2x + 5$

A) $\frac{65}{4}$ B) $\frac{85}{4}$ C) $\frac{85}{2}$ D) $\frac{65}{2}$

Solve the problem.

76) Find the mass of a thin plate covering the region inside the curve $r = 8 + 2\cos\theta$ if $\delta(x, y) = 6$. 76) _______

A) 98π B) 600π C) 264π D) 396π

Use the given transformation to evaluate the integral.

77) $x = 5u$, $y = 7v$, $z = 4w$; 77) ______

$$\iiint_R x^2y^2 \, dx\, dy\, dz,$$

where R is the interior of the ellipsoid $\frac{x^2}{25} + \frac{y^2}{49} + \frac{z^2}{16} = 1$

A) 7π B) $\frac{28}{3}\pi$ C) $\frac{16}{3}\pi$ D) $\frac{28}{5}\pi$

Solve the problem.

78) Write an iterated triple integral in the order dx dy dz for the volume of the rectangular solid in the first octant bounded by the planes $x = 9$, $y = 4$, and $z = 5$. 78) ______

A) $\int_0^9 \int_0^{4-x} \int_0^{5-y-x} dx\, dy\, dz$ B) $\int_0^9 \int_0^4 \int_0^5 dx\, dy\, dz$

C) $\int_0^5 \int_0^{4-x} \int_0^{9-y-x} dx\, dy\, dz$ D) $\int_0^5 \int_0^4 \int_0^9 dx\, dy\, dz$

79) Find the centroid of the first-octant portion of a solid ball of radius 5 centered at the origin. 79) ______

A) $(\bar{x}, \bar{y}, \bar{z}) = \left(\frac{25}{8}, \frac{25}{8}, \frac{25}{8}\right)$ B) $(\bar{x}, \bar{y}, \bar{z}) = (3, 3, 3)$

C) $(\bar{x}, \bar{y}, \bar{z}) = (2, 2, 2)$ D) $(\bar{x}, \bar{y}, \bar{z}) = \left(\frac{15}{8}, \frac{15}{8}, \frac{15}{8}\right)$

Use the given transformation to evaluate the integral.

80) $u = x + y$, $v = x - y$; 80) ______

$$\iint_R (x + y) \sin (x - y) \, dx\, dy,$$

where R is the parallelogram bounded by the lines $y = x$, $y = x - 8$, $y = -x$, $y = -x + 2$

A) $1(1 + \cos 8)$ B) $2(1 - \cos 8)$ C) $2(1 + \cos 8)$ D) $1(1 - \cos 8)$

Solve the problem.

81) Evaluate 81) ______

$$\int_0^\infty \frac{\sin x}{x} \, dx$$

by integrating

$$\int_0^\infty \int_0^\infty e^{-xy} \sin x \, dA.$$

A) $\frac{\pi}{2}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{3}$ D) $\frac{\pi}{6}$

Use a spherical coordinate integral to find the volume of the given solid.

82) The solid bounded below by the sphere $\rho = 7 \cos \phi$ and above by the cone $z = \sqrt{x^2 + y^2}$ 82) ______

A) $\frac{343}{25}\pi$ B) $\frac{343}{20}\pi$ C) $\frac{343}{24}\pi$ D) $\frac{343}{18}\pi$

Evaluate the improper integral.

83) $\int_0^\infty \int_0^\infty \frac{dx\, dy}{(x^2 + 4)(y^2 + 9)}$ 83) ______

A) $\frac{\pi}{24}$ B) $\frac{\pi}{36}$ C) $\frac{\pi^2}{24}$ D) $\frac{\pi^2}{36}$

Change the Cartesian integral to an equivalent polar integral, and then evaluate.

84) $\int_{-7}^{7} \int_{-\sqrt{49 - y^2}}^{\sqrt{49 - y^2}} (x^2 + y^2)^{5/2} \, dx\, dy$ 84) ______

A) 117649π B) 235298π C) 33614π D) 16807π

Solve the problem.

85) Let R be a thin triangular region cut off from the first quadrant by the line $x + y = 13$. If the density of R is given by $\delta(x, y) = ax + \frac{y}{a}$ where $a > 0$, for what value of a will the moment of inertia of R about the y-axis be a minimum? 85) ______

A) $\sqrt{13}$ B) $\sqrt{3}$ C) $\frac{1}{\sqrt{13}}$ D) $\frac{1}{\sqrt{3}}$

86) A rectangular solid is defined by $0 \le x \le 7$, $0 \le y \le 3$, $0 \le z \le 4$. An adjacent rectangular solid is defined by $7 \le x \le 10$, $0 \le y \le 8$, $0 \le z \le 9$. If the solids have the same uniform density, find their center of mass. 86) ______

A) $\bar{x} = \frac{103}{50}$, $\bar{y} = \frac{597}{200}$, $\bar{z} = \frac{19}{5}$ B) $\bar{x} = \frac{103}{75}$, $\bar{y} = \frac{199}{100}$, $\bar{z} = \frac{38}{15}$

C) $\bar{x} = \frac{103}{150}$, $\bar{y} = \frac{199}{200}$, $\bar{z} = \frac{19}{15}$ D) $\bar{x} = \frac{103}{100}$, $\bar{y} = \frac{597}{400}$, $\bar{z} = \frac{19}{10}$

Integrate the function f over the given region.

87) $f(x, y) = 4x \sin xy$ over the rectangle $0 \le x \le \pi$, $0 \le y \le 1$ 87) ______

A) π B) $\frac{\pi}{4}$ C) $4\pi - 4$ D) 4π

Evaluate the integral.

88) $\int_5^{10} \int_0^{\pi/2} \int_0^{\pi/2} (\rho \sin \phi)^2 \, d\theta\, d\phi\, d\rho$ 88) ______

A) $\frac{875}{24}\pi^2$ B) $\frac{875}{18}\pi$ C) $\frac{875}{24}\pi$ D) $\frac{875}{18}\pi^2$

Solve the problem.

89) Let D be the region bounded below by the xy–plane, on the side by the cylinder $r = 8\cos\theta$, and on top by the paraboloid $z = 6r^2$. Set up the triple integral in cylindrical coordinates that gives the volume of D using the order of integration dz dr dθ. 89) _______

A) $\int_0^{\pi/2}\int_0^{8\cos\theta}\int_0^{6r^2} r\,dz\,dr\,d\theta$ B) $\int_0^{\pi}\int_0^{8\cos\theta}\int_0^{6r^2} r\,dz\,dr\,d\theta$

C) $\int_0^{\pi/4}\int_0^{8\cos\theta}\int_0^{6r^2} r\,dz\,dr\,d\theta$ D) $\int_0^{2\pi}\int_0^{8\cos\theta}\int_0^{6r^2} r\,dz\,dr\,d\theta$

90) Find the mass of a sphere of radius 8 if $\delta = k\rho$, k a constant. 90) _______

A) $512k\pi$ B) $4096k\pi$ C) $64k\pi$ D) $8192k\pi$

Evaluate the integral.

91) $\int_8^9\int_{6\pi}^{8\pi}\int_0^z \frac{r}{z}\,dr\,d\theta\,dz$ 91) _______

A) $\frac{17}{2}\pi$ B) $\frac{17}{3}\pi$ C) 17π D) $\frac{34}{3}\pi$

Solve the problem.

92) Find the average height of the paraboloid $z = x^2 + y^2$ above the annular region $49 \le x^2 + y^2 \le 64$ in the xy–plane. 92) _______

A) $\frac{177}{2}$ B) $\frac{113}{2}$ C) 81 D) $\frac{241}{2}$

93) Find the radius of gyration R_L of a tetrahedron of constant density bounded by the coordinate planes and the plane $\frac{x}{9} + \frac{y}{10} + \frac{z}{5} = 1$, where L is the line through the points (0, 1, 3), (0, 3, 3). 93) _______

A) 1470 B) 1050 C) $\frac{1815}{2}$ D) $\frac{3315}{2}$

Provide an appropriate response.

94) What form do planes perpendicular to the z–axis have in spherical coordinates? 94) _______

A) $\rho = a\sec\phi$ B) $\rho = a\csc\phi$ C) $\rho = a\cos\phi$ D) $\rho = a\sin\phi$

Find the area of the region specified in polar coordinates.

95) One petal of the rose curve $r = 6\cos 3\theta$ 95) _______

A) 3π B) 9π C) 18π D) 6π

Change the Cartesian integral to an equivalent polar integral, and then evaluate.

96) $\int_{-2}^{2}\int_{-\sqrt{4-y^2}}^{\sqrt{4-y^2}} dx\,dy$ 96) _______

A) 2π B) 8π C) 4π D) 16π

Find the area of the region specified by the integral(s).

97) $\int_0^7\int_{7-x}^{e^x} dy\,dx$ 97) _______

A) $e^7 - 25.5$ B) $e^7 - 17.33$ C) $e^7 - 33.67$ D) $e^7 - 13.25$

Integrate the function f over the given region.

98) $f(x, y) = y^2 e^{x^4}$ over the triangular region in the first quadrant bounded by the lines x = y/<a>, x = 1, y = 0, and y = 7 98) _______

A) $\frac{343}{3}(e - 1)$ B) $\frac{343}{12}e$ C) $\frac{343}{12}(e - 1)$ D) $343(e + 1)$

Solve the problem.

99) Find the centroid of the region bounded above by the sphere $x^2 + y^2 + z^2 = 49$ and below by the plane $z = 3$ if the density is constant. 99) _______

A) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{507}{68}$ B) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{75}{17}$

C) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{51}{4}$ D) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{60}{17}$

Find the area of the region specified by the integral(s).

100) $\int_0^{10}\int_0^{\ln x} dy\,dx$ 100) _______

A) ln 10 B) 10 ln 10 C) 10(ln 10 – 1) D) ln 10 + 1

Use a spherical coordinate integral to find the volume of the given solid.

101) The solid bounded below by the xy–plane, on the sides by the sphere $\rho = 9$, and above by the cone $\phi = \frac{\pi}{3}$ 101) _______

A) $\frac{729}{4}\pi$ B) 243π C) $\frac{729}{2}\pi$ D) $\frac{729}{5}\pi$

Evaluate the integral.

102) $\int_6^9\int_{4\pi}^{6\pi}\int_0^{\theta} rz\,dr\,dz\,d\theta$ 102) _______

A) $-7.2704e{+}12\pi^2$ B) $-\frac{1.8176e{+}13}{3}\pi^2$ C) $-6.816e{+}12\pi^2$ D) $-9.088e{+}12\pi^2$

Evaluate the improper integral.

103) $\int_0^{\infty}\int_0^{\infty} \frac{dx\,dy}{(x + 4)^2 (y + 9)^2}$ 103) _______

A) $\frac{1}{144}$ B) $\frac{1}{108}$ C) $\frac{1}{72}$ D) $\frac{1}{36}$

Solve the problem.

104) Find the moment of inertia about the y-axis of the region enclosed by the curve $r = 8 + 2 \sin \theta$ if $\delta(x, y) = \frac{1}{r}$. 104) ______

A) $\frac{920}{3}\pi$ B) 136π C) $\frac{536}{3}\pi$ D) $\frac{664}{3}\pi$

Find the volume of the indicated region.

105) The region that lies under the paraboloid $z = x^2 + y^2$ and above the triangle enclosed by the lines $x = 2$, $y = 0$, and $y = 3x$ 105) ______

A) 24 B) 48 C) 12 D) 68

Integrate the function f over the given region.

106) $f(x, y) = \frac{1}{xy}$ over the square $6 \le x \le 8, 6 \le y \le 8$ 106) ______

A) $\left(\ln \frac{3}{4}\right)^2$ B) $\left(\frac{\ln 6}{\ln 8}\right)^2$ C) $\frac{\ln 6}{\ln 8}$ D) $\ln \frac{3}{4}$

Evaluate the integral.

107) $\int_{-4}^{-5} \int_{7}^{8} xy^2 \, dx \, dy$ 107) ______

A) $\frac{6893}{6}$ B) $\frac{305}{2}$ C) $-\frac{6893}{6}$ D) $-\frac{305}{2}$

Solve the problem.

108) The centers of four nonoverlapping spheres having the same mass are located at the points $(2, 9, 8)$, $(6, 2, 9)$, $(8, 6, 2)$, and $(9, 8, 6)$. Find their center of mass (assume that each sphere has uniform density). 108) ______

A) $\bar{x} = \frac{25}{2}, \ \bar{y} = \frac{25}{2}, \ \bar{z} = \frac{25}{2}$ B) $\bar{x} = \frac{25}{4}, \ \bar{y} = \frac{25}{4}, \ \bar{z} = \frac{25}{4}$

C) $\bar{x} = \frac{25}{3}, \ \bar{y} = \frac{25}{3}, \ \bar{z} = \frac{25}{3}$ D) $\bar{x} = \frac{25}{6}, \ \bar{y} = \frac{25}{6}, \ \bar{z} = \frac{25}{6}$

Use a spherical coordinate integral to find the volume of the given solid.

109) The solid enclosed by the cardioid of revolution $\rho = 9 + 2 \cos \phi$ 109) ______

A) 255π B) 1020π C) 510π D) 2040π

Write an equivalent double integral with the order of integration reversed.

110) $\int_0^1 \int_0^{\tan^{-1} x} dy \, dx$ 110) ______

A) $\int_0^{\pi/4} \int_{\tan^{-1} y}^{1} dx \, dy$ B) $\int_0^{\pi/4} \int_{\tan^{-1} y}^{\pi/2} dx \, dy$

C) $\int_0^{\pi/4} \int_{\tan y}^{\pi/2} dx \, dy$ D) $\int_0^{\pi/4} \int_{\tan y}^{1} dx \, dy$

Change the Cartesian integral to an equivalent polar integral, and then evaluate.

111) $\int_0^4 \int_0^{\sqrt{16 - x^2}} e^{-(x^2 + y^2)} \, dy \, dx$ 111) ______

A) $\frac{\pi\left(1 - e^{-16}\right)}{2}$ B) $\frac{\pi\left(1 - e^{-16}\right)}{4}$ C) $\frac{\pi\left(1 + e^{-16}\right)}{2}$ D) $\frac{\pi\left(1 + e^{-16}\right)}{4}$

Provide an appropriate response.

112) What does the graph of the equation $\rho = \sec \phi$ look like? 112) ______

A) A line B) A cylinder C) A sphere D) A plane

Solve the problem.

113) Write an iterated triple integral in the order dz dy dx for the volume of the tetrahedron cut from the first octant by the plane $\frac{x}{6} + \frac{y}{10} + \frac{z}{3} = 1$. 113) ______

A) $\int_0^6 \int_0^{1 - y/10} \int_0^{1 - x/6 - y/10} dz \, dy \, dx$

B) $\int_0^6 \int_0^{6(1 - y/10)} \int_0^{3(1 - x/6 - y/10)} dz \, dy \, dx$

C) $\int_0^6 \int_0^{10(1 - x/6)} \int_0^{3(1 - x/6 - y/10)} dz \, dy \, dx$

D) $\int_0^6 \int_0^{1 - x/6} \int_0^{1 - x/6 - y/10} dz \, dy \, dx$

Use a CAS integration utility to evaluate the triple integral of the given function over the specified solid region.

114) $F(x, y, z) = 2x + 9y + 4z$ over the tetrahedron bounded by the coordinate planes and the plane $x + y + z = 1$ 114) ______

A) $\frac{5}{6}$ B) $\frac{5}{8}$ C) $\frac{5}{12}$ D) $\frac{5}{9}$

Evaluate the spherical coordinate integral.

115) $\int_0^{\pi/2} \int_0^{\pi/3} \int_{\sec \phi}^{5} \rho^3 \sin \phi \, d\rho \, d\phi \, d\theta$ 115) ______

A) $\frac{1861}{24}\pi$ B) $\frac{467}{6}\pi$ C) $\frac{467}{12}\pi$ D) $\frac{1861}{48}\pi$

Solve the problem.

116) Integrate $f(x, y) = \frac{\ln(x^2 + y^2)}{\sqrt{x^2 + y^2}}$ over the region $0 \le x^2 + y^2 \le 9$. 116) ______

A) $12\pi(2 \ln 3 - 1)$ B) $6\pi(\ln 3 - 1)$ C) $12\pi(\ln 3 - 1)$ D) $6\pi(2 \ln 3 - 1)$

Find the average value of the function f over the region R.

117) $f(x, y) = 5x + 8y$ 117) ______
R is the triangle with vertices (0, 0), (2, 0), and (0, 4) .

A) $\frac{14}{3}$ B) $\frac{23}{3}$ C) 14 D) $\frac{10}{3}$

Find the volume of the indicated region.

118) The region in the first octant bounded by the coordinate planes and the surface $z = 4 - x^2 - y$ 118) ______

A) $\frac{32}{3}$ B) 8 C) $\frac{64}{9}$ D) $\frac{128}{15}$

Solve the problem.

119) A cubical box in the first octant is bounded by the coordinate planes and the planes $x = 1$, $y = 1$, $z = 1$. The box is filled with a liquid of density $\delta(x, y, z) = 3x + 2y + 10z + 1$. Find the work done by (constant) gravity g in moving the liquid in the container down to the the xy-plane. 119) ______

A) $\frac{71}{12}g$ B) $\frac{21}{4}g$ C) $\frac{61}{12}g$ D) $\frac{67}{12}g$

Find the area of the region specified by the integral(s).

120) $\displaystyle\int_{\pi/4}^{\pi/2}\int_{4\cos x}^{4\sin x} dy\,dx$ 120) ______

A) 8 B) 1 C) 4 D) $4\sqrt{2}$

Use a spherical coordinate integral to find the volume of the given solid.

121) The solid between the spheres $\rho = \cos\phi$ and $\rho = 10$ 121) ______

A) $\frac{1333}{2}\pi$ B) $\frac{2000}{3}\pi$ C) $\frac{4000}{3}\pi$ D) $\frac{7999}{6}\pi$

Find the average value of F(x, y, z) over the given region.

122) $F(x, y, z) = xyz$ over the cube in the first octant bounded by the coordinate planes and the planes $x = 9$, $y = 9$, $z = 9$ 122) ______

A) $\frac{243}{2}$ B) $\frac{243}{4}$ C) $\frac{729}{8}$ D) 243

Solve the problem.

123) What region in the xy-plane minimizes the value of 123) ______

$$\iint_R (49x^2 + 16y^2 - 784)\, dA \text{ ?}$$

A) The ellipse $49x^2 + 16y^2 = 1$

B) The ellipse $\frac{x^2}{16} + \frac{y^2}{49} = 1$

C) The ellipse $\frac{x^2}{49} + \frac{y^2}{16} = 1$

D) The ellipse $16x^2 + 49y^2 = 784$

Evaluate the integral.

124) $\displaystyle\int_0^5\int_0^{\sqrt{25-y^2}}\int_0^{5x+10y} dz\,dx\,dy$ 124) ______

A) 25 B) 125 C) 3125 D) 625

Set up the iterated integral for evaluating

$$\iiint_D f(r, \theta, z)\, dz\, r\, dr\, d\theta$$

over the given region D.

125) D is the solid right cylinder whose base is the region between the circles $r = 5\cos\theta$ and $r = 6\cos\theta$, and whose top lies in the plane $z = 6 - y$. 125) ______

A) $\displaystyle\int_0^{\pi}\int_{5\cos\theta}^{6\cos\theta}\int_0^{6-\sin\theta} f(r, \theta, z)\, dz\, r\, dr\, d\theta$

B) $\displaystyle\int_0^{\pi}\int_{5\cos\theta}^{6\cos\theta}\int_0^{6-r\sin\theta} f(r, \theta, z)\, dz\, r\, dr\, d\theta$

C) $\displaystyle\int_0^{2\pi}\int_{5\cos\theta}^{6\cos\theta}\int_0^{6-\sin\theta} f(r, \theta, z)\, dz\, r\, dr\, d\theta$

D) $\displaystyle\int_0^{2\pi}\int_{5\cos\theta}^{6\cos\theta}\int_0^{6-r\sin\theta} f(r, \theta, z)\, dz\, r\, dr\, d\theta$

Write an equivalent double integral with the order of integration reversed.

126) $\displaystyle\int_0^6\int_{y^2}^{36} 3y\, dx\, dy$ 126) ______

A) $\displaystyle\int_0^{36}\int_6^{\sqrt{x}} 3y\, dy\, dx$ B) $\displaystyle\int_0^{6}\int_0^{\sqrt{x}} 3y\, dy\, dx$

C) $\displaystyle\int_0^{36}\int_0^{\sqrt{x}} 3y\, dy\, dx$ D) $\displaystyle\int_0^{6}\int_6^{\sqrt{x}} 3y\, dy\, dx$

Provide an appropriate response.

127) What form do planes perpendicular to the y-axis have in spherical coordinates? 127) ______

A) $\rho = a\csc\theta$ B) $\rho = a\csc\phi$ C) $\rho = a\sin\phi\sin\theta$ D) $\rho = a\csc\phi\csc\theta$

Evaluate the integral.

128) $\displaystyle\int_0^1\int_0^{v^4} v\, du\, dv$ 128) ______

A) $\frac{2}{5}$ B) $\frac{2}{6}$ C) $\frac{1}{6}$ D) $\frac{1}{5}$

Solve the problem.

