1. What is the value of the integral $\int_C y \sin(z) ds$ where C is the circular helix given by the equations $x = \cos t,\ y = \sin t$ and $z = t$ for $0 \leq t \leq 2\pi$?

A. $-2\sqrt{2}\pi$

B. -2π

C. $\sqrt{2}\pi$

D. $-\sqrt{2}\pi$

E. $2\sqrt{2}\pi$

2. What is the value of the line integral $\int_C \mathbf{F} \cdot d\mathbf{r}$, where $\mathbf{F}(x, y) = \langle x^2, y^2 \rangle$ and C is the arc of the parabola $y = 2x^2$ from $(0, 0)$ to $(1, 2)$?

A. 1

B. -3

C. 5

D. -5

E. 3

3. Let R be the region in the first quadrant between the lines $y = 0$, $\sqrt{3}x - y = 0$, and inside the circle $x^2 + y^2 = 4$. Evaluate

$$\iint_R xy dA.$$

A. 3/2

B. 1/3

C. 1/2

D. 3/4

E. 3/8

4. Let E be the solid region in the first octant that is bounded by the planes $x = 2,\ y = 0,\ y = x,\ z = 0$, and $z = x$. Evaluate

$$\iiint_E x dV.$$

A. 4/3

B. 2

C. 3/2

D. 4

E. 8/3

5. A lamina L occupies the triangular region in the xy–plane with vertices $(0,0)$, $(0,1)$ and $(1,0)$. If the mass density at (x,y) is $\rho(x,y) = 1 + x$, then the x–coordinate of the center of mass of L is equal to:

A. 5/9

B. 1/2

C. 2/3

D. 3/5

E. 3/8

6. Use the method of Lagrange multipliers to find the x components only of the points where the absolute maximum and absolute minimum occur for

$$f(x,y) = (x-2)^2 + (y-4)^2$$

on the curve

$$x^2 + y^2 = 5.$$

A. 2 and -2

B. 0 and -1

C. 1 and -1

D. -2 and 1

E. 1 and 0

7. Use the midpoint rule with $m = n = 2$ to approximate

$$\iint_R x^2 y \, dA$$

where R is the region $\{(x, y) \,|\, 0 \leq x \leq 4,\ 2 \leq y \leq 4\}$.

A. 108

B. 120

C. 136

D. 128

E. 114

8. Let E be the solid region enclosed by the cylinder $x^2 + y^2 = 1$, and the planes $z = 0$ and $y + z = 2$. Which of the following triple integrals is equal to the volume of E?

A. $\int_0^{2\pi} \int_0^1 \int_0^{2-r\sin\theta} r dz dr d\theta$

B. $\int_0^{2\pi} \int_0^1 \int_0^{2-\sin\theta} r dz dr d\theta$

C. $\int_0^{\pi} \int_0^1 \int_0^{2-r\sin\theta} r dz dr d\theta$

D. $\int_0^{\pi} \int_0^1 \int_0^{2-\sin\theta} r dz dr d\theta$

E. $\int_0^{2\pi} \int_0^{\sin\theta} \int_0^{2} r dz dr d\theta$

9. Which of the following converts

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

to spherical coordinates?

A. $\int_0^{2\pi}\int_0^{\pi/4}\int_0^{2/\cos\phi} \rho^3\cos\phi\cdot\sin\phi d\rho d\phi d\theta$

B. $\int_0^{2\pi}\int_{\pi/4}^{\pi/2}\int_0^{2/\cos\phi} \rho^3\cos\phi\cdot\sin\phi d\rho d\phi d\theta$

C. $\int_0^{2\pi}\int_0^{\pi/4}\int_0^{2} 2\rho^2\cos\phi\cdot\sin\phi d\rho d\phi d\theta$

D. $\int_0^{2\pi}\int_0^{\pi/4}\int_0^{2/\cos\phi} 2\rho^2\cos\phi\cdot\sin\phi d\rho d\phi d\theta$

E. $\int_0^{2\pi}\int_{\pi/4}^{\pi}\int_0^{2/\cos\phi} 2\rho^2\cos\phi\cdot\sin\phi d\rho d\phi d\theta$

10. The point with rectangular coordinates $(-\sqrt{3}, 0, 1)$ has spherical coordinates (ρ, θ, ϕ) equal to

A. $(2, \pi, \frac{\pi}{6})$

B. $(2, \pi, \frac{\pi}{3})$

C. $(1, \pi, \frac{\pi}{6})$

D. $(1, \pi, \frac{\pi}{3})$

E. $(3, 0, \frac{\pi}{3})$