129) The centers of three nonoverlapping spheres having the same mass are located at the points (5, 0, 0), (0, 2, 0), and (0, 0, 4). Find their center of mass (assume that each sphere has uniform density). 129) ______

A) $\bar{x} = \frac{5}{4}, \bar{y} = \frac{1}{2}, \bar{z} = 1$ B) $\bar{x} = \frac{10}{3}, \bar{y} = \frac{4}{3}, \bar{z} = \frac{8}{3}$

C) $\bar{x} = \frac{5}{3}, \bar{y} = \frac{2}{3}, \bar{z} = \frac{4}{3}$ D) $\bar{x} = \frac{5}{2}, \bar{y} = 1, \bar{z} = 2$

130) Write 130) ______

$$\int_0^8 \int_0^y f(x, y)\, dx\, dy + \int_8^{16} \int_0^{16 - y} f(x, y)\, dx\, dy + \int_0^8 \int_y^8 f(x, y)\, dx\, dy +$$

$$\int_0^8 \int_8^{16 - y} f(x, y)\, dx\, dy$$

as a single iterated integral with the order of integration reversed.

A) $\int_8^{16} \int_8^{16 - x} f(x, y)\, dy\, dx$ B) $\int_8^{16} \int_0^{16 - x} f(x, y)\, dy\, dx$

C) $\int_0^{16} \int_8^{16 - x} f(x, y)\, dy\, dx$ D) $\int_0^{16} \int_0^{16 - x} f(x, y)\, dy\, dx$

Change the Cartesian integral to an equivalent polar integral, and then evaluate.

131) $\int_{-5}^{5} \int_0^{\sqrt{25 - x^2}} dy\, dx$ 131) ______

A) $\frac{5\pi}{2}$ B) $\frac{\pi}{2}$ C) $\frac{25\pi}{2}$ D) $\frac{125\pi}{2}$

Solve the problem.

132) Find the radius of gyration R_x of the rectangular solid of density $\delta(x, y, z) = xyz$ defined by $0 \le x \le 6, 0 \le y \le 7, 0 \le z \le 10$. 132) ______

A) $\sqrt{\frac{149}{3}}$ B) $\sqrt{\frac{149}{2}}$ C) $\sqrt{\frac{149}{6}}$ D) $\sqrt{\frac{149}{4}}$

133) Let V_t be the volume of the tetrahedron bounded by the coordinate planes and the plane $\frac{x}{4} + \frac{y}{2} + \frac{z}{5} = 1$, and let V_e be the volume of the ellipsoid $\frac{x^2}{16} + \frac{y^2}{4} + \frac{z^2}{25} = 1$. Find the quotient $\frac{V_e}{V_t}$. 133) ______

A) 8π B) $\frac{2\pi}{3}$ C) $\frac{4\pi}{3}$ D) 4π

134) Solve for a: 134) ______

$$\int_0^a \int_0^{10(1 - x/a)} \int_0^{3(1 - x/a - y/10)} dz\, dy\, dx = 15$$

A) $a = \frac{5}{2}$ B) $a = 2$ C) $a = \frac{18}{5}$ D) $a = 3$

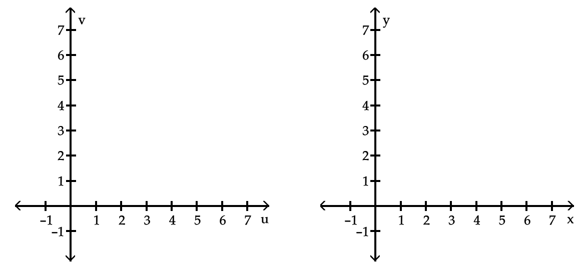
135) Find the centroid of a hemispherical shell having outer radius 10 and inner radius 3 if the density is constant. 135) ______

A) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{1417}{417}$ B) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{4251}{1112}$

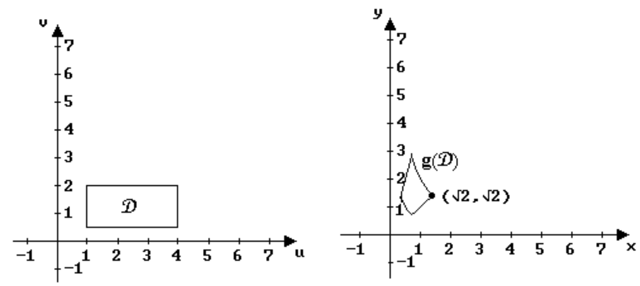
C) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{1417}{556}$ D) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{2834}{417}$

Sketch D and g(D) from the description of D and change of variables (x, y) = g(u, v).

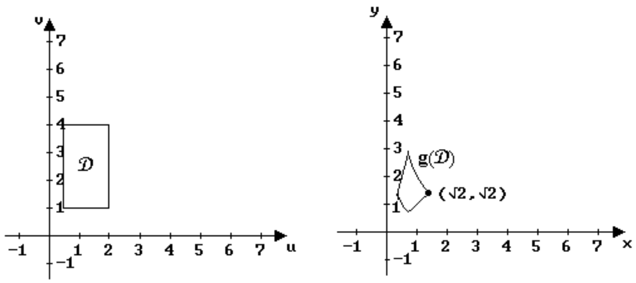
136) $u = xy, v = \frac{y}{x}$ where D is the rectangle $1 \le x \le 4, \frac{1}{2} \le y \le 2$ 136)



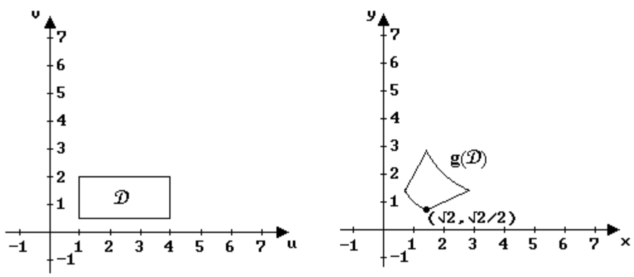
A)



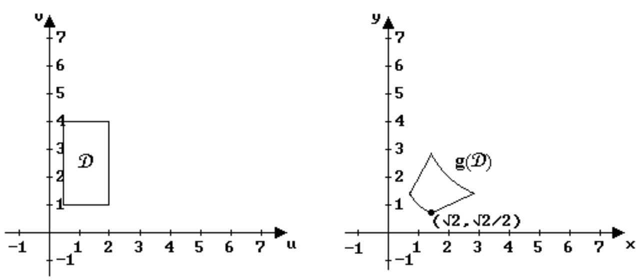
B)



C)



D)



Determine the order of integration and then evaluate the integral.

137) $\displaystyle\int_0^{27}\int_{\sqrt[3]{x}}^{3} \frac{1}{y^4+1}\,dy\,dx$ 137) ______

A) $\dfrac{\ln 82 - 1}{4}$ B) $\ln 3$ C) $\ln 3 - 1$ D) $\dfrac{\ln 82}{4}$

Find the area of the region specified by the integral(s).

138) $\displaystyle\int_0^{4}\int_0^{y} dx\,dy + \int_4^{8}\int_0^{8-y} dx\,dy$ 138) ______

A) 4 B) 2 C) 32 D) 16

Use the given transformation to evaluate the integral.

139) $x = 8u,\ y = 7v,\ z = 10w;$ 139) ______

$$\iiint_R z^2\,dx\,dy\,dz,$$

where R is the interior of the ellipsoid $\dfrac{x^2}{64} + \dfrac{y^2}{49} + \dfrac{z^2}{100} = 1$

A) 224π B) $\dfrac{560}{3}\pi$ C) 140π D) $\dfrac{448}{3}\pi$

Solve the problem.

140) Find the centroid of the region cut from the first quadrant by the line $\dfrac{x}{8} + \dfrac{y}{6} = 1$. 140) ______

A) $\bar{x} = \dfrac{3}{2}, \bar{y} = 2$ B) $\bar{x} = \dfrac{8}{3}, \bar{y} = 2$ C) $\bar{x} = 2, \bar{y} = \dfrac{8}{3}$ D) $\bar{x} = 2, \bar{y} = \dfrac{3}{2}$

Find the Jacobian $\dfrac{\partial(x, y)}{\partial(u, v)}$ or $\dfrac{\partial(x, y, z)}{\partial(u, v, w)}$ (as appropriate) using the given equations.

141) $x = 3u^2,\ y = 10uv$ 141) ______

A) $30u^2$ B) $60u^2$ C) $30v^2$ D) $60v^2$

Find the area of the region specified in polar coordinates.

142) The smaller loop of the curve $r = 2 + 4\sin\theta$ 142) ______

A) $2(2\pi - 3\sqrt{3})$ B) $2(2\pi + 3\sqrt{3})$ C) $1(2\pi + 3\sqrt{3})$ D) $1(2\pi - 3\sqrt{3})$

Find the average value of $F(x, y, z)$ over the given region.

143) $F(x, y, z) = 4x + 6y + 5z$ over the cube in the first octant bounded by the coordinate planes and the planes $x = 3, y = 3, z = 3$ 143) ______

A) $\dfrac{45}{2}$ B) $\dfrac{63}{2}$ C) $\dfrac{45}{4}$ D) $\dfrac{45}{8}$

Solve the problem.

144) Evaluate 144) ______

$$\int_0^{\infty} \frac{\tan^{-1}\frac{x}{5} - \tan^{-1}\frac{x}{9}}{x}\,dx$$

by writing the integrand as an integral.

A) $\ln \frac{5}{9}$ B) $\frac{\pi}{2} \ln \frac{9}{5}$ C) $\frac{\pi}{4} \ln \frac{9}{5}$ D) $\frac{\pi}{4} \ln \frac{9}{10}$

Evaluate the integral.

145) $\int_6^7 \int_{5\pi}^{7\pi} \int_0^z \frac{r}{z}\,d\theta\,dz\,dr$ 145) ______

A) 13π B) $\frac{13}{2}\pi$ C) $\frac{13}{3}\pi$ D) $\frac{26}{3}\pi$

Solve the problem.

146) Find the moment of inertia about the x-axis of a thin disk bounded by the circle $r = 9 \cos \theta$ if the disk's density is given by $\delta(x, y) = x^2 + y^2$. 146) ______

A) $\frac{885735}{256}\pi$ B) $\frac{531441}{256}\pi$ C) $\frac{531441}{128}\pi$ D) $\frac{885735}{128}\pi$

147) Write 147) ______

$$\int_0^4 \int_0^y f(x, y)\,dx\,dy + \int_4^8 \int_0^{8-y} f(x, y)\,dx\,dy + \int_0^4 \int_y^4 f(x, y)\,dx\,dy + \int_0^4 \int_4^{8-y} f(x, y)\,dx\,dy$$

as a single iterated integral with the same order of integration.

A) $\int_4^8 \int_0^{8-y} f(x, y)\,dx\,dy$ B) $\int_0^8 \int_4^{8-y} f(x, y)\,dx\,dy$

C) $\int_4^8 \int_4^{8-y} f(x, y)\,dx\,dy$ D) $\int_0^8 \int_0^{8-y} f(x, y)\,dx\,dy$

Evaluate the integral.

148) $\int_0^8 \int_0^2 (5x^2y - 8xy)\,dy\,dx$ 148) ______

A) $\frac{448}{3}$ B) $\frac{1792}{3}$ C) $\frac{224}{3}$ D) $\frac{3584}{3}$

Use the given transformation to evaluate the integral.

149) $x = 8u,\ y = 10v,\ z = 7w;$ 149) ______

$$\iiint_R \left(\frac{x^2}{64} + \frac{y^2}{100} + \frac{z^2}{49}\right)^3 dx\,dy\,dz,$$

where R is the interior of the ellipsoid $\frac{x^2}{64} + \frac{y^2}{100} + \frac{z^2}{49} = 1$

A) $\frac{1120}{3}\pi$ B) 140π C) $\frac{560}{3}\pi$ D) 420π

Integrate the function f over the given region.

150) $f(x, y) = \sqrt{x} + \sqrt{y}$ over the rectangle $0 \le x \le 1,\ 0 \le y \le 1$ 150) ______

A) $\frac{8}{3}$ B) $\frac{4}{3}$ C) $\frac{1}{3}$ D) $\frac{2}{3}$

Solve the problem.

151) Find the moment of inertia about the z-axis of a thick-walled right circular cylinder bounded on the inside by the cylinder $r = 1$, on the outside by the cylinder $r = 4$, and on the top and bottom by the planes $z = 3$ and $z = 7$. 151) ______

A) 1020π B) 512π C) 255π D) 510π

Write an equivalent double integral with the order of integration reversed.

152) $\int_5^9 \int_5^{14-y} dx\,dy$ 152) ______

A) $\int_5^4 \int_9^{14-x} dy\,dx$ B) $\int_5^9 \int_5^{14-x} dy\,dx$

C) $\int_5^4 \int_5^{14-x} dy\,dx$ D) $\int_5^9 \int_9^{14-x} dy\,dx$

Solve the problem.

153) What domain D in $\mathcal{R}^3$ maximizes the value of the integral 153) ______

$$\iiint_D \left(\frac{x^2}{16} + \frac{y^2}{36} + \frac{z^2}{64} - 1\right) dV?$$

A) $D = \mathcal{R}^3$

B) D = the boundary of the ellipsoid $\frac{x^2}{16} + \frac{y^2}{36} + \frac{z^2}{64} = 1$.

C) D = the boundary and interior of the ellipsoid $\frac{x^2}{16} + \frac{y^2}{36} + \frac{z^2}{64} = 1$.

D) No such minimum domain exists.

Find the average value of the function over the region.

154) $f(\rho, \phi, \theta) = \rho \cos \phi$ over the solid lower ball $\rho \le 9,\ \pi/2 \le \rho \le \pi$ 154) ______

A) $\frac{8}{27}$ B) $-\frac{27}{8}$ C) $-\frac{6561}{4}\pi$ D) $\frac{27}{16}$

Evaluate the integral.

155) $\int_0^{10} \int_0^{3(1-x/10)} \int_0^{9(1-x/10-y/3)} xyz \, dz\, dy\, dx$ 155) ______

A) $\frac{405}{2}$ B) $\frac{405}{4}$ C) 225 D) $\frac{1215}{4}$

Evaluate the spherical coordinate integral.

156) $\int_0^{2\pi} \int_0^{\pi} \int_{(1-\sin\phi)/2}^{(1-\cos\phi)/2} \rho^2 \sin\phi \, d\rho\, d\phi\, d\theta$ 156) ______

A) $\frac{1}{48}\pi(15\pi - 8)$ B) $\frac{1}{96}\pi(15\pi - 16)$ C) $\frac{1}{96}\pi(15\pi - 8)$ D) $\frac{1}{48}\pi(15\pi - 16)$

Evaluate the integral.

157) $\int_0^{\pi} \int_{(1-\sin\phi)/2}^{(1-\cos\phi)/2} \int_0^{3\pi} \rho^2 \sin\phi \, d\theta\, d\rho\, d\phi$ 157) ______

A) $\frac{1}{64}\pi(15\pi - 8)$ B) $\frac{1}{64}\pi(15\pi - 16)$ C) $\frac{1}{32}\pi(15\pi - 8)$ D) $\frac{1}{32}\pi(15\pi - 16)$

Find the area of the region specified in polar coordinates.

158) The region enclosed by the curve $r = 8 + \cos\theta$ 158) ______

A) 65π B) $\frac{65}{2}\pi$ C) $\frac{129}{2}\pi$ D) 43π

Solve the problem.

159) Let D be the region bounded below by the xy-plane, on the side by the cylinder $r = 6 \sin\theta$, and on top by the paraboloid $z = 10r^2$. Set up the triple integral in cylindrical coordinates that gives the volume of D using the order of integration $dz\, dr\, d\theta$. 159) ______

A) $\int_0^{\pi/2} \int_0^{6\sin\theta} \int_0^{10r^2} r\, dz\, dr\, d\theta$ B) $\int_0^{\pi} \int_0^{6\sin\theta} \int_0^{10r^2} r\, dz\, dr\, d\theta$

C) $\int_0^{2\pi} \int_0^{6\sin\theta} \int_0^{10r^2} r\, dz\, dr\, d\theta$ D) $\int_0^{\pi/4} \int_0^{6\sin\theta} \int_0^{10r^2} r\, dz\, dr\, d\theta$

160) Find the center of mass of the solid enclosed between the cone with equation $z = 7\sqrt{x^2 + y^2}$ and the plane with equation $z = 7$ if the density at any point is proportional to the distance from that point to the plane $z = 7$. 160) ______

A) $(\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{49}{12}\right)$ B) $(\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{14}{3}\right)$

C) $(\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{35}{8}\right)$ D) $(\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{21}{5}\right)$

Use a CAS integration utility to evaluate the triple integral of the given function over the specified solid region.

161) $F(x, y, z) = (1 + x + y + z)^2$ over the rectangular cube $0 \le x, y, z \le 9$ 161) ______

A) 171315 B) $\frac{349191}{2}$ C) 164754 D) $\frac{336069}{2}$

Change the Cartesian integral to an equivalent polar integral, and then evaluate.

162) $\int_{-8}^{8} \int_{-\sqrt{64-y^2}}^{0} \frac{\sqrt{x^2+y^2}}{1+\sqrt{x^2+y^2}} \, dx\, dy$ 162) ______

A) $\frac{\pi(48 + \ln 9)}{4}$ B) $\frac{\pi(48 + \ln 9)}{2}$ C) $\frac{\pi(48 + 2\ln 9)}{4}$ D) $\frac{\pi(48 + 2\ln 9)}{2}$

Solve the problem.

163) Find the mass of a thin plate covering the region inside the curve $r = 7 + 2\cos\theta$ if $\delta(x, y) = \frac{1}{r}$. 163) ______

A) 28π B) 14π C) 7π D) 21π

164) Find the average distance from a point P(x, y) in the first quadrant of the disk $x^2 + y^2 \le 36$ to the origin. 164) ______

A) 2 B) 4 C) 3 D) $\frac{3}{2}$

Use the given transformation to evaluate the integral.

165) $u = 2x + y - z$, $v = -x + y + z$, $w = -x + y + 2z$; 165) ______

$$\iiint_R dx\, dy\, dz,$$

where R is the parallelepiped bounded by the planes $2x + y - z = 5$, $2x + y - z = 8$, $-x + y + z = 3$, $-x + y + z = 6$, $-x + y + 2z = 8$, $-x + y + 2z = 9$

A) 27 B) 6 C) $\frac{27}{2}$ D) 3

Solve the problem.

166) Find the mass of a thin plate bounded by $|x| + |y| = 7$ if $\delta(x, y) = x^2y^2$. 166) ______

A) $\frac{117649}{45}$ B) $\frac{16807}{8}$ C) $\frac{117649}{25}$ D) $\frac{117649}{40}$

Evaluate the integral.

167) $\int_0^1 \int_0^y e^{x+y} \, dx\, dy$ 167) ______

A) $\frac{1}{2}(e^2 - e)^2$ B) $\frac{1}{3}(e - 1)^2$ C) $\frac{1}{2}(e - 1)^2$ D) $\frac{1}{e}(e^2 - e)^2$

Solve the problem.

168) Find the moment of inertia about the y-axis of the thin infinite region of constant density $\delta = 10$ in the first quadrant bounded by the coordinate axes and the curve $y = e^{-3x}$. 168) ______

A) $\frac{10}{9}$ B) $\frac{10}{81}$ C) $\frac{20}{27}$ D) $\frac{5}{27}$

Integrate the function f over the given region.

169) $f(x, y) = \frac{x}{3} + \frac{y}{6}$ over the trapezoidal region bounded by the x-axis, y-axis, line $x = 3$, and line $y = -\frac{4}{3}x + 10$ 169) ______

A) $\frac{82}{3}$ B) $\frac{112}{3}$ C) $\frac{172}{3}$ D) $\frac{67}{3}$

Solve the problem.

170) Find the radius of gyration about the x-axis of the thin infinite region of constant density $\delta = 5$ in the first quadrant bounded by the coordinate axes and the curve $y = e^{-9x}$. 170) ______

A) $\frac{1}{3}$ B) $\frac{1}{2}$ C) $\frac{\pi}{2}$ D) $\frac{\pi}{3}$

171) Find the center of mass of a tetrahedron of constant density bounded by the coordinate planes and the plane $\frac{x}{10} + \frac{y}{7} + \frac{z}{9} = 1$. 171) ______

A) $\bar{x} = 5, \bar{y} = \frac{7}{2}, \bar{z} = \frac{9}{2}$ B) $\bar{x} = \frac{5}{2}, \bar{y} = \frac{7}{4}, \bar{z} = \frac{9}{4}$

C) $\bar{x} = \frac{10}{3}, \bar{y} = \frac{7}{3}, \bar{z} = 3$ D) $\bar{x} = \frac{20}{3}, \bar{y} = \frac{14}{3}, \bar{z} = 6$

Use a CAS integration utility to evaluate the triple integral of the given function over the specified solid region.

172) $F(x, y, z) = x + y + z$ over the tetrahedron bounded by the coordinate planes and the plane $\frac{x}{6} + \frac{y}{10} + \frac{z}{4} = 1$ 172) ______

A) $\frac{800}{3}$ B) $\frac{1600}{9}$ C) $\frac{400}{3}$ D) 200

Find the volume of the indicated region.

173) The region that lies under the plane $z = 7x + 2y$ and over the triangle bounded by the lines $y = x$, $y = 2x$, and $x + y = 6$ 173) ______

A) 49 B) 63 C) 45 D) 59

Solve the problem.

174) Find the average height of the paraboloid $z = 8x^2 + 9y^2$ above the annular region $4 \le x^2 + y^2 \le 25$ in the xy-plane. 174) ______

A) $\frac{725}{4}$ B) $\frac{493}{6}$ C) $\frac{377}{2}$ D) $\frac{493}{4}$

Use the given transformation to evaluate the integral.

175) $u = 2x + y - z, v = -x + y + z, w = -x + y + 2z;$ 175) ______

$$\iiint_R (2x + y - z)(z - x + y)\, dx\, dy\, dz,$$

where R is the parallelepiped bounded by the planes $2x + y - z = 5$, $2x + y - z = 10$, $-x + y + z = 5$, $-x + y + z = 10$, $-x + y + 2z = 8$, $-x + y + 2z = 9$

A) $\frac{1875}{2}$ B) $\frac{16875}{2}$ C) $\frac{16875}{4}$ D) $\frac{1875}{4}$

Solve the problem.

176) Let D be the smaller cap cut from a solid ball of radius 7 units by a plane 6 units from the center of the sphere. Set up the triple integral for the volume of D in spherical coordinates. 176) ______

A) $\int_0^{2\pi} \int_0^{\tan^{-1}(\sqrt{13}/6)} \int_{\sec\phi}^{7} \rho^2 \sin\phi\, d\rho\, d\phi\, d\theta$

B) $\int_0^{2\pi} \int_0^{\tan^{-1}(\sqrt{13}/7)} \int_{6\sec\phi}^{7} \rho^2 \sin\phi\, d\rho\, d\phi\, d\theta$

C) $\int_0^{2\pi} \int_0^{\tan^{-1}(\sqrt{13}/7)} \int_{\sec\phi}^{7} \rho^2 \sin\phi\, d\rho\, d\phi\, d\theta$

D) $\int_0^{2\pi} \int_0^{\tan^{-1}(\sqrt{13}/6)} \int_{6\sec\phi}^{7} \rho^2 \sin\phi\, d\rho\, d\phi\, d\theta$

Find the volume of the indicated region.

177) The region bounded below by the xy-plane, laterally by the cylinder $r = 4\cos\theta$, and above by the plane $z = 3$ 177) ______

A) 12π B) 9π C) 3π D) 36π

Evaluate the spherical coordinate integral.

178) $\int_0^{\pi} \int_0^{\pi} \int_0^{2\sin\phi} \rho^2 \sin\phi\, d\rho\, d\phi\, d\theta$ 178) ______

A) $\frac{8}{3}\pi^2$ B) $\frac{4}{3}\pi^2$ C) $1\pi^2$ D) $\frac{8}{9}\pi^2$

Solve the problem.

179) Rewrite the integral 179) ______

$$\int_0^{8} \int_0^{5(1 - x/8)} \int_0^{4(1 - x/8 - y/5)} dz\, dy\, dx$$

in the order dx dy dz.

A) $\int_0^{4} \int_0^{5(1 - z/4)} \int_0^{8(1 - y/5 - z/4)} dx\, dy\, dz$

B) $\int_0^{4} \int_0^{8(1 - z/4)} \int_0^{5(1 - y/5 - z/4)} dx\, dy\, dz$

C) $\int_0^{8} \int_0^{4(1 - x/8)} \int_0^{5(1 - x/8 - y/5)} dx\, dy\, dz$

D) $\int_0^{8} \int_0^{5(1 - x/8)} \int_0^{4(1 - x/8 - y/5)} dx\, dy\, dz$

180) Find the centroid of the rectangular solid defined by $0 \le x \le 8, 0 \le y \le 7, 0 \le z \le 4$. 180) ______

A) $\bar{x} = \frac{8}{3}, \bar{y} = \frac{7}{3}, \bar{z} = \frac{4}{3}$
B) $\bar{x} = 8, \bar{y} = 7, \bar{z} = 4$
C) $\bar{x} = 4, \bar{y} = \frac{7}{2}, \bar{z} = 2$
D) $\bar{x} = 2, \bar{y} = \frac{7}{4}, \bar{z} = 1$

Use the given transformation to evaluate the integral.

181) $x = 9u, y = 2v, z = 8w$; 181) ______

$$\iiint_R x^2y^2z^2 \, dx\, dy\, dz,$$

where R is the interior of the ellipsoid $\frac{x^2}{81} + \frac{y^2}{4} + \frac{z^2}{64} = 1$

A) $\frac{32}{105}\pi$
B) $\frac{192}{35}\pi$
C) $\frac{64}{105}\pi$
D) $\frac{96}{35}\pi$

Write an equivalent double integral with the order of integration reversed.

182) $\int_0^{10} \int_0^{3y/10} dx\, dy$ 182) ______

A) $\int_0^3 \int_0^{3x/10} dy\, dx$
B) $\int_0^x \int_0^{10/3} dy\, dx$
C) $\int_0^3 \int_{10x/3}^{10} dy\, dx$
D) $\int_0^3 \int_0^{x/10} dy\, dx$

Solve the problem.

183) Find the centroid of a hemispherical shell having outer radius 10 and inner radius 7 if the density varies as the square of the distance from the base. 183) ______

A) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{1470585}{221848}$
B) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{196078}{27731}$
C) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{882351}{221848}$
D) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{882351}{110924}$

Find the area of the region specified by the integral(s).

184) $\int_{-2}^{7} \int_{y^2}^{5y+14} dx\, dy$ 184) ______

A) $\frac{243}{2}$
B) $\frac{2048}{3}$
C) 972
D) $\frac{1331}{6}$

Solve the problem.

185) Find the moment of inertia of a sphere of radius 5 and constant density δ about a diameter. 185) ______

A) $\frac{6250}{3}\delta\pi$
B) $1875\delta\pi$
C) $\frac{5000}{3}\delta\pi$
D) $\frac{21875}{12}\delta\pi$

Use a spherical coordinate integral to find the volume of the given solid.

186) The solid between the sphere $\rho = 1$ and the cardioid of revolution $\rho = 9 + 7\cos\phi$ 186) ______

A) $\frac{4676}{3}\pi$
B) $\frac{5845}{3}\pi$
C) $\frac{5845}{6}\pi$
D) $\frac{2338}{3}\pi$

Solve the problem.

187) Let A, B, and C be the squares $\{(x, y) \mid 0 \le x, y \le 2\}$, $\{(x, y) \mid 2 \le x, y \le 4\}$, and $\{(x, y) \mid 4 \le x, y \le 8\}$, respectively. Use Pappus's formula to find the centroid of $A \cup B \cup C$. 187) ______

A) $\bar{x} = \frac{14}{3}, \bar{y} = \frac{14}{3}$
B) $\bar{x} = 5, \bar{y} = 5$
C) $\bar{x} = \frac{9}{2}, \bar{y} = \frac{9}{2}$
D) $\bar{x} = \frac{16}{3}, \bar{y} = \frac{16}{3}$

Use a CAS integration utility to evaluate the triple integral of the given function over the specified solid region.

188) $F(x, y, z) = \left(\frac{1}{(x^2 + 14)(y^2 + 14)(z^2 + 14)}\right)^{3/2}$ over the rectangular cube $0 \le x, y, z \le 1$ 188) ______

A) $\frac{\sqrt{15}}{9{,}261{,}000}$
B) $\frac{\sqrt{15}}{44{,}100}$
C) $\frac{\sqrt{15}}{661{,}500}$
D) $\frac{\sqrt{15}}{617{,}400}$

Solve the problem.

189) Rewrite the integral 189) ______

$$\int_0^5 \int_0^{2(1-z/5)} \int_0^{10(1-y/2-z/5)} dx\, dy\, dz$$

in the order dz dy dx.

A) $\int_0^5 \int_0^{2(1-x/10)} \int_0^{10(1-x/10-y/2)} dz\, dy\, dx$
B) $\int_0^{10} \int_0^{2(1-z/5)} \int_0^{5(1-y/2-z/5)} dz\, dy\, dx$
C) $\int_0^5 \int_0^{2(1-z/5)} \int_0^{10(1-y/2-z/5)} dz\, dy\, dx$
D) $\int_0^{10} \int_0^{2(1-x/10)} \int_0^{5(1-x/10-y/2)} dz\, dy\, dx$

Find the volume of the indicated region.

190) The region bounded by the paraboloid $z = 1 - \frac{x^2}{100} - \frac{y^2}{36}$ and the xy-plane 190) ______

A) 180π
B) 300π
C) 30π
D) 20π

Evaluate the integral.

191) $\int_2^9 \int_3^{10} \int_0^{5r} r\, dz\, d\theta\, dr$ 191) ______

A) $\frac{25235}{6}$
B) $\frac{25235}{3}$
C) $\frac{25235}{4}$
D) $\frac{25235}{2}$

Find the volume of the indicated region.

192) The region enclosed by the cylinder $x^2 + y^2 = 81$ and the planes $z = 0$ and $x + y + z = 18$ 192) ______

A) 729π B) 1458π C) 2187π D) 2916π

Solve the problem.

193) Let D be the region bounded below by the xy-plane, above by the sphere $x^2 + y^2 + z^2 = 100$, and on the sides by the cylinder $x^2 + y^2 = 49$. Set up the triple integral in cylindrical coordinates that gives the volume of D using the order of integration dr dz dθ. 193) ______

A) $\int_0^{2\pi}\int_0^{\sqrt{51}}\int_0^{10} r\,dr\,dz\,d\theta + \int_0^{2\pi}\int_{\sqrt{51}}^{7}\int_0^{\sqrt{49 - z^2}} r\,dr\,dz\,d\theta$

B) $\int_0^{2\pi}\int_0^{\sqrt{51}}\int_0^{7} r\,dr\,dz\,d\theta + \int_0^{2\pi}\int_{\sqrt{51}}^{10}\int_0^{\sqrt{49 - z^2}} r\,dr\,dz\,d\theta$

C) $\int_0^{2\pi}\int_0^{\sqrt{51}}\int_0^{10} r\,dr\,dz\,d\theta + \int_0^{2\pi}\int_{\sqrt{51}}^{7}\int_0^{\sqrt{100 - z^2}} r\,dr\,dz\,d\theta$

D) $\int_0^{2\pi}\int_0^{\sqrt{51}}\int_0^{7} r\,dr\,dz\,d\theta + \int_0^{2\pi}\int_{\sqrt{51}}^{10}\int_0^{\sqrt{100 - z^2}} r\,dr\,dz\,d\theta$

194) Find the mass of a thin triangular plate bounded by the coordinate axes and the line $x + y = 6$ if $\delta(x, y) = x + y$. 194) ______

A) 288 B) 144 C) 72 D) 36

195) The northern third of Indiana is a rectangle measuring 96 miles by 132 miles. Thus, let $D = [0, 96] \times [0, 132]$. Assuming that the total annual snowfall (in inches), $S(x,y)$, at $(x,y) \in D$ is given by the function 195) ______

$S(x,y) = 60e^{-0.001(2x + y)}$, $(x,y) \in D$,

find the average snowfall on D.

A) 51.14 inches B) 52.06 inches C) 52.44 inches D) 51.78 inches

196) A cubical box in the first octant is bounded by the coordinate planes and the planes $x = 2$, $y = 4$, $z = 10$. The box is filled with a liquid of density $\delta(x, y, z) = x + y + z + 3$. Find the work done by (constant) gravity g in moving the liquid in the container down to the the xy-plane. 196) ______

A) $\frac{12160}{3}g$ B) $\frac{30400}{9}g$ C) $\frac{15200}{3}g$ D) $3800g$

197) Find the center of mass of the region of constant density bounded from above by the sphere $x^2 + y^2 + z^2 = 4$ and from below by the cone $z = \sqrt{x^2 + y^2}$. 197) ______

A) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{5}{8}(2 + \sqrt{2})$ B) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{3}{8}(2 + \sqrt{2})$

C) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{3}{4}(2 + \sqrt{2})$ D) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{7}{8}(2 + \sqrt{2})$

198) Find the center of mass of a thin triangular plate bounded by the coordinate axes and the line $x + y = 5$ if $\delta(x, y) = x + y$. 198) ______

A) $\bar{x} = \frac{10}{3}, \bar{y} = \frac{10}{3}$ B) $\bar{x} = \frac{15}{8}, \bar{y} = \frac{15}{8}$ C) $\bar{x} = \frac{25}{12}, \bar{y} = \frac{25}{12}$ D) $\bar{x} = \frac{5}{3}, \bar{y} = \frac{5}{3}$

Find the area of the region specified in polar coordinates.

199) The region enclosed by the curve $r = 10 \cos \theta$ 199) ______

A) 50π B) $\frac{100}{3}\pi$ C) 100π D) 25π

Solve the problem.

200) Write 200) ______

$$\int_0^6\int_0^y f(x, y)\,dx\,dy + \int_6^{12}\int_0^{12 - y} f(x, y)\,dx\,dy + \int_0^6\int_y^6 f(x, y)\,dx\,dy$$

as a single iterated integral.

A) $\int_0^6\int_6^{12 - x} f(x, y)\,dy\,dx$ B) $\int_0^6\int_0^{12 - x} f(x, y)\,dy\,dx$

C) $\int_{-6}^6\int_x^{12 - x} f(x, y)\,dy\,dx$ D) $\int_{-6}^6\int_6^{12 - x} f(x, y)\,dy\,dx$

Determine the order of integration and then evaluate the integral.

201) $\int_0^{60}\int_{y/6}^{10} \tan^{-1} x^2\,dx\,dy$ 201) ______

A) $300 \tan^{-1} 100 - \frac{3}{2} \ln 10{,}001$ B) $300 \tan^{-1} 100 - 3 \ln 10{,}001$

C) $150 \tan^{-1} 100 - 3 \ln 10{,}001$ D) $150 \tan^{-1} 100 - \frac{3}{2} \ln 10{,}001$

Use a spherical coordinate integral to find the volume of the given solid.

202) The solid enclosed by the cardioid of revolution $\rho = 8 + 7 \cos \phi$, $z \geq 0$ 202) ______

A) $\frac{6647}{3}\pi$ B) $\frac{6647}{4}\pi$ C) $\frac{6647}{6}\pi$ D) $\frac{6647}{2}\pi$

Solve the problem.

203) Let D be the region bounded below by the xy-plane, above by the sphere $x^2 + y^2 + z^2 = 64$, and on the sides by the cylinder $x^2 + y^2 = 4$. Set up the triple integral in cylindrical coordinates that gives the volume of D using the order of integration dz dθ dr. 203) ______

A) $\int_0^8\int_0^{2\pi}\int_0^{\sqrt{4 - r^2}} r\,dz\,d\theta\,dr$ B) $\int_0^8\int_0^{2\pi}\int_0^{\sqrt{4 - r^2}} dz\,d\theta\,dr$

C) $\int_0^2\int_0^{2\pi}\int_0^{\sqrt{64 - r^2}} r\,dz\,d\theta\,dr$ D) $\int_0^2\int_0^{2\pi}\int_0^{\sqrt{64 - r^2}} dz\,d\theta\,dr$

Evaluate the spherical coordinate integral.

204) $\displaystyle\int_0^{\pi/2}\int_0^{\pi/2}\int_0^{2\cos\phi} \rho^2 \sin\phi \, d\rho \, d\phi \, d\theta$ 204) ______

A) $\frac{1}{3}\pi$ B) $\frac{1}{3}\pi^2$ C) $\frac{4}{9}\pi^2$ D) $\frac{4}{9}\pi$

Solve the problem.

205) Find the average distance from a point P(r, θ) in the region bounded by $r = 3 + 7\cos\theta$ to the origin. 205) ______

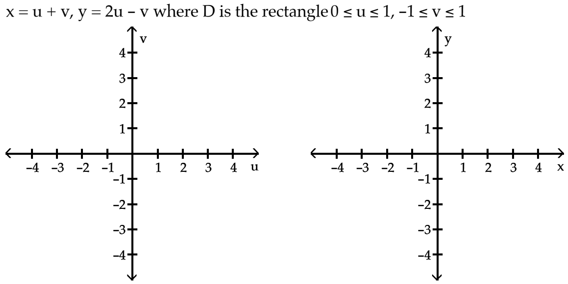
A) $\frac{495}{134}$ B) $\frac{330}{67}$ C) $\frac{165}{67}$ D) $\frac{1485}{268}$

206) Find the radius of gyration R_x of the rectangular solid defined by $0 \le x \le 8$, $0 \le y \le 3$, $0 \le z \le 7$. 206) ______

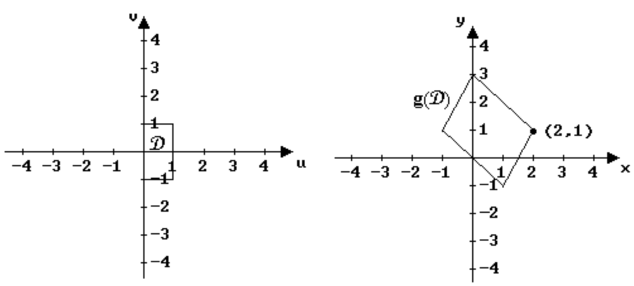
A) $\sqrt{\frac{58}{3}}$ B) $\sqrt{\frac{113}{3}}$ C) $\sqrt{\frac{122}{3}}$ D) $\sqrt{\frac{73}{3}}$

Sketch D and g(D) from the description of D and change of variables (x, y) = g(u, v).

207) $x = u + v$, $y = 2u - v$ where D is the rectangle $0 \le u \le 1$, $-1 \le v \le 1$ 207)



A)



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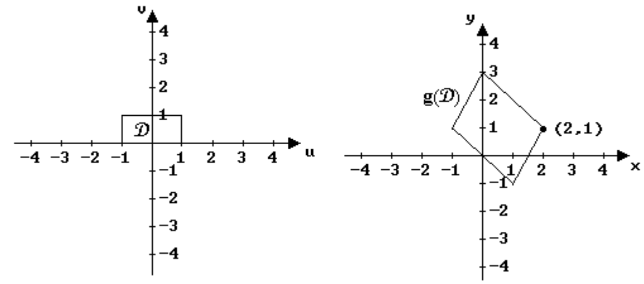
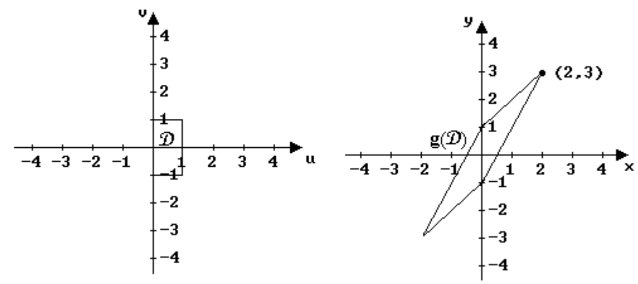
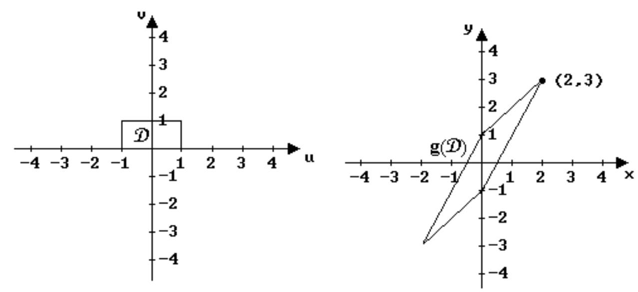


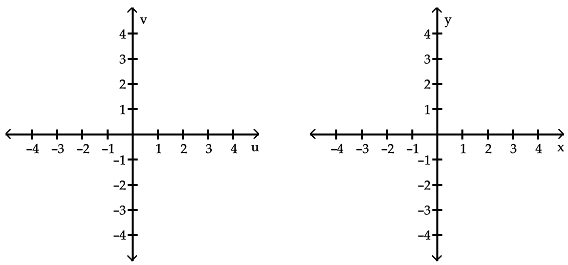
C)



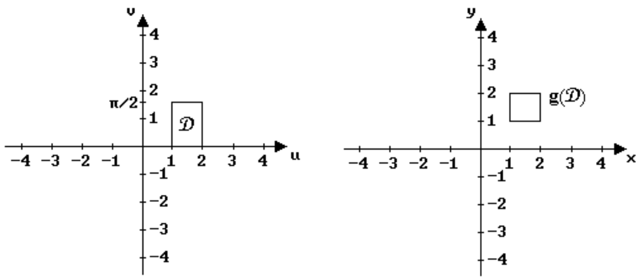
D)



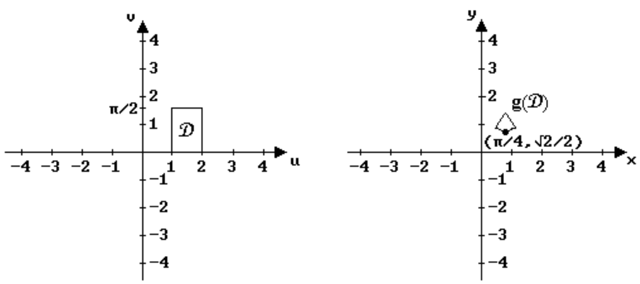
208) $x = u \cos v$, $y = u \sin v$ where D is the rectangle $1 \le u \le 2$, $0 \le v \le \frac{\pi}{2}$ 208)



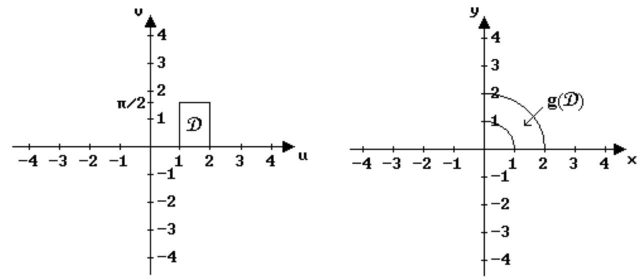
A)



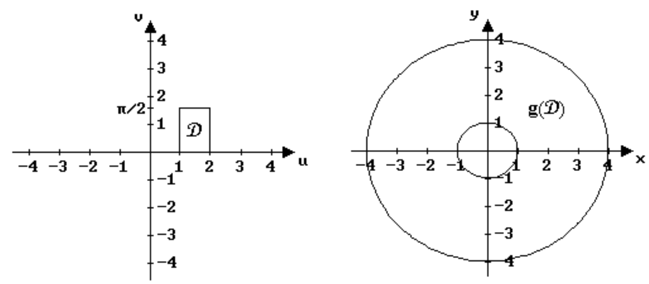
B)



C)



D)



Evaluate the improper integral.

209) $\displaystyle\int_0^8 \int_0^9 \ln xy \, dx \, dy$ 209) ______

A) $72(\ln 72 - 1)$ B) $\dfrac{\ln 72 - 1}{72}$ C) $72(\ln 72 - 2)$ D) $\dfrac{\ln 72 - 2}{72}$

Solve the problem.

210) Write an iterated triple integral in the order dz dy dx for the volume of the region enclosed by the paraboloids $z = 8 - x^2 - y^2$ and $z = x^2 + y^2$. 210) ______

A) $\displaystyle\int_{-2}^{2} \int_{-\sqrt{8-x^2}}^{\sqrt{8-x^2}} \int_{x^2+y^2}^{4-x^2-y^2} dz\, dy\, dx$ B) $\displaystyle\int_{-2}^{2} \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} \int_{x^2+y^2}^{8-x^2-y^2} dz\, dy\, dx$

C) $\displaystyle\int_{-2}^{2} \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} \int_{x^2+y^2}^{4-x^2-y^2} dz\, dy\, dx$ D) $\displaystyle\int_{-2}^{2} \int_{-\sqrt{8-x^2}}^{\sqrt{8-x^2}} \int_{x^2+y^2}^{8-x^2-y^2} dz\, dy\, dx$

Integrate the function f over the given region.

211) $f(x, y) = \sin 3x$ over the rectangle $0 \le x \le \frac{\pi}{3}$, $0 \le y \le \pi$ 211) ______

A) $\frac{\pi}{3}$ B) π C) $\frac{2\pi}{3}$ D) $\frac{\pi}{6}$

Use a CAS integration utility to evaluate the triple integral of the given function over the specified solid region.

212) $F(x, y, z) = \dfrac{1}{(x^2+13)^{3/2}(y^2+13)^{5/2}(z^2+13)^{7/2}}$ over the rectangular cube $0 \le x, y, z \le 1$ 212) ______

A) $\dfrac{114923}{9.085908033e+13}\sqrt{14}$ B) $\dfrac{114923}{6.230336937e+13}\sqrt{14}$

C) $\dfrac{114923}{1.246067387e+14}\sqrt{14}$ D) $\dfrac{114923}{1.168188176e+14}\sqrt{14}$

Solve the problem.

213) Find the moment of inertia about the x-axis of a thin plane of constant density $\delta = 7$ bounded by the coordinate axes and the line $\frac{x}{9} + \frac{y}{6} = 1$. 213) ______

A) 756 B) 1701 C) 1134 D) $\frac{5103}{2}$

Change the Cartesian integral to an equivalent polar integral, and then evaluate.

214) $\displaystyle\int_{-8}^{8}\int_{-\sqrt{64-y^2}}^{\sqrt{64-y^2}} \ln(x^2 + y^2 + 1)\,dx\,dy$ 214) ______

A) $\pi(65 \ln 65 - 64)$ B) $\pi(64 \ln 65 + 64)$ C) $\pi(64 \ln 65 - 64)$ D) $\pi(65 \ln 65 + 64)$

Find the volume of the indicated region.

215) The region bounded by the cylinders $r = 4$, $r = 10$ and the planes $z = 9$, $z = 10$ 215) ______

A) 84π B) 252π C) 336π D) 168π

Express the area of the region bounded by the given line(s) and/or curve(s) as an iterated double integral.

216) The lines $\frac{x}{2} + \frac{y}{10} = 1$, $\frac{x}{10} + \frac{y}{2} = 1$, and $y = 0$ 216) ______

A) $\displaystyle\int_0^{12}\int_{10(1-y/2)}^{2(1-y/2)} dx\,dy$ B) $\displaystyle\int_0^{1.67}\int_{2(1-y/10)}^{10(1-y/2)} dx\,dy$

C) $\displaystyle\int_0^{1.67}\int_{10(1-y/2)}^{2(1-y/10)} dx\,dy$ D) $\displaystyle\int_0^{12}\int_{2(1-y/10)}^{10(1-y/2)} dx\,dy$

Solve the problem.

217) Find the average distance from a point P(x, y) in the annular region $81 \le x^2 + y^2 \le 49$ to the origin. 217) ______

A) $\frac{193}{24}$ B) $\frac{579}{64}$ C) $\frac{957}{64}$ D) $\frac{319}{24}$

218) Find the moment of inertia about the y-axis of a thin disk bounded by the circle $r = 10 \cos \theta$ if the disk's density is given by $\delta(x, y) = \frac{1}{r^2}$. 218) ______

A) $\frac{75}{4}\pi$ B) $\frac{125}{4}\pi$ C) $\frac{125}{2}\pi$ D) $\frac{75}{2}\pi$

Change the Cartesian integral to an equivalent polar integral, and then evaluate.

219) $\displaystyle\int_0^{\ln 4}\int_0^{\sqrt{(\ln 4)^2 - y^2}} e^{\sqrt{x^2+y^2}}\,dx\,dy$ 219) ______

A) $\frac{\pi(4 \ln 4 + 3)}{2}$ B) $\frac{\pi(4 \ln 4 - 3)}{4}$ C) $\frac{\pi(4 \ln 4 - 3)}{2}$ D) $\frac{\pi(4 \ln 4 + 3)}{4}$

Evaluate the integral.

220) $\displaystyle\int_{-1}^{1}\int_0^1\int_0^3 (x^2 + y^2 + z^2)\,dx\,dy\,dz$ 220) ______

A) 23.2 B) 22 C) 28 D) −26

Find the volume of the indicated region.

221) The region bounded by the paraboloid $z = 36 - x^2 - y^2$ and the xy-plane 221) ______

A) 432π B) 648π C) 324π D) 216π

Solve the problem.

222) Evaluate 222) ______

$$\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} \frac{1}{(1 + x^2 + y^2)^3}\,dx\,dy.$$

A) $\frac{\pi}{2}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{3}$ D) $\frac{\pi}{6}$

Find the average value of F(x, y, z) over the given region.

223) $F(x, y, z) = 3x + 6y + 5z$ over the rectangular solid in the first octant bounded by the coordinate planes and the planes $x = 8$, $y = 3$, $z = 6$ 223) ______

A) 45 B) 54 C) 36 D) 24

Use the given transformation to evaluate the integral.

224) $u = -4x + y$, $v = 2x + y$; 224) ______

$$\iint_R (2x + y)\,dx\,dy,$$

where R is the parallelogram bounded by the lines $y = 4x + 4$, $y = 4x + 7$, $y = -2x + 2$, $y = -2x + 8$

A) 15 B) 1080 C) 540 D) 30

Solve the problem.

225) A solid of constant density is bounded below by the plane $z = 0$, above by the cone $z = r$, and on the sides by the cylinder $r = 9$. Find the center of mass. 225) ______

A) (0, 0, 3) B) $(0, 0, \frac{45}{8})$ C) $(0, 0, \frac{27}{8})$ D) (0, 0, 6)

226) Find the center of mass of the rectangular solid of density $\delta(x, y, z) = xyz$ defined by $0 \le x \le 10$, $0 \le y \le 5$, $0 \le z \le 2$. 226) ______

A) $\bar{x} = \frac{5}{2}, \bar{y} = \frac{5}{4}, \bar{z} = \frac{1}{2}$
B) $\bar{x} = \frac{20}{3}, \bar{y} = \frac{10}{3}, \bar{z} = \frac{4}{3}$
C) $\bar{x} = \frac{10}{3}, \bar{y} = \frac{5}{3}, \bar{z} = \frac{2}{3}$
D) $\bar{x} = 5, \bar{y} = \frac{5}{2}, \bar{z} = 1$

Find the volume of the indicated region.

227) The region bounded by the coordinate planes and the planes $z = x + y$, $z = 7$ 227) ______

A) $\frac{343}{4}$
B) $\frac{343}{3}$
C) $\frac{343}{2}$
D) $\frac{343}{6}$

Solve the problem.

228) A solid right circular cylinder is bounded by the cylinder $r = 1$ and the planes $z = 0$ and $z = 4$. Find the moment of inertia about the z-axis if the density is $\delta = 3z$. 228) ______

A) 16π
B) 4π
C) 24π
D) 12π

Evaluate the integral.

229) $\int_0^{\pi}\int_0^{\pi}\int_0^{\pi} \sin(8u + 2)\, du\, dv\, dw$ 229) ______

A) $\frac{1}{8}\pi \cos 2$
B) $\frac{1}{8}\pi^2 \cos 2$
C) $\frac{1}{4}\pi \cos 2$
D) $\frac{1}{4}\pi^2 \cos 2$

Find the volume of the indicated region.

230) The tetrahedron cut off from the first octant by the plane $\frac{x}{9} + \frac{y}{4} + \frac{z}{7} = 1$ 230) ______

A) 84
B) 63
C) 42
D) 126

Solve the problem.

231) Find the centroid of the region cut from the fourth quadrant by the circle $x^2 + y^2 = 49$. 231) ______

A) $\bar{x} = \frac{28}{3\pi}, \bar{y} = -\frac{28}{3\pi}$
B) $\bar{x} = \frac{7}{3\pi}, \bar{y} = -\frac{7}{3\pi}$
C) $\bar{x} = -\frac{3\pi}{28}, \bar{y} = \frac{3\pi}{28}$
D) $\bar{x} = \frac{3\pi}{28}, \bar{y} = -\frac{3\pi}{28}$

Evaluate the integral by changing the order of integration in an appropriate way.

232) $\int_0^{16}\int_{x/2}^{8}\int_0^{\infty} ze^{-(y^2 + z^2)}\, dz\, dy\, dx$ 232) ______

A) $1\left(1 - e^{-128}\right)$
B) $1\left(1 - e^{-64}\right)$
C) $\frac{1}{2}\left(1 - e^{-128}\right)$
D) $\frac{1}{2}\left(1 - e^{-64}\right)$

Express the area of the region bounded by the given line(s) and/or curve(s) as an iterated double integral.

233) The lines $\frac{x}{5} + \frac{y}{10} = 1$, $\frac{x}{10} + \frac{y}{5} = 1$, and $x = 0$ 233) ______

A) $\int_0^{3.3}\int_{5(1 - x/10)}^{10(1 - x/5)} dy\, dx$
B) $\int_0^{15}\int_{10(1 - x/5)}^{5(1 - x/10)} dy\, dx$
C) $\int_0^{3.3}\int_{10(1 - x/5)}^{5(1 - x/10)} dy\, dx$
D) $\int_0^{15}\int_{5(1 - x/10)}^{10(1 - x/5)} dy\, dx$

Solve the problem.

234) Evaluate 234) ______

$$\int_{-6}^{6}\int_{-\sqrt{36 - y^2}}^{\sqrt{36 - y^2}}\int_0^{\sqrt{49 - x^2 - y^2}} dz\, dx\, dy$$

by transforming to cylindrical or spherical coordinates.

A) $\frac{4\pi}{3}\left(49 - (13)^{3/2}\right)$
B) $\frac{2\pi}{3}\left(343 - (13)^{3/2}\right)$
C) $\frac{2\pi}{3}\left(49 - (13)^{3/2}\right)$
D) $\frac{4\pi}{3}\left(343 - (13)^{3/2}\right)$

Write an equivalent double integral with the order of integration reversed.

235) $\int_4^{13}\int_{17 - x}^{13} dy\, dx$ 235) ______

A) $\int_4^{13}\int_{13 - y}^{9} dx\, dy$
B) $\int_4^{13}\int_{17 - y}^{13} dx\, dy$
C) $\int_4^{9}\int_{17 - y}^{13} dx\, dy$
D) $\int_4^{9}\int_{13 - y}^{9} dx\, dy$

Find the volume of the indicated region.

236) The region in the first octant bounded by the coordinate planes and the planes $x + z = 4$, $y + 5z = 20$ 236) ______

A) $\frac{80}{3}$
B) $\frac{64}{3}$
C) $\frac{320}{3}$
D) $\frac{1280}{3}$

Evaluate the integral.

237) $\int_8^{10}\int_{6\pi}^{8\pi}\int_0^{z} \frac{r}{z}\, dr\, dz\, d\theta$ 237) ______

A) $14\pi^2$
B) $\frac{56}{9}\pi^2$
C) $7\pi^2$
D) $\frac{28}{3}\pi^2$

Solve the problem.

238) A rectangular plate of constant density $\delta(x, y) = 1$ occupies the region bounded by the lines $x = 7$ and $y = 10$ in the first quadrant. The moment of inertia I_a of the rectangle about the line $y = a$ is given by 238) ______

$$I_a = \int_0^{7}\int_0^{10} (y - a)^2\, dy\, dx.$$

Find the value of a that minimizes I_a.

A) 1
B) 5
C) $\frac{7}{2}$
D) $\frac{1}{2}$

Use the given transformation to evaluate the integral.

239) $u = 2x + y - z$, $v = -x + y + z$, $w = -x + y + 2z$; 239) ______

$$\iiint_R (2x + y - z)\,dx\,dy\,dz,$$

where R is the parallelepiped bounded by the planes $2x + y - z = 2$, $2x + y - z = 4$, $-x + y + z = 4$, $-x + y + z = 5$, $-x + y + 2z = 7$, $-x + y + 2z = 9$

A) 6 B) 4 C) 36 D) 16

Solve the problem.

240) Let A and B be the squares 240) ______

$\{(x, y) \mid 0 \le x, y \le 2\}$ and $\{(x, y) \mid 3 \le x, y \le 8\}$,

respectively. Use Pappus's formula to find the centroid of $A \cup B$.

A) $\bar{x} = \frac{283}{58}, \bar{y} = \frac{283}{58}$ B) $\bar{x} = \frac{299}{58}, \bar{y} = \frac{299}{58}$ C) $\bar{x} = \frac{291}{58}, \bar{y} = \frac{291}{58}$ D) $\bar{x} = \frac{307}{58}, \bar{y} = \frac{307}{58}$

Find the Jacobian $\frac{\partial(x, y)}{\partial(u, v)}$ or $\frac{\partial(x, y, z)}{\partial(u, v, w)}$ (as appropriate) using the given equations.

241) $x = 8u \cos 7v$, $y = 8u \sin 7v$ 241) ______

A) 392u B) 448v C) 448u D) 392v

Evaluate the integral.

242) $\int_0^6 \int_0^{36 - x^2} x\,dy\,dx$ 242) ______

A) 432 B) 324 C) 72 D) 54

243) $\int_0^{\pi/2} \int_3^8 \int_0^{\pi/3} \rho^4 \sin^2 \phi \cos \phi\,d\phi\,d\rho\,d\theta$ 243) ______

A) $\frac{32525}{81}\pi\sqrt{3}$ B) $\frac{32525}{81}\pi\sqrt{2}$ C) $\frac{6505}{16}\pi\sqrt{2}$ D) $\frac{6505}{16}\pi\sqrt{3}$

Set up the iterated integral for evaluating

$$\iiint_D f(r, \theta, z)\,dz\,r\,dr\,d\theta$$

over the given region D.

244) D is the right circular cylinder whose base is the circle $r = 4 \cos \theta$ in the xy-plane and whose top lies in the plane $z = 10 - x - y$. 244) ______

A) $\int_0^{\pi} \int_0^{4 \sin \theta} \int_0^{10 - \sin \theta - \cos \theta} f(r, \theta, z)\,dz\,r\,dr\,d\theta$

B) $\int_0^{2\pi} \int_0^{4 \cos \theta} \int_0^{10 - r(\cos \theta + \sin \theta)} f(r, \theta, z)\,dz\,r\,dr\,d\theta$

C) $\int_0^{\pi} \int_0^{4 \cos \theta} \int_0^{10 - r(\cos \theta + \sin \theta)} f(r, \theta, z)\,dz\,r\,dr\,d\theta$

D) $\int_0^{2\pi} \int_0^{4 \sin \theta} \int_0^{10 - \sin \theta - \cos \theta} f(r, \theta, z)\,dz\,r\,dr\,d\theta$

Solve the problem.

245) A cubical box in the first octant is bounded by the coordinate planes and the planes $x = 1$, $y = 1$, $z = 1$. The box is filled with a liquid of density $\delta(x, y, z) = x + y + z + 4$. Find the work done by (constant) gravity g in moving the liquid in the container down to the the xy-plane. 245) ______

A) $\frac{17}{2}g$ B) $\frac{17}{3}g$ C) $\frac{17}{4}g$ D) $\frac{17}{6}g$

246) If $f(x, y) = (3000e^y)/(1 + |x|/2)$ represents the population density of a planar region on Earth, where x and y are measured in miles, find the number of people within the rectangle $-9 \le x \le 9$ and $-2 \le y \le 0$. 246) ______

A) $6000(1 - e^{-2}) \ln \frac{11}{2} \approx 8844$ B) $12{,}000(1 - e^{-2}) \ln \frac{11}{2} \approx 17{,}688$

C) $6000(1 - e^{-2}) \ln 5 \approx 12{,}440$ D) $3000(1 - e^{-2}) \ln \frac{11}{2} \approx 4422$

Evaluate the integral by changing the order of integration in an appropriate way.

247) $\int_0^1 \int_0^8 \int_y^8 \frac{x \sin z}{z}\,dz\,dy\,dx$ 247) ______

A) $1 + \cos 8$ B) $\frac{1 + \sin 8}{2}$ C) $1 - \sin 8$ D) $\frac{1 - \cos 8}{2}$

Evaluate the improper integral.

248) $\int_0^{\infty} \int_0^{\infty} e^{-(10x + 9y)}\,dy\,dx$ 248) ______

A) $\frac{1}{90}$ B) $\frac{\pi}{180}$ C) $\frac{1}{180}$ D) $\frac{\pi}{90}$

Evaluate the integral.

249) $\displaystyle\int_0^{\ln 3}\int_{e^y}^{3} e^y \, dx \, dy$ 249) ______

A) 1 B) 8 C) 4 D) 2

250) $\displaystyle\int_0^{10\pi}\int_0^{13\pi} (\sin x + \cos y) \, dx \, dy$ 250) ______

A) 20π B) 11π C) 10π D) 21π

Set up the iterated integral for evaluating

$$\iiint_D f(r, \theta, z) \, dz \, r \, dr \, d\theta$$

over the given region D.

251) D is the right circular cylinder whose base is the circle $r = 2 \sin \theta$ in the xy–plane and whose top lies in the plane $z = 7 - y$. 251) ______

A) $\displaystyle\int_0^{2\pi}\int_0^{2\sin\theta}\int_0^{7 - r\sin\theta} f(r, \theta, z) \, dz \, r \, dr \, d\theta$

B) $\displaystyle\int_0^{2\pi}\int_0^{2\sin\theta}\int_0^{7 - \sin\theta} f(r, \theta, z) \, dz \, r \, dr \, d\theta$

C) $\displaystyle\int_0^{\pi}\int_0^{2\sin\theta}\int_0^{7 - r\sin\theta} f(r, \theta, z) \, dz \, r \, dr \, d\theta$

D) $\displaystyle\int_0^{\pi}\int_0^{2\sin\theta}\int_0^{7 - \sin\theta} f(r, \theta, z) \, dz \, r \, dr \, d\theta$

252) D is the rectangular solid whose base is the triangle with vertices at (0, 0), (0, 5), and (5, 5), and whose top lies in the plane $z = 8$. 252) ______

A) $\displaystyle\int_0^{\pi/2}\int_0^{5\csc\theta}\int_0^{8} f(r, \theta, z) \, dz \, r \, dr \, d\theta$

B) $\displaystyle\int_{\pi/4}^{\pi/2}\int_0^{5\sec\theta}\int_0^{8} f(r, \theta, z) \, dz \, r \, dr \, d\theta$

C) $\displaystyle\int_{\pi/4}^{\pi/2}\int_0^{5\csc\theta}\int_0^{8} f(r, \theta, z) \, dz \, r \, dr \, d\theta$

D) $\displaystyle\int_0^{\pi/2}\int_0^{5\sec\theta}\int_0^{8} f(r, \theta, z) \, dz \, r \, dr \, d\theta$

Solve the problem.

253) Evaluate 253) ______

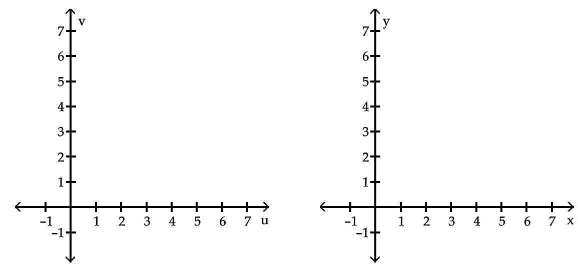
$$\int_0^{\infty} \frac{e^{-2x^2} - e^{-5x^2}}{x} \, dx$$

by writing the integrand as an integral.

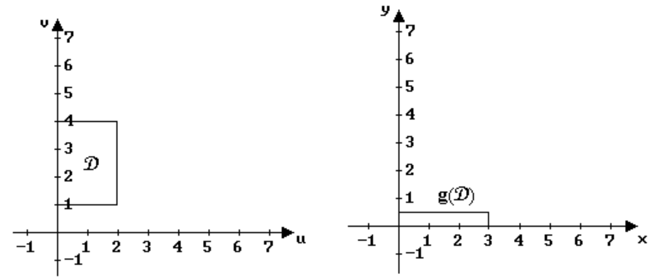
A) $\frac{1}{2} \ln \frac{2}{5}$ B) $\frac{1}{2} \ln \frac{5}{2}$ C) $\ln \frac{5}{2}$ D) $\ln \frac{2}{5}$

Sketch D and g(D) from the description of D and change of variables (x, y) = g(u, v).

254) $x = 3u$, $y = \frac{1}{2}v$ where D is the rectangle $0 \le u \le 2$, $1 \le v \le 4$ 254)



A)



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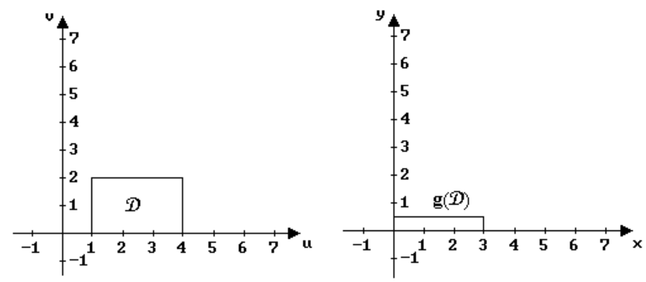

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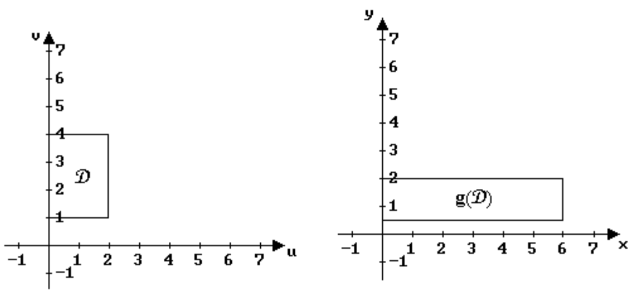
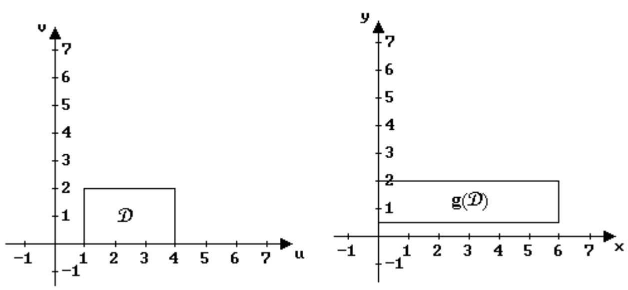


D)



Evaluate the integral.

255) $\int_0^1 \int_0^1 \int_0^1 (8x + 7y + 10z)\, dz\, dy\, dx$ 255) ______

A) 103 B) $\frac{25}{2}$ C) $\frac{25}{6}$ D) $\frac{25}{3}$

Evaluate the spherical coordinate integral.

256) $\int_0^{2\pi} \int_0^{\pi/4} \int_0^{4} (\rho^5 \cos \phi)\, \rho^2 \sin \phi\, d\rho\, d\phi\, d\theta$ 256) ______

A) $\frac{1.6e+09}{3}\pi$ B) 4096π C) 13436928π D) $\frac{2097152}{3}\pi$

Solve the problem.

257) For what value of a is the volume of the tetrahedron formed by the coordinate planes and the plane $\frac{x}{a} + \frac{y}{5} + \frac{z}{9} = 1$ equal to 8? 257) ______

A) $a = \frac{16}{15}$ B) $a = \frac{32}{45}$ C) $a = \frac{64}{45}$ D) $a = \frac{8}{15}$

258) Find the radius of gyration about the y-axis of a thin triangular plate bounded by the coordinate axes and the line $x + y = 10$ if $\delta(x, y) = x + y$. 258) ______

A) $\frac{10}{\sqrt{2}}$ B) $\frac{10}{\sqrt{3}}$ C) $\frac{10}{\sqrt{5}}$ D) $\frac{10}{\sqrt{6}}$

259) What region in the xy-plane maximizes the value of 259) ______

$$\iint_R (576 - 36x^2 - 16y^2)\, dA\ ?$$

A) The ellipse $36x^2 + 16y^2 = 1$ B) The ellipse $\frac{x^2}{16} + \frac{y^2}{36} = 1$

C) The ellipse $\frac{x^2}{36} + \frac{y^2}{16} = 1$ D) The ellipse $16x^2 + 36y^2 = 576$

260) Find the centroid of the infinite region in the first quadrant bounded by the coordinate axes and the curve $y = e^{-5x}$. 260) ______

A) $\bar{x} = \frac{1}{5}, \bar{y} = \frac{1}{2}$ B) $\bar{x} = \frac{1}{10}, \bar{y} = \frac{1}{2}$ C) $\bar{x} = \frac{1}{5}, \bar{y} = \frac{1}{4}$ D) $\bar{x} = \frac{1}{10}, \bar{y} = \frac{1}{4}$

Express the area of the region bounded by the given line(s) and/or curve(s) as an iterated double integral.

261) The curves $y = x(x - 6)$ and $y = x(x - 6)(x - 10)$ 261) ______

A) $\int_6^{10} \int_{x(x-6)}^{x(x-10)} dy\, dx$ B) $\int_6^{10} \int_{x(x-6)}^{x(x-6)(x-10)} dy\, dx$

C) $\int_0^{6} \int_{x(x-6)}^{x(x-10)} dy\, dx$ D) $\int_0^{6} \int_{x(x-6)}^{x(x-6)(x-10)} dy\, dx$

262) The coordinate axes and the line $x + y = 5$ 262) ______

A) $\int_{-5}^{5} \int_{x}^{5} dy\, dx$ B) $\int_0^{5} \int_0^{5-x} dy\, dx$

C) $\int_0^{5} \int_5^{x} dy\, dx$ D) $\int_{-5}^{5} \int_0^{5-x} dy\, dx$

Solve the problem.

263) Let D be the smaller cap cut from a solid ball of radius 8 units by a plane 7 units from the center of the sphere. Set up the triple integral for the volume of D in cylindrical coordinates. 263) ______

A) $\int_0^{2\pi} \int_0^{\sqrt{113}} \int_7^{\sqrt{64 - r^2}} r\, dz\, dr\, d\theta$ B) $\int_0^{2\pi} \int_0^{\sqrt{15}} \int_8^{\sqrt{49 - r^2}} r\, dz\, dr\, d\theta$

C) $\int_0^{2\pi} \int_0^{\sqrt{15}} \int_7^{\sqrt{64 - r^2}} r\, dz\, dr\, d\theta$ D) $\int_0^{2\pi} \int_0^{\sqrt{113}} \int_8^{\sqrt{49 - r^2}} r\, dz\, dr\, d\theta$

264) Find the radius of gyration about the z–axis of a thick–walled right circular cylinder bounded on the inside by the cylinder r = 1, on the outside by the cylinder r =6, and on the top and bottom by the planes z = 7 and z = 11. 264) ______

A) $\frac{1295}{71}$ B) $\sqrt{\frac{1295}{71}}$ C) 2590π D) $\sqrt{\frac{37}{2}}$

Evaluate the integral by changing the order of integration in an appropriate way.

265) $\int_0^4 \int_y^4 \int_0^\pi \frac{\sin z \sin x}{x}\, dz\, dx\, dy$ 265) ______

A) $2(1 + \sin 4)$ B) $2 \cos 4$ C) $2(1 - \cos 4)$ D) $2 \sin 4$

Solve the problem.

266) Set up the triple integral for the volume of the sphere $\rho = 2$ in spherical coordinates. 266) ______

A) $\int_0^{2\pi} \int_0^{\pi} \int_0^{2} \rho^2 \sin \phi\, d\rho\, d\phi\, d\theta$ B) $\int_0^{2\pi} \int_0^{\pi/2} \int_0^{2} d\rho\, d\phi\, d\theta$

C) $\int_0^{2\pi} \int_0^{\pi} \int_0^{2} d\rho\, d\phi\, d\theta$ D) $\int_0^{2\pi} \int_0^{\pi/2} \int_0^{2} \rho^2 \sin \phi\, d\rho\, d\phi\, d\theta$

267) Find the radius of gyration R_x of the region of constant density bounded by the paraboloid $z = 100 - x^2 - y^2$ and the xy–plane. 267) ______

A) $\frac{10}{3}\sqrt{606}$ B) $\frac{5}{2}\sqrt{606}$ C) $\frac{10}{9}\sqrt{606}$ D) $\frac{5}{3}\sqrt{606}$

Evaluate the integral.

268) $\int_9^{10} \int_0^{\pi/2} \int_0^{\pi/2} \rho \sin \phi\, d\theta\, d\phi\, d\rho$ 268) ______

A) $\frac{19}{6}\pi$ B) $\frac{19}{6}$ C) $\frac{19}{4}\pi$ D) $\frac{19}{4}$

Find the area of the region specified by the integral(s).

269) $\int_0^8 \int_0^{10(1 - x/8)} dy\, dx$ 269) ______

A) 5 B) 4 C) $\frac{160}{3}$ D) 40

Use a spherical coordinate integral to find the volume of the given solid.

270) The solid bounded below by the hemisphere $\rho = 1$, $z \geq 0$, and above by the cardioid of revolution $\rho = 8 + 7 \cos \phi$ 270) ______

A) $\frac{6643}{9}\pi$ B) $\frac{6643}{8}\pi$ C) $\frac{6643}{10}\pi$ D) $\frac{6643}{6}\pi$

Evaluate the improper integral.

271) $\int_2^6 \int_1^{101} \frac{dx\, dy}{\sqrt{(x - 1)(y - 2)}}$ 271) ______

A) 100 B) 60 C) 80 D) 120

Evaluate the integral.

272) $\int_0^{10} \int_0^{2} (x + y)\, dx\, dy$ 272) ______

A) 6 B) 960 C) 120 D) 48

Evaluate the integral by changing the order of integration in an appropriate way.

273) $\int_0^{216} \int_{\sqrt[3]{z}}^{6} \int_1^{1297} \frac{1}{x(y^4 + 1)}\, dx\, dy\, dz$ 273) ______

A) $\frac{\ln^2 1297}{4}$ B) $\frac{\ln 1297}{2}$ C) $\frac{\ln 1297}{4}$ D) $\frac{\ln^2 1297}{2}$

Solve the problem.

274) Evaluate 274) ______

$$\iiint_R (5x + y - z)(z - x + 6y)(x - y + 10z)\, dV$$

where R is the parallelepiped enclosed by the planes $5x + y - z = 1$, $5x + y - z = 3$, $-x + 6y + z = -2$, $-x + 6y + z = 5$, $x - y + 10z = -1$, $x - y + 10z = 6$.

A) $\frac{243}{107}$ B) $\frac{676}{321}$ C) $\frac{240}{107}$ D) $\frac{245}{107}$

Change the Cartesian integral to an equivalent polar integral, and then evaluate.

275) $\int_0^{11} \int_0^{\sqrt{121 - y^2}} (x^2 + y^2)\, dx\, dy$ 275) ______

A) $\frac{14,641\pi}{8}$ B) $\frac{121\pi}{8}$ C) $\frac{1331\pi}{4}$ D) $\frac{1331\pi}{8}$

Find the volume of the indicated region.

276) The region bounded by the cylinder $x^2 + y^2 = 16$ and the planes $z = 0$ and $x + z = 5$ 276) ______

A) 400π B) 80π C) 100π D) 20π

Evaluate the integral.

277) $\int_5^{8} \int_5^{10} \int_0^{6r} r\, d\theta\, dz\, dr$ 277) ______

A) $\frac{5805}{4}$ B) 3870 C) 1935 D) $\frac{5805}{2}$

Set up the iterated integral for evaluating

$$\iiint_D f(r, \theta, z)\, dz\, r\, dr\, d\theta$$

over the given region D.

278) D is the solid right cylinder whose base is the region in the xy–plane that lies inside the cardioid $r = 10 + 3\cos\theta$ and outside the circle $r = 7$, and whose top lies in the plane $z = 9$. 278) ______

A) $\int_0^{\pi}\int_0^{10+3\cos\theta}\int_0^{9} f(r, \theta, z)\, dz\, r\, dr\, d\theta$

B) $\int_0^{2\pi}\int_7^{10+3\cos\theta}\int_0^{9} f(r, \theta, z)\, dz\, r\, dr\, d\theta$

C) $\int_0^{\pi}\int_7^{10+3\cos\theta}\int_0^{9} f(r, \theta, z)\, dz\, r\, dr\, d\theta$

D) $\int_0^{2\pi}\int_0^{10+3\cos\theta}\int_0^{9} f(r, \theta, z)\, dz\, r\, dr\, d\theta$

Use the given transformation to evaluate the integral.

279) $x = 10u,\ y = 5v,\ z = 6w$; 279) ______

$$\iiint_R (x^2 + y^2 + z^2)\, dx\, dy\, dz,$$

where R is the interior of the ellipsoid $\frac{x^2}{100} + \frac{y^2}{25} + \frac{z^2}{36} = 1$

A) 120π B) 180π C) 200π D) 240π

Evaluate the integral.

280) $\int_0^{\pi/4}\int_0^{3}\int_0^{2\pi} (\rho^3\cos\phi)\,\rho^2\sin\phi\, d\theta\, d\rho\, d\phi$ 280) ______

A) $\frac{243}{4}\pi$ B) 2592π C) $\frac{1265625}{4}\pi$ D) $\frac{177147}{8}\pi$

Solve the problem.

281) Find the centroid of the region enclosed by the curve $r = 7 + 2\cos\theta$. 281) ______

A) $\bar{x} = \frac{100}{51}, \bar{y} = 0$ B) $\bar{x} = \frac{50}{51}, \bar{y} = 0$ C) $\bar{x} = \frac{52}{51}, \bar{y} = 0$ D) $\bar{x} = \frac{104}{51}, \bar{y} = 0$

Find the average value of F(x, y, z) over the given region.

282) $F(x, y, z) = x^9 y^7 z^8$ over the cube in the first octant bounded by the coordinate planes and the planes $x = 1, y = 1, z = 1$ 282) ______

A) $\frac{1}{191}$ B) $\frac{1}{720}$ C) $\frac{1}{504}$ D) $\frac{1}{695}$

Solve the problem.

283) Find the mass of the solid in the first octant between the spheres $x^2 + y^2 + z^2 = 36$ and $x^2 + y^2 + z^2 = 64$ if the density at any point is inversely proportional to its distance from the origin. 283) ______

A) $\frac{28}{3}k\pi$ B) $7k\pi$ C) $\frac{14}{3}k\pi$ D) $56k\pi$

284) Find the center of mass of the upper half of a solid ball of radius 5 centered at the origin if the density at any point is proportional to the distance from that point to the z–axis. 284) ______

A) $(\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{5}{8}\pi\right)$ B) $(\bar{x}, \bar{y}, \bar{z}) = (0, 0, 2)$

C) $(\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{5}{8}(1 + \sqrt{2})\right)$ D) $(\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{16}{3}\frac{1}{\pi}\right)$

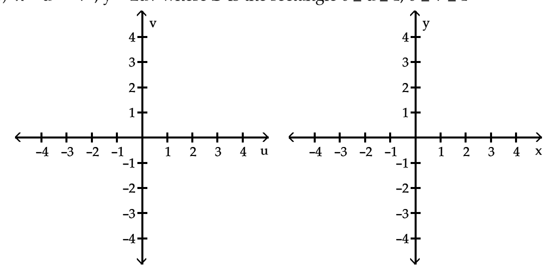
Find the volume of the indicated region.

285) The region bounded below by the xy–plane, laterally by the cylinder $r = 5\sin\theta$, and above by the plane $z = 9 - x$ 285) ______

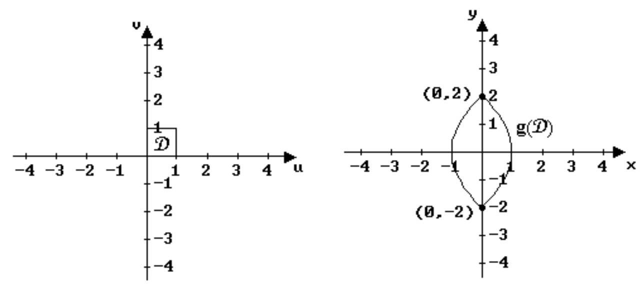
A) $\frac{45}{4}\pi$ B) $\frac{2025}{4}\pi$ C) $\frac{225}{4}\pi$ D) $\frac{405}{4}\pi$

Sketch D and g(D) from the description of D and change of variables (x, y) = g(u, v).

286) $x = u^2 - v^2,\ y = 2uv$ where D is the rectangle $0 \le u \le 1, 0 \le v \le 1$ 286)



A)



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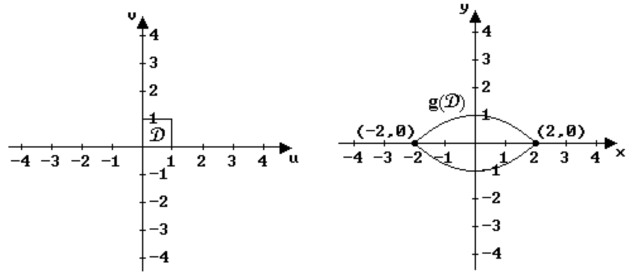
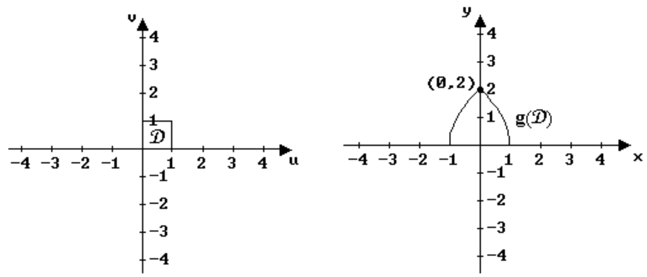
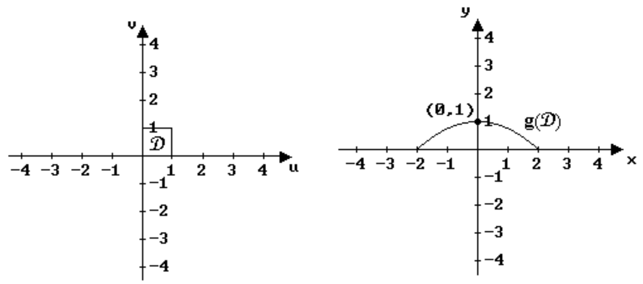


C)



D)



Evaluate the integral by changing the order of integration in an appropriate way.

287) $\displaystyle\int_1^7 \int_0^{400} \int_{\sqrt{y/4}}^{10} \frac{\sin x^2}{xz}\, dx\, dy\, dz$ 287) ______

A) 2 ln 7 (1 − cos 100) B) 1 ln 7 (1 − sin 100)
C) 2 ln 7 (1 − sin 100) D) 1 ln 7 (1 − cos 100)

Evaluate the improper integral.

288) $\displaystyle\int_0^9 \int_0^{81} \frac{dx\, dy}{\sqrt{xy}}$ 288) ______

A) 36 B) 12 C) 108 D) 162

Find the area of the region specified by the integral(s).

289) $\displaystyle\int_0^2 \int_0^{2-x} dy\, dx$ 289) ______

A) $\frac{2}{3}$ B) 2 C) $\frac{4}{3}$ D) 1

Find the area of the region specified in polar coordinates.

290) The region enclosed by the curve $r = 3 \sin 2\theta$ 290) ______

A) $\frac{3}{2}\pi$ B) $\frac{9}{2}\pi$ C) $\frac{9}{4}\pi$ D) $\frac{9}{8}\pi$

Solve the problem.

291) Find the moment of inertia about the origin of a thin disk bounded by the circle $r = 5 \sin \theta$ if the disk's density is given by $\delta(x, y) = r^2$. 291) ______

A) $\frac{78125}{48}\pi$ B) $\frac{15625}{32}\pi$ C) $\frac{15625}{16}\pi$ D) $\frac{78125}{96}\pi$

Express the area of the region bounded by the given line(s) and/or curve(s) as an iterated double integral.

292) The curve $y = \ln x$ and the lines $x = 6$ and $y = 0$ 292) ______

A) $\displaystyle\int_0^6 \int_0^{\ln x} dx\, dy$ B) $\displaystyle\int_0^6 \int_{-6}^{\ln y} dx\, dy$

C) $\displaystyle\int_0^6 \int_{-6}^{\ln x} dy\, dx$ D) $\displaystyle\int_0^6 \int_0^{\ln x} dy\, dx$

293) The curve $y = e^x$ and the lines $x + y = 8$ and $x = 8$ 293) ______

A) $\displaystyle\int_0^8 \int_8^{e^x - x} dy\, dx$ B) $\displaystyle\int_0^8 \int_{8-x}^{e^x} dy\, dx$

C) $\displaystyle\int_0^8 \int_x^{e^x - x} dy\, dx$ D) $\displaystyle\int_0^8 \int_{x-8}^{e^x} dy\, dx$

Evaluate the integral.

294) $\int_3^9 \int_{-10}^6 3x\, dy\, dx$ 294) ______

A) -2304 B) -864 C) 1728 D) -576

Express the area of the region bounded by the given line(s) and/or curve(s) as an iterated double integral.

295) The parabola $x = y^2$ and the line $y = \frac{x}{3} - \frac{70}{3}$ 295) ______

A) $\int_7^{10} \int_{y^2}^{3y+70} dx\, dy$ B) $\int_{-7}^{10} \int_0^{3y+70} dx\, dy$

C) $\int_7^{10} \int_0^{3y+70} dx\, dy$ D) $\int_{-7}^{10} \int_{y^2}^{3y+70} dx\, dy$

Solve the problem.

296) Find the center of mass of the hemisphere $z = 4 - x^2 - y^2$ if the density is proportional to the distance from the center. 296) ______

A) $\left(0, 0, \frac{16}{15}\right)$ B) $\left(0, 0, \frac{4}{5}\right)$ C) $\left(0, 0, \frac{6}{5}\right)$ D) $\left(0, 0, \frac{14}{15}\right)$

297) Find the average distance from a point $P(x, y)$ in the first two quadrants of the disk $x^2 + y^2 \le 81$ to the origin. 297) ______

A) $\frac{9}{4}$ B) 6 C) $\frac{9}{2}$ D) 3

298) Find the moment of inertia about the y-axis of the thin semicircular region of constant density $\delta = 5$ bounded by the x-axis and the curve $y = \sqrt{16 - x^2}$. 298) ______

A) $\frac{1280}{3}\pi$ B) 160π C) $\frac{640}{3}\pi$ D) 320π

299) Let R be a thin triangular region cut off from the first quadrant by the line $x + y = 10$. If the density of R is given by $\delta(x, y) = ax + \frac{y}{a}$ where $a > 0$, for what value of a will the moment of inertia of R about the origin be a minimum? 299) ______

A) $\frac{1}{10}$ B) 1 C) 10 D) $\frac{2}{3}$

Provide an appropriate response.

300) What does the graph of the equation $\phi = \frac{\pi}{2}$ look like? 300) ______

A) The xz-plane B) The z-axis C) The xy-plane D) The y-axis

Evaluate the cylindrical coordinate integral.

301) $\int_0^{\pi} \int_0^4 \int_0^{6/r} \sin\theta\, dz\, r\, dr\, d\theta$ 301) ______

A) 72π B) 24π C) 72 D) 48

Find the Jacobian $\frac{\partial(x, y)}{\partial(u, v)}$ or $\frac{\partial(x, y, z)}{\partial(u, v, w)}$ (as appropriate) using the given equations.

302) $u = -4x - 3,\ v = -2y + 3,\ w = 3z + 1$ 302) ______

A) $-\frac{1}{9}$ B) -9 C) $\frac{1}{24}$ D) 24

Solve the problem.

303) Find the moment of inertia about the x-axis of the region enclosed by the curve $r = 10 + 8 \sin\theta$ if $\delta(x, y) = 7$. 303) ______

A) 74172π B) 72380π C) 49980π D) 66780π

Find the average value of the function f over the region R.

304) $f(x, y) = \sin \frac{3}{2}(x + y)$ 304) ______

R: $0 \le x \le \frac{\pi}{3},\ 0 \le y \le \frac{\pi}{3}$

A) $\frac{6}{\pi^2}$ B) π^2 C) $4\pi^2$ D) $\frac{8}{\pi^2}$

Find the average value of F(x, y, z) over the given region.

305) $F(x, y, z) = 8x$ over the cube in the first octant bounded by the coordinate planes and the planes $x = 7, y = 7, z = 7$ 305) ______

A) 1568 B) 28 C) 224 D) 196

Find the average value of the function f over the region R.

306) $f(x, y) = 9x + 6y$ 306) ______

R: $0 \le x \le 1,\ 0 \le y \le 1$

A) 15 B) $\frac{21}{2}$ C) 12 D) $\frac{15}{2}$

307) $f(x, y) = e^{10x}$ 307) ______

R: $0 \le x \le \frac{1}{10},\ 0 \le y \le \frac{1}{10}$

A) $2e - 1$ B) $\frac{2e - 1}{100}$ C) $\frac{e - 1}{10}$ D) $e - 1$

Find the Jacobian $\frac{\partial(x, y)}{\partial(u, v)}$ or $\frac{\partial(x, y, z)}{\partial(u, v, w)}$ (as appropriate) using the given equations.

308) $x = 6u \cos 3v,\ y = 6u \sin 3v,\ z = 2w$ 308) ______

A) $108v$ B) $216v$ C) $216u$ D) $108u$

Solve the problem.

309) Evaluate 309) ______

$$\int_0^\infty \frac{\sin ax}{x}\,dx,\ a > 0$$

by integrating

$$\int_0^\infty \int_0^\infty e^{-xy} \sin ax\,dA.$$

A) $\frac{\pi a}{3}$ B) $\frac{\pi a}{6}$ C) $\frac{\pi a}{4}$ D) $\frac{\pi}{2}$

Find the volume of the indicated region.

310) The region bounded by the coordinate planes, the parabolic cylinder $z = 16 - x^2$, and the plane $y = 6$ 310) ______

A) 768 B) 288 C) 256 D) 576

Evaluate the integral by changing the order of integration in an appropriate way.

311) $\int_0^{\pi/4} \int_0^{35} \int_{z/7}^{5} \frac{\tan x \tan y}{y}\,dy\,dz\,dx$ 311) ______

A) $-\frac{7}{2}\ln 2 \ln \cos 5$ B) $7 \ln 2 \ln \cos 5$ C) $-7 \ln 2 \ln \cos 5$ D) $\frac{7}{2}\ln 2 \ln \cos 5$

Find the average value of the function f over the region R.

312) $f(x, y) = 7x + 10y$ 312) ______

R is the region bounded by the coordinate axes and the lines $x + y = 2$ and $x + y = 10$.

A) $\frac{527}{12}$ B) $\frac{527}{24}$ C) $\frac{527}{18}$ D) $\frac{527}{9}$

Evaluate the integral.

313) $\int_2^8 \int_8^9 \int_0^{2r} r\,d\theta\,dr\,dz$ 313) ______

A) $\frac{6076}{3}$ B) 4340 C) 868 D) $\frac{9548}{3}$

Use a CAS integration utility to evaluate the triple integral of the given function over the specified solid region.

314) $F(x, y, z) = 5x - 3y + 2z$ over the rectangular solid $0 \le x \le 6, 0 \le y \le 4, 0 \le z \le 7$ 314) ______

A) 8064 B) 2688 C) 1344 D) 1792

Evaluate the integral.

315) $\int_0^8 \int_0^{4(1 - z/8)} \int_0^{2(1 - y/4 - z/8)} dx\,dy\,dz$ 315) ______

A) 8 B) $\frac{32}{3}$ C) $\frac{64}{3}$ D) 16

Use the given transformation to evaluate the integral.

316) $u = y - x,\ v = y + x;$ 316) ______

$$\iint_R \cosh\left(\frac{y - x}{y + x}\right) dx\,dy,$$

where R is the trapezoid with vertices at (6, 0), (7, 0), (0, 6), (0, 7)

A) $\frac{13(e^2 - 1)}{2e}$ B) $\frac{13(e^2 - 1)}{3e}$ C) $\frac{13(e^2 - 1)}{4e}$ D) $\frac{13(e^2 - 1)}{6e}$

Find the average value of the function f over the region R.

317) $f(x, y) = 9x + 4y$ 317) ______

R: $0 \le x \le 7, 0 \le y \le 6$

A) $\frac{87}{2}$ B) $\frac{63}{2}$ C) $\frac{67}{2}$ D) $\frac{69}{2}$

Solve the problem.

318) Write an iterated triple integral in the order dz dy dx for the volume of the rectangular solid in the first octant bounded by the planes $x = 6$, $y = 2$, and $z = 7$. 318) ______

A) $\int_0^6 \int_0^2 \int_0^7 dz\,dy\,dx$ B) $\int_0^6 \int_0^{2-x} \int_0^{7-y-x} dz\,dy\,dx$

C) $\int_0^7 \int_0^2 \int_0^6 dz\,dy\,dx$ D) $\int_0^7 \int_0^{2-x} \int_0^{6-y-x} dz\,dy\,dx$

Find the volume of the indicated region.

319) The region enclosed by the sphere $x^2 + y^2 + z^2 = 64$ and the cylinder $(x - 4)^2 + y^2 = 16$ 319) ______

A) $\frac{1024}{9}(3\pi - 4)$ B) $\frac{256}{3}(3\pi - 4)$ C) $\frac{1024}{3}(3\pi - 4)$ D) $\frac{320}{3}(3\pi - 4)$

Evaluate the integral.

320) $\int_{-4}^{7} \int_{-1}^{2} 2y\,dx\,dy$ 320) ______

A) 33 B) 99 C) -363 D) -99

Find the volume of the indicated region.

321) The region under the surface $z = x^2 + y^4$, and bounded by the planes $x = 0$ and $y = 100$ and the cylinder $y = x^2$ 321) ______

A) $\frac{6.000044e+10}{33}$ B) $\frac{6.00044e+09}{33}$ C) $\frac{6.0000044e+11}{33}$ D) $\frac{600440000}{33}$

Provide an appropriate response.

322) What form do planes perpendicular to the y-axis have in cylindrical coordinates? 322) ______

A) $r = a \csc \theta$ B) $r = a \sec \theta$ C) $r = a \sin \theta$ D) $r = a \cos \theta$

Find the area of the region specified in polar coordinates.

323) The region enclosed by the curve $r = 10 - 7 \cos \theta$ 323) ______

A) $\frac{149}{7}\pi$ B) $\frac{198}{7}\pi$ C) $\frac{249}{7}\pi$ D) 149π

Solve the problem.

324) Find the moment of inertia about the x-axis of a thin triangular plate bounded by the coordinate axes and the line $x + y = 10$ if $\delta(x, y) = x + y$. 324) ______

A) 10000 B) $\frac{20000}{3}$ C) $\frac{100000}{9}$ D) 20000

325) Integrate $f(x, y) = \sin(x^2 + y^2)$ over the region $0 \le x^2 + y^2 \le 4$. 325) ______

A) $\pi(1 - \cos 4)$ B) $2\pi(1 - \cos^2 2)$ C) $\pi(1 - \cos^2 2)$ D) $2\pi(1 - \cos 4)$

Evaluate the spherical coordinate integral.

326) $\displaystyle\int_0^{\pi/2}\int_0^{\pi/3}\int_{4\sec\phi}^{5\sec\phi} \rho^3 \sin\phi\cos\phi \, d\rho\, d\phi\, d\theta$ 326) ______

A) $\frac{1845}{8}\pi$ B) $\frac{1107}{8}\pi$ C) $\frac{1845}{16}\pi$ D) $\frac{1107}{16}\pi$

Find the Jacobian $\frac{\partial(x, y)}{\partial(u, v)}$ or $\frac{\partial(x, y, z)}{\partial(u, v, w)}$ (as appropriate) using the given equations.

327) $x = 5u + 3$, $y = -4v - 5$, $z = -3w + 1$ 327) ______

A) -900 B) 60 C) -15 D) 15

Solve the problem.

328) Find the center of mass of the region of density $\delta(x, y, z) = \frac{1}{64 - x^2 - y^2}$ bounded by the paraboloid $z = 64 - x^2 - y^2$ and the xy-plane. 328) ______

A) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{1}{2}$ B) $\bar{x} = 0, \bar{y} = 0, \bar{z} = 8$

C) $\bar{x} = 0, \bar{y} = 0, \bar{z} = 4$ D) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{8}{3}$

329) Find the moment of inertia I_y of the region of constant density $\delta(x, y, z) = 1$ bounded by the paraboloid $z = 9 - x^2 - y^2$ and the xy-plane. 329) ______

A) $\frac{135}{2}\pi$ B) 810π C) $\frac{1215}{2}\pi$ D) $\frac{405}{2}\pi$

330) Find the average height of the part of the paraboloid $z = 36 - x^2 - y^2$ that lies above the xy-plane. 330) ______

A) 54 B) 12 C) 18 D) 90

Find the volume of the indicated region.

331) The region inside the solid sphere $\rho \le 9$ that lies between the cones $\phi = \frac{\pi}{3}$ and $\phi = \frac{\pi}{2}$ 331) ______

A) $\frac{729}{2}\pi$ B) $\frac{243}{2}\pi$ C) 243π D) $\frac{729}{4}\pi$

Evaluate the integral by changing the order of integration in an appropriate way.

332) $\displaystyle\int_0^{\infty}\int_0^{45}\int_{y/5}^{9} e^{-(x^2 + z)}\, dx\, dy\, dz$ 332) ______

A) $\frac{5}{4}\left(1 - e^{-90}\right)$ B) $\frac{5}{2}\left(1 - e^{-90}\right)$ C) $\frac{5}{4}\left(1 - e^{-81}\right)$ D) $\frac{5}{2}\left(1 - e^{-81}\right)$

Solve the problem.

333) Let D be the region bounded below by the xy-plane, above by the sphere $x^2 + y^2 + z^2 = 36$, and on the sides by the cylinder $x^2 + y^2 = 16$. Set up the triple integral in cylindrical coordinates that gives the volume of D using the order of integration dz dr dθ. 333) ______

A) $\displaystyle\int_0^{2\pi}\int_0^{4}\int_0^{\sqrt{36 - z^2}} r\, dz\, dr\, d\theta$ B) $\displaystyle\int_0^{2\pi}\int_0^{4}\int_0^{\sqrt{36 - r^2}} r\, dz\, dr\, d\theta$

C) $\displaystyle\int_0^{2\pi}\int_0^{6}\int_0^{\sqrt{16 - z^2}} r\, dz\, dr\, d\theta$ D) $\displaystyle\int_0^{2\pi}\int_0^{6}\int_0^{\sqrt{16 - r^2}} r\, dz\, dr\, d\theta$

Write an equivalent double integral with the order of integration reversed.

334) $\displaystyle\int_0^{\pi/2}\int_0^{\sin x} (10x + 8y)\, dy\, dx$ 334) ______

A) $\displaystyle\int_0^{\pi/2}\int_{\sin^{-1} y}^{1} (10x + 8y)\, dx\, dy$ B) $\displaystyle\int_0^{1}\int_{\pi/2}^{\sin^{-1} y} (10x + 8y)\, dx\, dy$

C) $\displaystyle\int_0^{1}\int_{\sin^{-1} y}^{\pi/2} (10x + 8y)\, dx\, dy$ D) $\displaystyle\int_0^{1}\int_0^{\sin^{-1} y} (10x + 8y)\, dx\, dy$

Solve the problem.

335) Find the moment of inertia about the y-axis of a thin infinite region in the first quadrant bounded by the coordinate axes and the curve $y = e^{-8x}$ if $\delta(x, y) = xy$. 335) ______

A) $\frac{3}{20480}$ B) $\frac{3}{65536}$ C) $\frac{5}{65536}$ D) $\frac{3}{8192}$

Evaluate the cylindrical coordinate integral.

336) $\displaystyle\int_0^{\pi/2}\int_0^{\cos^2\theta}\int_{6r^4}^{10r^4} z\sin\theta\, dz\, r\, dr\, d\theta$ 336) ______

A) $\frac{22}{35}$ B) $\frac{41}{105}$ C) $\frac{16}{105}$ D) $\frac{1}{9}$

Solve the problem.

337) Write an iterated triple integral in the order dx dy dz for the volume of the tetrahedron cut from the first octant by the plane $\frac{x}{3} + \frac{y}{5} + \frac{z}{4} = 1$. 337) ______

A) $\int_0^4 \int_0^{3(1-y/5)} \int_0^{3(1-y/5-z/4)} dx\,dy\,dz$

B) $\int_0^4 \int_0^{1-y/5} \int_0^{1-y/5-z/4} dx\,dy\,dz$

C) $\int_0^4 \int_0^{5(1-z/4)} \int_0^{3(1-y/5-z/4)} dx\,dy\,dz$

D) $\int_0^4 \int_0^{1-z/4} \int_0^{1-y/5-z/4} dx\,dy\,dz$

Evaluate the integral.

338) $\int_{-5}^{0} \int_{-2}^{0} (9x - 6y)\,dy\,dx$ 338) ______

A) $-\frac{33}{2}$ B) -165 C) -33 D) $-\frac{165}{2}$

339) $\int_0^2 \int_{-1}^{y^2} \int_5^z yz\,dx\,dz\,dy$ 339) ______

A) $-\frac{61}{3}$ B) $-\frac{128}{3}$ C) $\frac{68}{3}$ D) $\frac{23}{3}$

Evaluate the integral by changing the order of integration in an appropriate way.

340) $\int_0^2 \int_1^2 \int_{\sqrt{x/2}}^{1} \frac{e^{y^3}}{z}\,dy\,dz\,dx$ 340) ______

A) $\frac{2}{3}\ln 3\,(e - 1)$ B) $1 \ln 2\,(e - 1)$ C) $1 \ln 3\,(e - 1)$ D) $\frac{2}{3}\ln 2\,(e - 1)$

Evaluate the improper integral.

341) $\int_0^{81} \int_0^{81} \frac{dy\,dx}{\sqrt{x} + \sqrt{y}}$ 341) ______

A) $108(1 - \ln 2)$ B) $216(1 - \ln 2)$ C) $972(1 - \ln 2)$ D) $1944(1 - \ln 2)$

Find the volume of the indicated region.

342) The region bounded by the paraboloid $z = 16 - x^2 - y^2$ and the xy–plane 342) ______

A) 32π B) 128π C) $\frac{64}{3}\pi$ D) $\frac{256}{3}\pi$

Evaluate the improper integral.

343) $\int_1^{10} \int_0^{\infty} \frac{1}{x(y^2 + 1)}\,dy\,dx$ 343) ______

A) $\frac{\ln 10}{2}$ B) $\frac{\ln 10}{3}$ C) $\frac{(\ln 10)\pi}{2}$ D) $\frac{(\ln 10)\pi}{3}$

Change the Cartesian integral to an equivalent polar integral, and then evaluate.

344) $\int_{-10}^{10} \int_{-\sqrt{100 - x^2}}^{\sqrt{100 - x^2}} \frac{1}{(1 + x^2 + y^2)^2}\,dy\,dx$ 344) ______

A) $\frac{100}{101}\pi$ B) $\frac{400}{101}\pi$ C) $\frac{100}{201}\pi$ D) $\frac{200}{101}\pi$

Solve the problem.

345) Evaluate 345) ______

$$\int_0^{\infty} \int_0^{\infty} \frac{1}{(1 + x^2 + y^2)^7}\,dx\,dy.$$

A) $\frac{\pi}{6}$ B) $\frac{\pi}{24}$ C) $\frac{\pi}{32}$ D) $\frac{\pi}{8}$

Find the average value of F(x, y, z) over the given region.

346) $F(x, y, z) = xyz$ over the rectangular solid in the first octant bounded by the coordinate planes and the planes $x = 4$, $y = 10$, $z = 5$ 346) ______

A) 25 B) $\frac{25}{2}$ C) $\frac{100}{9}$ D) $\frac{50}{3}$

Solve the problem.

347) Find the center of mass of a tetrahedron of density $\delta(x, y, z) = x + y + z$ bounded by the coordinate planes and the plane $\frac{x}{5} + \frac{y}{8} + \frac{z}{6} = 1$. 347) ______

A) $\bar{x} = \frac{30}{19}, \bar{y} = \frac{54}{19}, \bar{z} = \frac{75}{38}$ B) $\bar{x} = \frac{40}{19}, \bar{y} = \frac{72}{19}, \bar{z} = \frac{50}{19}$

C) $\bar{x} = \frac{24}{19}, \bar{y} = \frac{216}{95}, \bar{z} = \frac{30}{19}$ D) $\bar{x} = \frac{20}{19}, \bar{y} = \frac{36}{19}, \bar{z} = \frac{25}{19}$

Find the average value of the function over the region.

348) $f(\rho, \phi, \theta) = \rho$ over the "ice cream cone" cut from the solid sphere $p \le 6$ by the cone $\phi = \pi/3$ 348) ______

A) $\frac{2}{9}$ B) $\frac{1}{8}$ C) 324π D) $\frac{9}{2}$

Find the volume of the indicated region.

349) The region that lies under the plane $\frac{x}{2} + \frac{y}{6} + \frac{z}{7} = 1$ and above the square $0 \le x, y \le \frac{3}{2}$ 349) ______

A) $\frac{63}{8}$ B) $\frac{147}{16}$ C) $\frac{441}{8}$ D) $\frac{441}{16}$

Use a spherical coordinate integral to find the volume of the given solid.

350) The solid between the spheres $\rho = 3\cos\phi$ and $\rho = 5\cos\phi$ 350) ______

A) $\frac{49}{2}\pi$ B) $\frac{98}{3}\pi$ C) $\frac{49}{3}\pi$ D) 49π

Evaluate the cylindrical coordinate integral.

351) $\int_0^{6\pi}\int_0^{10}\int_r^{2r} dz\ r\ dr\ d\theta$ 351) ______

A) 2000π B) 200π C) 40000π D) 20000π

Solve the problem.

352) Let R be a thin triangular region cut off from the first quadrant by the line $x + y = 12$. If the density of R is given by $\delta(x, y) = ax + \frac{y}{a}$ where $a > 0$, for what value of a will the moment of inertia of R about the x-axis be a minimum? 352) ______

A) $\frac{1}{\sqrt{3}}$ B) $\sqrt{3}$ C) $\frac{1}{\sqrt{12}}$ D) $\sqrt{12}$

Use a CAS integration utility to evaluate the triple integral of the given function over the specified solid region.

353) $F(x, y, z) = x^2 y^4 z^2$ over the cylinder bounded by $x^2 + y^2 \le 16$ and the planes $z = -6$, $z = -4$ 353) ______

A) $\frac{622592}{13}\pi$ B) $\frac{2490368}{59}\pi$ C) $\frac{2490368}{49}\pi$ D) $\frac{155648}{3}\pi$

Express the area of the region bounded by the given line(s) and/or curve(s) as an iterated double integral.

354) The coordinate axes and the line $\frac{x}{5} + \frac{y}{4} = 1$ 354) ______

A) $\int_0^5\int_{y/4}^5 dx\ dy$ B) $\int_0^5\int_{y/5}^4 dx\ dy$

C) $\int_0^5\int_{x/5}^4 dy\ dx$ D) $\int_0^5\int_0^{4(1 - x/5)} dy\ dx$

Solve the problem.

355) Find the mass of a tetrahedron of density $\delta(x, y, z) = x + y + z$ bounded by the coordinate planes and the plane $\frac{x}{9} + \frac{y}{7} + \frac{z}{2} = 1$. 355) ______

A) $\frac{756}{5}$ B) $\frac{567}{5}$ C) 126 D) $\frac{189}{2}$

Find the volume of the indicated region.

356) The region bounded above by the sphere $x^2 + y^2 + z^2 = 36$ and below by the cone $z = \sqrt{x^2 + y^2}$ 356) ______

A) $72\pi(2 - \sqrt{2})$ B) $72\pi(2 - \sqrt{3})$ C) $54\pi(2 - \sqrt{3})$ D) $54\pi(2 - \sqrt{2})$

Use the given transformation to evaluate the integral.

357) $x = 7u$, $y = 6v$, $z = 4w$; 357) ______

$$\iiint_R \left(\frac{x^2}{49} + \frac{y^2}{36} + \frac{z^2}{16}\right)^{\pi} dx\ dy\ dz,$$

where R is the interior of the ellipsoid $\frac{x^2}{49} + \frac{y^2}{36} + \frac{z^2}{16} = 1$

A) $\frac{336\pi}{\pi + 1}$ B) $\frac{672\pi}{\pi + 1}$ C) $\frac{672\pi}{\pi + 2}$ D) $\frac{672\pi}{\pi + 3}$

Evaluate the integral.

358) $\int_0^{\pi}\int_0^{(1 - \cos\phi)/2}\int_0^{8\pi} \rho^2 \sin\phi\ d\theta\ d\rho\ d\phi$ 358) ______

A) 4π B) $\frac{8}{3}\pi$ C) $\frac{4}{3}\pi$ D) 2π

Find the average value of the function f over the region R.

359) $f(x, y) = \frac{1}{(xy)^2}$ 359) ______

R: $1 \le x \le 7$, $1 \le y \le 7$

A) $\frac{1}{7}$ B) $\frac{\ln 7}{7}$ C) $\frac{1}{49}$ D) $\frac{\ln 7}{49}$

Evaluate the integral.

360) $\int_0^4\int_0^{10}\int_0^5 xyz\ dx\ dy\ dz$ 360) ______

A) $\frac{20000}{3}$ B) 10000 C) 5000 D) $\frac{10000}{3}$

Integrate the function f over the given region.

361) $f(x, y) = xy$ over the rectangle $4 \le x \le 6$, $2 \le y \le 5$ 361) ______

A) 140 B) 105 C) 210 D) 70

Evaluate the cylindrical coordinate integral.

362) $\int_{3\pi}^{8\pi}\int_3^{10}\int_{7/r}^{8/r} dz\ r\ dr\ d\theta$ 362) ______

A) 70π B) 490π C) 245π D) 35π

Evaluate the integral.

363) $\int_0^2\int_0^{\sqrt{z}}\int_0^{5\pi} (r^2 \sin^2\theta + z^2)\ r\ d\theta\ dr\ dz$ 363) ______

A) $\frac{35}{6}$ B) $\frac{140}{3}\pi$ C) $\frac{35}{3}\pi$ D) $\frac{7}{3}\pi$

Find the volume of the indicated region.

364) The tetrahedron bounded by the coordinate planes and the plane $\frac{x}{3} + \frac{y}{5} + \frac{z}{4} = 1$ 364) ______

A) 15 B) 30 C) 20 D) 10

Solve the problem.

365) Find the moment of inertia I_y of a tetrahedron of constant density $\delta(x, y, z) = x + y + z$ bounded by the coordinate planes and the plane $\frac{x}{2} + \frac{y}{5} + \frac{z}{3} = 1$. 365) ______

A) $\frac{750}{47}$ B) $\frac{50}{3}$ C) $\frac{250}{9}$ D) $\frac{375}{16}$

366) Find the center of mass of the hemisphere of constant density bounded $z = \sqrt{49 - x^2 - y^2}$ and the xy-plane. 366) ______

A) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{7}{4}$ B) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{7}{3}$

C) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{14}{3}$ D) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{21}{8}$

367) Find the radius of gyration about the x-axis of a thin infinite region in the first quadrant bounded by the coordinate axes and the curve $y = e^{-2x}$ if $\delta(x, y) = xy$. 367) ______

A) $\frac{\sqrt{3}}{4}$ B) $\frac{\sqrt{5}}{2}$ C) $\frac{\sqrt{5}}{4}$ D) $\frac{\sqrt{2}}{4}$

368) Find the volume of the parallelepiped enclosed by the planes $3x + y - z = 1$, $3x + y - z = 3$, $-x + 3y + z = -2$, $-x + 3y + z = 5$, $x - y + 2z = -1$, $x - y + 2z = 6$. 368) ______

A) $\frac{14}{13}$ B) $\frac{21}{26}$ C) $\frac{7}{13}$ D) $\frac{49}{13}$

Evaluate the integral.

369) $\int_{-6}^{10} \int_{-2}^{8} dy\, dx$ 369) ______

A) 68 B) 92 C) 1 D) 160

Solve the problem.

370) Find the centroid of the region cut from the first quadrant by the line $x + y = 9$. 370) ______

A) $\bar{x} = \frac{9}{2}, \bar{y} = \frac{9}{2}$ B) $\bar{x} = 3, \bar{y} = 3$ C) $\bar{x} = 6, \bar{y} = 6$ D) $\bar{x} = \frac{9}{4}, \bar{y} = \frac{9}{4}$

Evaluate the cylindrical coordinate integral.

371) $\int_{0}^{\pi/2} \int_{8}^{16} \int_{1/r^2}^{1/r} z \cos\theta\, dz\, r\, dr\, d\theta$ 371) ______

A) $\frac{512 \ln 2 - 3}{1024}$ B) $\frac{256 \ln 2 - 3}{1024}$ C) $\frac{256 \ln 2 - 6}{1024}$ D) $\frac{512 \ln 2 - 6}{1024}$

Use a CAS integration utility to evaluate the triple integral of the given function over the specified solid region.

372) $F(x, y, z) = (x + y + z)^2$ over the tetrahedron bounded by the coordinate planes and the plane $\frac{x}{4} + \frac{y}{8} + \frac{z}{6} = 1$ 372) ______

A) $\frac{1760}{3}$ B) $\frac{2816}{5}$ C) 660 D) 704

Solve the problem.

373) Given that 373) ______

$$\int_{0}^{\infty} e^{-x^2}\, dx = \frac{\sqrt{\pi}}{2},$$

evaluate

$$\int_{-\infty}^{\infty} e^{-5x^2}\, dx .$$

A) $\frac{1}{2}\sqrt{5\pi}$ B) $\sqrt{\frac{\pi}{5}}$ C) $\sqrt{5\pi}$ D) $\frac{1}{2}\sqrt{\frac{\pi}{5}}$

374) Let D be the region bounded below by the cone $z = \sqrt{x^2 + y^2}$ and above by the sphere $z = \sqrt{49 - x^2 - y^2}$. Set up the triple integral in cylindrical coordinates that gives the volume of using the order of integration dz dr dθ. 374) ______

A) $\int_{0}^{\pi/2} \int_{0}^{7} \int_{0}^{\sqrt{49 - r^2}} r\, dz\, dr\, d\theta$ B) $\int_{0}^{\pi/2} \int_{0}^{7/\sqrt{2}} \int_{0}^{\sqrt{49 - r^2}} r\, dz\, dr\, d\theta$

C) $\int_{0}^{2\pi} \int_{0}^{7/\sqrt{2}} \int_{0}^{\sqrt{49 - r^2}} r\, dz\, dr\, d\theta$ D) $\int_{0}^{2\pi} \int_{0}^{7} \int_{0}^{\sqrt{49 - r^2}} r\, dz\, dr\, d\theta$

375) Integrate $f(x, y) = \frac{\ln(x^2 + y^2)}{x^2 + y^2}$ over the region $1 \le x^2 + y^2 \le 16$. 375) ______

A) $2\pi \ln 4$ B) $\pi(\ln 4)^2$ C) $\pi \ln 4$ D) $2\pi(\ln 4)^2$

376) Evaluate 376) ______

$$\int_{0}^{\infty} \int_{0}^{\infty} \frac{1}{(7 + x^2 + y^2)^4}\, dx\, dy.$$

A) $\frac{\pi}{1029}$ B) $\frac{\pi}{4116}$ C) $\frac{\pi}{1715}$ D) $\frac{\pi}{6860}$

377) Let A and B be the squares 377) ______

$\{(x, y) \mid 0 \le x, y \le 3\}$ and $\{(x, y) \mid 3 \le x, y \le 4\}$,

respectively. Use Pappus's formula to find the centroid of $A \cup B$.

A) $\bar{x} = \frac{17}{10}, \bar{y} = \frac{17}{10}$ B) $\bar{x} = \frac{13}{2}, \bar{y} = \frac{13}{2}$ C) $\bar{x} = \frac{101}{10}, \bar{y} = \frac{101}{10}$ D) $\bar{x} = \frac{53}{10}, \bar{y} = \frac{53}{10}$

Evaluate the integral.

378) $\int_0^{\pi/2}\int_2^{10}\int_0^{\pi/3} \rho^3 \sin\phi \cos\phi \, d\phi \, d\rho \, d\theta$ 378) ______

A) 780π B) 936π C) 1560π D) 468π

Find the average value of F(x, y, z) over the given region.

379) $F(x, y, z) = x^2 + y^2 + z^2$ over the cube in the first octant bounded by the coordinate planes and the planes $x = 4, y = 4, z = 4$ 379) ______

A) 48 B) 32 C) 16 D) 4

Evaluate the cylindrical coordinate integral.

380) $\int_0^{7\pi}\int_0^{4}\int_{-\sqrt{16-r^2}}^{\sqrt{16-r^2}} dz \, r \, dr \, d\theta$ 380) ______

A) $\frac{448}{3}\pi$ B) $\frac{896}{3}\pi$ C) $\frac{2240}{3}\pi$ D) 224π

Express the area of the region bounded by the given line(s) and/or curve(s) as an iterated double integral.

381) The lines $x = 0$, $y = 3x$, and $y = 5$ 381) ______

A) $\int_0^{3}\int_0^{x/5} dy \, dx$ B) $\int_0^{3}\int_0^{y/5} dx \, dy$

C) $\int_0^{5}\int_0^{y/3} dx \, dy$ D) $\int_0^{5}\int_0^{y/3} dy \, dx$

Solve the problem.

382) For what value of b is the volume of the ellipsoid $\frac{x^2}{100} + \frac{y^2}{b^2} + \frac{z^2}{36} = 1$ equal to 8π? 382) ______

A) $b = \frac{1}{10}$ B) $b = \frac{1}{15}$ C) $b = \frac{1}{5}$ D) $b = \frac{2}{15}$

383) Find the center of mass of the region of constant density bounded by the paraboloid $z = 25 - x^2 - y^2$ and the xy-plane. 383) ______

A) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{5}{2}$ B) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{25}{2}$

C) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{5}{3}$ D) $\bar{x} = 0, \bar{y} = 0, \bar{z} = \frac{25}{3}$

Evaluate the integral.

384) $\int_0^{1}\int_0^{1} (10x + 2y) \, dy \, dx$ 384) ______

A) 4 B) -4 C) 52 D) 6

385) $\int_2^{9}\int_{5\pi}^{9\pi}\int_0^{\theta} rz \, dz \, d\theta \, dr$ 385) ______

A) $\frac{36089}{3}\pi^3$ B) $\frac{11627}{3}\pi^3$ C) $\frac{46508}{15}\pi^3$ D) $\frac{23858}{3}\pi^3$

Evaluate the spherical coordinate integral.

386) $\int_0^{\pi/2}\int_0^{\pi/2}\int_6^{8} \rho \sin\phi \, d\rho \, d\phi \, d\theta$ 386) ______

A) 7π B) 7 C) $\frac{14}{3}$ D) $\frac{14}{3}\pi$

387) $\int_0^{6\pi}\int_0^{\pi}\int_0^{(1-\cos\phi)/2} \rho^2 \sin\phi \, d\rho \, d\phi \, d\theta$ 387) ______

A) 2π B) 3π C) 1π D) $\frac{3}{2}\pi$

Find the area of the region specified by the integral(s).

388) $\int_0^{4}\int_{4-x}^{5-x} dy \, dx + \int_4^{5}\int_0^{5-x} dy \, dx$ 388) ______

A) $\frac{9}{2}$ B) 8 C) $\frac{41}{2}$ D) $\frac{25}{2}$

Solve the problem.

389) Evaluate 389) ______

$$\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} \frac{1}{(9 + x^2 + y^2)^{10}} \, dx \, dy.$$

A) $\frac{\pi}{4.261625379e+09}$ B) $\frac{\pi}{7.74840978e+09}$

C) $\frac{\pi}{3.486784401e+09}$ D) $\frac{\pi}{3.87420489e+09}$

Find the Jacobian $\frac{\partial(x, y)}{\partial(u, v)}$ or $\frac{\partial(x, y, z)}{\partial(u, v, w)}$ (as appropriate) using the given equations.

390) $x = -3u - 4v$, $y = 4u - 5v$ 390) ______

A) -31 B) -1 C) 31 D) 1

Find the area of the region specified by the integral(s).

391) $\int_0^{4}\int_{x(x-4)}^{x(x-4)(x-8)} dy \, dx$ 391) ______

A) 128 B) $\frac{512}{3}$ C) $\frac{224}{3}$ D) $\frac{704}{3}$

Evaluate the integral.

392) $\int_0^{\pi/2}\int_0^{\pi/2}\int_0^{9\cos\phi} \rho^2 \sin\phi \, d\rho \, d\theta \, d\phi$ 392) ______

A) $\frac{243}{8}\pi$ B) $\frac{81}{2}\pi^2$ C) $\frac{243}{8}\pi^2$ D) $\frac{81}{2}\pi$

Solve the problem.

393) Let D be the region that is bounded below by the cone $\phi = \frac{\pi}{4}$ and above by the sphere $\rho = 9$. Set up the triple integral for the volume of D in spherical coordinates. 393) ______

A) $\int_0^{2\pi}\int_0^{\pi/2}\int_0^{9} \rho^2 \sin\phi \, d\rho \, d\phi \, d\theta$ B) $\int_0^{2\pi}\int_0^{3\pi/4}\int_0^{9} \rho^2 \sin\phi \, d\rho \, d\phi \, d\theta$

C) $\int_0^{2\pi}\int_0^{\pi/4}\int_0^{9} \rho^2 \sin\phi \, d\rho \, d\phi \, d\theta$ D) $\int_0^{2\pi}\int_0^{\pi}\int_0^{9} \rho^2 \sin\phi \, d\rho \, d\phi \, d\theta$

Set up the iterated integral for evaluating

$$\iiint_D f(r, \theta, z) \, dz \, r \, dr \, d\theta$$

over the given region D.

394) D is the rectangular solid whose base is the triangle with vertices at (0, 0), (9, 0), and (9, 9), and whose top lies in the plane z = 3. 394) ______

A) $\int_0^{\pi/4}\int_0^{9\csc\theta}\int_0^{3} f(r, \theta, z) \, dz \, r \, dr \, d\theta$ B) $\int_0^{\pi/2}\int_0^{9\csc\theta}\int_0^{3} f(r, \theta, z) \, dz \, r \, dr \, d\theta$

C) $\int_0^{\pi/4}\int_0^{9\sec\theta}\int_0^{3} f(r, \theta, z) \, dz \, r \, dr \, d\theta$ D) $\int_0^{\pi/2}\int_0^{9\sec\theta}\int_0^{3} f(r, \theta, z) \, dz \, r \, dr \, d\theta$

Solve the problem.

395) Solve for a: 395) ______

$$\int_0^{48a}\int_0^{a}\int_0^{x^2} dy \, dx \, dz = 10{,}000$$

A) $a = \frac{10}{3}$ B) $a = \frac{5}{3}$ C) $a = \frac{5}{2}$ D) $a = 5$

Use the given transformation to evaluate the integral.

396) $u = y - x, \; v = y + x;$ 396) ______

$$\iint_R \cos\left(\frac{y - x}{y + x}\right) dx \, dy,$$

where R is the trapezoid with vertices at (6, 0), (10, 0), (0, 6), (0, 10)

A) 16 sin 1 B) 16 sin 2 C) 32 sin 1 D) 32 sin 2

Solve the problem.

397) Find the mass of a thin infinite region in the first quadrant bounded by the coordinate axes and the curve $y = e^{-5x}$ if $\delta(x, y) = xy$. 397) ______

A) $\frac{1}{100}$ B) $\frac{1}{75}$ C) $\frac{1}{200}$ D) $\frac{2}{75}$

Find the volume of the indicated region.

398) The region common to the interiors of the cylinders $x^2 + y^2 = 25$ and $x^2 + z^2 = 25$ 398) ______

A) $\frac{2000}{3}$ B) $\frac{250}{3}$ C) $\frac{500}{3}$ D) 500

Evaluate the integral.

399) $\int_0^{\pi/2}\int_4^{8}\int_0^{\pi/2} \rho^3 \sin\phi \, d\phi \, d\rho \, d\theta$ 399) ______

A) 640π B) 960π C) $\frac{1280}{3}\pi$ D) 480π

400) $\int_1^{e^3}\int_1^{e^8}\int_1^{e^7} \frac{1}{xyz} \, dx \, dy \, dz$ 400) ______

A) 504 B) 168 C) 336 D) 56

401) $\int_0^{9}\int_0^{\sqrt{9x}} x^2 \, dy \, dx$ 401) ______

A) $\frac{4374}{5}$ B) $\frac{13122}{7}$ C) $\frac{2187}{5}$ D) $\frac{6561}{7}$

Evaluate the spherical coordinate integral.

402) $\int_0^{\pi/2}\int_0^{\pi/3}\int_{4\sec\phi}^{9\sec\phi} \rho^4 \sin^2\phi \cos\phi \, d\rho \, d\phi \, d\theta$ 402) ______

A) $\frac{58025}{9}\pi\sqrt{2}$ B) $\frac{11605}{2}\pi\sqrt{2}$ C) $\frac{11605}{2}\pi\sqrt{3}$ D) $\frac{58025}{9}\pi\sqrt{3}$

Find the average value of the function f over the region R.

403) $f(x, y) = e^{x^2}$ 403) ______

R is the region bounded by $y = 6x$, $y = 7x$, $x = 0$, and $x = 1$.

A) $\frac{2e - 1}{36}$ B) $2e - 1$ C) $e - 1$ D) $\frac{e - 1}{6}$

Find the average value of the function over the region.

404) $f(\rho, \phi, \theta) = \rho$ over the solid ball $\rho \le 5$ 404) ______

A) $\frac{4}{15}$ B) 5 C) $\frac{15}{4}$ D) 5π

Find the average value of F(x, y, z) over the given region.

405) $F(x, y, z) = 2x$ over the rectangular solid in the first octant bounded by the coordinate planes and the planes $x = 8, y = 6, z = 10$ 405) ______

A) 128 B) 8 C) 16 D) 64

Write an equivalent double integral with the order of integration reversed.

406) $\int_1^6 \int_0^{\ln x} 2x\, dy\, dx$ 406) ______

A) $\int_0^{\ln 6} \int_{e^y}^{6} 2x\, dx\, dy$ B) $\int_0^{\ln 6} \int_{e^y}^{6} 12x\, dx\, dy$

C) $\int_0^{\ln 6} \int_1^{6} 12x\, dx\, dy$ D) $\int_0^{\ln 6} \int_1^{6} 2x\, dx\, dy$

Evaluate the integral.

407) $\int_0^\infty \int_0^\infty \int_0^\infty e^{-(10x + 5y + 7z)}\, dz\, dx\, dy$ 407) ______

A) $\frac{1}{350}$ B) $\frac{3}{350}$ C) $\frac{1}{700}$ D) $\frac{4}{175}$

Solve the problem.

408) A container has the shape of the region in the first octant that is bounded by the parabolic cylinder with equation $x = y^2$ and by the planes with equations $z = 0, x = 0$, and $z = 3 - y$. The container is filled with liquid of density δ. Calculate the work needed to pump the liquid to the top of the container (that is, to the level $z = 3$). Assume units of meters and kilograms. 408) ______

A) $81g\delta$ J B) $\frac{243}{8}g\delta$ J C) $\frac{81}{4}g\delta$ J D) $\frac{81}{5}g\delta$ J

Find the area of the region specified by the integral(s).

409) $\int_0^8 \int_0^y dx\, dy + \int_0^8 \int_y^8 dx\, dy$ 409) ______

A) 64 B) 128 C) 4 D) 8

Solve the problem.

410) Find the centroid of the region enclosed between the cone with equation $z = 3\sqrt{x^2 + y^2}$ and the plane with equation $z = 3$. 410) ______

A) $(\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{12}{5}\right)$ B) $(\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{9}{4}\right)$

C) $(\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{15}{8}\right)$ D) $(\bar{x}, \bar{y}, \bar{z}) = (0, 0, 2)$

Find the average value of F(x, y, z) over the given region.

411) $F(x, y, z) = x^7 y^4 z^8$ over the rectangular solid in the first octant bounded by the coordinate planes and the planes $x = 2, y = 1, z = 3$ 411) ______

A) 17496 B) $\frac{69984}{19}$ C) $\frac{69984}{5}$ D) 69984

Solve the problem.

412) Set up the triple integral for the volume of the sphere $\rho = 8$ in cylindrical coordinates. 412) ______

A) $\int_0^{2\pi} \int_0^8 \int_{-\sqrt{64 - r^2}}^{\sqrt{64 - r^2}} r\, dz\, dr\, d\theta$ B) $\int_0^{2\pi} \int_0^8 \int_0^{\sqrt{64 - r^2}} dz\, dr\, d\theta$

C) $\int_0^{2\pi} \int_0^8 \int_{-\sqrt{64 - r^2}}^{\sqrt{64 - r^2}} dz\, dr\, d\theta$ D) $\int_0^{2\pi} \int_0^8 \int_0^{\sqrt{64 - r^2}} r\, dz\, dr\, d\theta$

413) Write an iterated triple integral in the order dz dy dx for the volume of the region in the first octant enclosed by the cylinder $x^2 + y^2 = 36$ and the plane $z = 2$. 413) ______

A) $\int_{-6}^{6} \int_{-\sqrt{36 - y^2}}^{\sqrt{36 - y^2}} \int_0^{2 - y} dz\, dy\, dx$ B) $\int_{-6}^{6} \int_{-\sqrt{36 - x^2}}^{\sqrt{36 - x^2}} \int_0^{2} dz\, dy\, dx$

C) $\int_{-6}^{6} \int_{-\sqrt{36 - y^2}}^{\sqrt{36 - y^2}} \int_0^{2} dz\, dy\, dx$ D) $\int_{-6}^{6} \int_{-\sqrt{36 - x^2}}^{\sqrt{36 - x^2}} \int_0^{y} dz\, dy\, dx$

Write an equivalent double integral with the order of integration reversed.

414) $\int_{\ln 2}^{\ln 5} \int_{e^y}^{5} 5y\, dx\, dy$ 414) ______

A) $\int_{\ln 5}^{5} \int_{\ln 2}^{\ln x} 5y\, dy\, dx$ B) $\int_2^{5} \int_{\ln 2}^{\ln x} 5y\, dy\, dx$

C) $\int_2^{5} \int_{\ln 5}^{\ln x} 5y\, dy\, dx$ D) $\int_{\ln 2}^{5} \int_{\ln 5}^{\ln x} 5y\, dy\, dx$

Solve the problem.

415) Find the mass of the region of density $\delta(x, y, z) = \frac{1}{9 - x^2 - y^2}$ bounded by the paraboloid $z = 9 - x^2 - y^2$ and the xy-plane. 415) ______

A) 27π B) 3π C) 81π D) 9π

Find the volume of the indicated region.

416) The region that lies inside the sphere $x^2 + y^2 + z^2 = 81$ and outside the cylinder $x^2 + y^2 = 64$ 416) ______

A) $\frac{5(729 - 17^{3/2})\pi}{2}$ B) $\frac{4(729 - 17^{3/2})\pi}{3}$ C) $\frac{2(729 - 17^{3/2})\pi}{3}$ D) $\frac{3(729 - 17^{3/2})\pi}{2}$

Solve the problem.

417) Evaluate 417) ______

$$\int_{-6}^{6} \int_{-\sqrt{36 - x^2}}^{\sqrt{36 - x^2}} \int_0^{8} (x^2 + y^2)z\, dz\, dy\, dx$$

by transforming to cylindrical or spherical coordinates.

A) 576π B) 3456π C) 27648π D) 20736π

418) Find the moment of inertia about the origin of the region enclosed by the curve $r = 10 + 5 \sin \theta$ if $\delta(x, y) = \frac{1}{r^2}$. 418) ______

A) $\frac{425}{2}\pi$ B) $\frac{225}{2}\pi$ C) $\frac{325}{2}\pi$ D) $\frac{625}{2}\pi$

Find the area of the region specified in polar coordinates.

419) One petal of the rose curve $r = 7 \sin 2\theta$ 419) ______

A) $\frac{49}{6}\pi$ B) $\frac{49}{8}\pi$ C) $\frac{49}{4}\pi$ D) $\frac{49}{2}\pi$

Set up the iterated integral for evaluating

$$\iiint_D f(r, \theta, z)\, dz\, r\, dr\, d\theta$$

over the given region D.

420) D is the right circular cylinder whose base is the circle $r = 5 \cos \theta$ in the xy-plane and whose top lies in the plane $z = 9 - x$. 420) ______

A) $\int_0^{\pi} \int_0^{5 \cos \theta} \int_0^{9 - \sin \theta} f(r, \theta, z)\, dz\, r\, dr\, d\theta$

B) $\int_0^{2\pi} \int_0^{5 \sin \theta} \int_0^{9 - r \cos \theta} f(r, \theta, z)\, dz\, r\, dr\, d\theta$

C) $\int_0^{2\pi} \int_0^{5 \sin \theta} \int_0^{9 - \sin \theta} f(r, \theta, z)\, dz\, r\, dr\, d\theta$

D) $\int_0^{\pi} \int_0^{5 \cos \theta} \int_0^{9 - r \cos \theta} f(r, \theta, z)\, dz\, r\, dr\, d\theta$

Evaluate the integral.

421) $\int_7^8 \int_{5\pi}^{10\pi} \int_0^{\theta} rz\, dr\, d\theta\, dz$ 421) ______

A) $\frac{14875}{4}\pi^3$ B) $\frac{219625}{12}\pi^3$ C) $\frac{132125}{12}\pi^3$ D) $\frac{102375}{4}\pi^3$

Set up the iterated integral for evaluating

$$\iiint_D f(r, \theta, z)\, dz\, r\, dr\, d\theta$$

over the given region D.

422) D is the solid right cylinder whose base is the region between the circles $r = 3 \sin \theta$ and $r = 7 \sin \theta$, and whose top lies in the plane $z = 8 - x - y$. 422) ______

A) $\int_0^{\pi} \int_{3 \sin \theta}^{7 \sin \theta} \int_0^{8 - r(\cos \theta + \sin \theta)} f(r, \theta, z)\, dz\, r\, dr\, d\theta$

B) $\int_0^{2\pi} \int_{3 \sin \theta}^{7 \sin \theta} \int_0^{8 - r(\cos \theta - \sin \theta)} f(r, \theta, z)\, dz\, r\, dr\, d\theta$

C) $\int_0^{2\pi} \int_{3 \sin \theta}^{7 \sin \theta} \int_0^{8 - r(\cos \theta + \sin \theta)} f(r, \theta, z)\, dz\, r\, dr\, d\theta$

D) $\int_0^{\pi} \int_{3 \sin \theta}^{7 \sin \theta} \int_0^{8 - r(\cos \theta - \sin \theta)} f(r, \theta, z)\, dz\, r\, dr\, d\theta$

Integrate the function f over the given region.

423) $f(x, y) = \frac{1}{\ln x}$ over the region bounded by the x-axis, line $x = 10$, and curve $y = \ln x$ 423) ______

A) 11 B) 10 C) 1 D) 9

Use the given transformation to evaluate the integral.

424) $u = y - x,\ v = y + x$; 424) ______

$$\iint_R e^{\frac{y - x}{y + x}}\, dx\, dy,$$

where R is the trapezoid with vertices at (2, 0), (3, 0), (0, 2), (0, 3)

A) $\frac{5(e^2 - 1)}{6e}$ B) $\frac{5(e^2 - 1)}{4e}$ C) $\frac{5(e^2 - 1)}{3e}$ D) $\frac{5(e^2 - 1)}{2e}$

Solve the problem.

425) Rewrite the integral 425) ______

$$\int_0^{1/10} \int_0^{(1-10z)/9} \int_0^{(1-9y-10z)/2} dx\, dy\, dz$$

in the order dz dy dx.

A) $\int_0^{1/2} \int_0^{(1-2x)/9} \int_0^{(1-9x-2y)/10} dz\, dy\, dx$

B) $\int_0^{1/10} \int_0^{(1-2x)/9} \int_0^{(1-10x-9y)/2} dz\, dy\, dx$

C) $\int_0^{1/2} \int_0^{(1-2x)/9} \int_0^{(1-2x-9y)/10} dz\, dy\, dx$

D) $\int_0^{1/10} \int_0^{(1-10z)/9} \int_0^{(1-9y-10z)/2} dz\, dy\, dx$

Write an equivalent double integral with the order of integration reversed.

426) $\int_0^7 \int_{6x/7+4}^{10} dy\, dx$ 426) ______

A) $\int_4^{10} \int_0^{7y/(-16)} dx\, dy$ B) $\int_4^7 \int_0^{7y/(-16)} dx\, dy$

C) $\int_0^{10} \int_0^{7y/(-16)} dx\, dy$ D) $\int_7^{10} \int_0^{7y/(-16)} dx\, dy$

Solve the problem.

427) Find the moment of inertia I_z of a tetrahedron of constant density $\delta(x, y, z) = 1$ bounded by the coordinate planes and the plane $\frac{x}{9} + \frac{y}{7} + \frac{z}{2} = 1$. 427) ______

A) $\frac{357}{2}$ B) $\frac{1113}{10}$ C) $\frac{1407}{5}$ D) 273

Evaluate the integral.

428) $\int_0^8 \int_0^{10} (7x - 3y)\, dx\, dy$ 428) ______

A) 184 B) 1840 C) 23 D) 230

Evaluate the cylindrical coordinate integral.

429) $\int_3^4 \int_\theta^{2\theta} \int_0^r \frac{3}{r^2}\, dz\, r\, dr\, d\theta$ 429) ______

A) $\frac{21}{2}$ B) $\frac{7}{2}$ C) $\frac{21}{4}$ D) 7

Find the area of the region specified in polar coordinates.

430) The region inside $r = 14 \sin \theta$ and outside $r = 7$ 430) ______

A) $49\left(\frac{\sqrt{3}}{2} + \frac{2\pi}{3}\right)$ B) $49\left(\frac{\sqrt{3}}{4} + \frac{\pi}{3}\right)$ C) $49\left(\frac{\sqrt{3}}{2} + \frac{\pi}{3}\right)$ D) $49\left(\frac{\sqrt{3}}{4} + \frac{2\pi}{3}\right)$

Solve the problem.

431) Let R be a thin triangular region cut off from the first quadrant by the line $x + y = 5$. If the density of R is given by $\delta(x, y) = ax + \frac{y}{a}$ where $a > 0$, for what value of a will the mass of R be a minimum? 431) ______

A) $\frac{1}{5}$ B) $\frac{2}{3}$ C) 1 D) 5

Evaluate the integral.

432) $\int_0^1 \int_{3y}^1 dx\, dy$ 432) ______

A) $\frac{5}{2}$ B) 2 C) -1 D) $-\frac{1}{2}$

Solve the problem.

433) Integrate $f(x, y) = \sin\sqrt{x^2 + y^2}$ over the region $0 \le x^2 + y^2 \le 36$. 433) ______

A) $2\pi(\sin 6 - 6 \cos 6)$ B) $\pi(\sin 6 - 6 \cos 6)$

C) $\pi(\sin 6 - \cos 6)$ D) $2\pi(\sin 6 - \cos 6)$

Evaluate the integral.

434) $\int_0^1 \int_9^{20} (s + t)\, dt\, ds$ 434) ______

A) 100 B) 150 C) 195 D) 145

Determine the order of integration and then evaluate the integral.

435) $\int_0^{512} \int_{\sqrt{y/8}}^8 \frac{\sin x^2}{x}\, dx\, dy$ 435) ______

A) $4(1 - \cos 64)$ B) $2\left(1 - \frac{\cos 64}{8}\right)$ C) $4\left(1 - \frac{\cos 64}{8}\right)$ D) $2(1 - \cos 64)$

Find the Jacobian $\frac{\partial(x, y)}{\partial(u, v)}$ or $\frac{\partial(x, y, z)}{\partial(u, v, w)}$ (as appropriate) using the given equations.

436) $u = -5x + 3y,\ v = 4x + 4y$ 436) ______

A) -32 B) 32 C) $-\frac{1}{32}$ D) $\frac{1}{32}$

Solve the problem.

437) Find the moment of inertia about the origin of a thin plane of constant density $\delta = 8$ bounded by the coordinate axes and the line $x + y = 8$. 437) ______

A) $\frac{256}{3}$ B) 8192 C) $\frac{2048}{3}$ D) $\frac{16384}{3}$

Determine the order of integration and then evaluate the integral.

438) $\int_0^6 \int_x^6 \frac{\sin y}{y}\, dy\, dx$ 438) ______

A) $1 - \cos 6$ B) $1 + \cos 6$ C) $-\cos 6$ D) $\cos 6$

Evaluate the improper integral.

439) $\int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \frac{dx\, dy}{(x^2 + 64)(y^2 + 16)}$ 439) ______

A) $\frac{\pi}{32}$ B) $\frac{\pi^2}{32}$ C) $\frac{\pi^2}{64}$ D) $\frac{\pi}{64}$

Express the area of the region bounded by the given line(s) and/or curve(s) as an iterated double integral.

440) The parabola $y = x^2$ and the line $y = 2x + 35$ 440) ______

A) $\int_{-5}^{7} \int_{0}^{2x + 35 - x^2} dx\, dy$ B) $\int_{0}^{7} \int_{35}^{2x + x^2} dy\, dx$

C) $\int_{0}^{7} \int_{x^2}^{2x + 35} dy\, dx$ D) $\int_{-5}^{7} \int_{x^2}^{2x + 35} dy\, dx$

Solve the problem.

441) Let D be the smaller cap cut from a solid ball of radius 8 units by a plane 2 units from the center of the sphere. Set up the triple integral for the volume of D in rectangular coordinates. 441) ______

A) $\int_{-\sqrt{68}}^{\sqrt{68}} \int_{-\sqrt{60 - x^2}}^{\sqrt{60 - x^2}} \int_{8}^{\sqrt{4 - x^2 - y^2}} dz\, dy\, dx$

B) $\int_{-\sqrt{60}}^{\sqrt{60}} \int_{-\sqrt{60 - x^2}}^{\sqrt{60 - x^2}} \int_{8}^{\sqrt{4 - x^2 - y^2}} dz\, dy\, dx$

C) $\int_{-\sqrt{68}}^{\sqrt{68}} \int_{-\sqrt{60 - x^2}}^{\sqrt{60 - x^2}} \int_{2}^{\sqrt{64 - x^2 - y^2}} dz\, dy\, dx$

D) $\int_{-\sqrt{60}}^{\sqrt{60}} \int_{-\sqrt{60 - x^2}}^{\sqrt{60 - x^2}} \int_{2}^{\sqrt{64 - x^2 - y^2}} dz\, dy\, dx$

442) Find the moment of intertia I_L of the rectangular solid of density $\delta(x, y, z) = 1$ defined by $0 \le x \le 3$, $0 \le y \le 9$, $0 \le z \le 8$, where L is the line through the points (4, 1, 0), (4, 2, 0). 442) ______

A) 3528 B) 6120 C) 7848 D) 6984

443) Solve for a: 443) ______

$$\int_a^{10a} \int_a^{10a} \int_a^{10a} dx\, dz\, dy = 27$$

A) $a = \frac{2}{3}$ B) $a = \frac{3}{11}$ C) $a = \frac{1}{3}$ D) $a = \frac{6}{11}$

Find the average value of the function f over the region R.

444) $f(x, y) = \frac{1}{xy}$ 444) ______

R is the region bounded by $y = \frac{1}{x}$, $y = \frac{2}{x}$, $x = 7$, and $x = 10$.

A) $\frac{7}{10} \ln 2$ B) $70 \ln 2$ C) $\frac{10}{7} \ln 2$ D) $\ln 2$

Use a CAS integration utility to evaluate the triple integral of the given function over the specified solid region.

445) $F(x, y, z) = x^2 + y^2 + z^2$ over the tetrahedron bounded by the coordinate planes and the plane $\frac{x}{5} + \frac{y}{10} + \frac{z}{7} = 1$ 445) ______

A) 1015 B) $\frac{5075}{6}$ C) 812 D) $\frac{15225}{16}$

Solve the problem.

446) Let A and B be the squares 446) ______

$\{(x, y) \mid 0 \le x, y \le 4\}$ and $\{(x, y) \mid 8 \le x, y \le 12\}$,

respectively. Use Pappus's formula to find the centroid of $A \cup B$.

A) $\bar{x} = 5$, $\bar{y} = 5$ B) $\bar{x} = 6$, $\bar{y} = 6$ C) $\bar{x} = 7$, $\bar{y} = 7$ D) $\bar{x} = \frac{14}{3}$, $\bar{y} = \frac{14}{3}$

447) Find the average distance from a point $P(r, \theta)$ in the region bounded by $r = 5 + 8 \sin \theta$ to the origin. 447) ______

A) $\frac{605}{114}$ B) $\frac{605}{76}$ C) $\frac{1210}{171}$ D) $\frac{605}{171}$

448) Find the moment of inertia about the z-axis of a region of constant density δ enclosed by the paraboloid $z = 36 - x^2 - y^2$ and the xy-plane. 448) ______

A) $7776\delta\pi$ B) $36\delta\pi$ C) $216\delta\pi$ D) $6\delta\pi$

Find the volume of the indicated region.

449) The region bounded by the paraboloid $z = x^2 + y^2$ and the plane $z = 64$ 449) ______

A) $\frac{4096}{3}\pi$ B) $\frac{2048}{3}\pi$ C) 1024π D) 2048π

Integrate the function f over the given region.

450) $f(x, y) = xy$ over the triangular region with vertices (0, 0), (3, 0), and (0, 6) 450) ______

A) $\frac{3}{4}$ B) $\frac{9}{4}$ C) $\frac{27}{2}$ D) $\frac{9}{2}$

Solve the problem.

451) Given that 451) ______

$$\int_0^{\infty} e^{-x^2}\, dx = \frac{\sqrt{\pi}}{2},$$

evaluate

$$\int_0^{\infty} e^{-3x^2}\, dx.$$

A) $\frac{1}{2}\sqrt{\frac{\pi}{3}}$ B) $\sqrt{3\pi}$ C) $\frac{1}{2}\sqrt{3\pi}$ D) $\sqrt{\frac{\pi}{3}}$

Evaluate the spherical coordinate integral.

452) $\int_0^{\pi/2} \int_0^{\pi/2} \int_9^{10} (\rho \sin \phi)^2\, d\rho\, d\phi\, d\theta$ 452) ______

A) $\frac{271}{24}\pi^2$ B) $\frac{271}{18}\pi$ C) $\frac{271}{18}\pi^2$ D) $\frac{271}{24}\pi$

Solve the problem.

453) Find the mass of a thin circular plate bounded by $x^2 + y^2 = 64$ if $\delta(x, y) = x^2 + y^2$. 453) ______

A) 32π B) 2048π C) 256π D) 4π

Evaluate the integral by changing the order of integration in an appropriate way.

454) $\int_0^{125} \int_0^{3} \int_{\sqrt[3]{x}}^{5} \frac{z}{y^4 + 1}\, dy\, dz\, dx$ 454) ______

A) $\frac{9}{4} \ln 126$ B) $\frac{9}{8} \ln 126$ C) $\frac{9}{8} \ln 626$ D) $\frac{9}{4} \ln 626$

Solve the problem.

455) Find the mass of a thin disk bounded by the circle $r = 8 \sin \theta$ if the disk's density is given by $\delta(x, y) = x^2 + y^2$. 455) ______

A) 1280π B) 384π C) 768π D) 640π

Evaluate the integral by changing the order of integration in an appropriate way.

456) $\int_1^{2} \int_0^{21} \int_{y/3}^{7} \frac{\tan x}{xz}\, dx\, dy\, dz$ 456) ______

A) $7 \ln 4 \ln \cos 7$ B) $-7 \ln 4 \ln \cos 7$ C) $7 \ln 2 \ln \cos 7$ D) $-7 \ln 2 \ln \cos 7$

Change the Cartesian integral to an equivalent polar integral, and then evaluate.

457) $\int_{-2}^{0} \int_{-\sqrt{4 - x^2}}^{0} \frac{1}{1 + \sqrt{x^2 + y^2}}\, dy\, dx$ 457) ______

A) $\frac{\pi(2 - \ln 3)}{4}$ B) $\frac{\pi(2 + \ln 3)}{2}$ C) $\frac{\pi(2 + \ln 3)}{4}$ D) $\frac{\pi(2 - \ln 3)}{2}$

Find the Jacobian $\frac{\partial(x, y)}{\partial(u, v)}$ or $\frac{\partial(x, y, z)}{\partial(u, v, w)}$ (as appropriate) using the given equations.

458) $x = 7u \cosh 8v$, $y = 7u \sinh 8v$ 458) ______

A) $392u$ B) $448v$ C) $392v$ D) $448u$

TRUE/FALSE. Write 'T' if the statement is true and 'F' if the statement is false.

Answer the question.

459) True or false? Consider the double integral 459) ______

$$\int_0^{2} \int_3^{6} (x^2 + y)\, dy\, dx.$$

The first step in calculating this integral involves integrating with respect to x.

460) True or false? Consider the double integral 460) ______

$$\int_0^{2} \int_3^{6} (x^2 + y)\, dy\, dx.$$

The first step in calculating this integral involves holding y constant.

461) True or false? Consider the double integral 461) ______

$$\int_0^{2} \int_3^{6} (x^2 + y)\, dx\, dy.$$

The first step in calculating this integral involves integrating with respect to x.

462) True or false? Consider the double integral 462) ______

$$\int_0^{2} \int_3^{6} (x^2 + y)\, dx\, dy.$$

The first step in calculating this integral involves holding y constant.

1) Find the area of the region between the curves $y = x^2$ and $y = 2x$ for x between 0 and 2.
2) This integral represents the volume of the region enclosed between the paraboloid with equation $z = 3 - r^2$ (or $z = 3 - x^2 - y^2$) and the xy-plane.
3) Find the volume bounded above by $f(x,y) = y + x$ which lies over the region for which $4 \le x \le 6$ and $1 \le y \le 2$.
4) Find the area of the region bounded by the curve $y = x^2$ and the lines $y = 0$, $x = 0$, and $x = 5$.
5) Find the volume bounded above by $f(x,y) = y + x$ which lies over the region for which $1 \le x \le 2$ and $4 \le y \le 6$.
6) This integral represents the volume of a wedge cut from a sphere of radius 1 by two half-planes whose edges meet at a $45°$ angle along a diameter of the sphere. The region resembles a section of an orange and is $\frac{1}{8}$ of the entire sphere.

7) B
8) B
9) B
10) C
11) B
12) C
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Answer Key
Testname: TEST 6

47) B
48) A
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51) D
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453) B
454) C
455) B
456) D
457) D
458) A
459) FALSE
460) FALSE
461) TRUE
462) TRUE