1. (Exam III Prob 47) Find the Jacobian of the transformation from the $xy$-plane to the $uv$-plane defined by

$$\begin{cases} u = xe^{xy} \\ v = ye^{xy} \end{cases}$$

(A) $2xve^{xy}$  
(B) $(1 - x^2 y^2)e^{2xy}$  
(C) $2e^{2xy}$  
(D) $(2xy + 1)e^{2xy}$  
(E) 0

2. (Exam II Prob 14) Let $f(x, y) = x^3 - axy + y^2 - x$. Find the greatest lower bound for $a$ so that $f(x, y)$ has a relative minimum point.

(A) 0  
(B) $\sqrt{48}$  
(C) 12  
(D) 6  
(E) Does not exist

3. (Chapter 3 Prob 27) Find $\iiint_R z \, dxdy$, where $z = 8xy$, and $R$ is the region in the first quadrant of $\mathbb{R}^2$ bounded by the two axes and the unit circle.

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

4. (Exam V Prob 17) The length of the curve $x(t) = e^t \cos t, y(t) = -e^t \sin t$ for $0 \leq t \leq 1$ is

(A) $2(e - 1)$  
(B) $\sqrt{2}(e - 1)$  
(C) $e$  
(D) $2e$  
(E) $\sqrt{2}$

5. (Chapter 3 Prob 25) If $F = (2y - 2x) \hat{i} + (x^2 + y) \hat{j}$, find the value of $\int_C F \cdot dr$, where $C$ is the portion of the parabola $y = x^2$, directed from $(-1,1)$ to the origin.

(A) $-1$  
(B) 0  
(C) 1  
(D) 2  
(E) 3
6. (Chapter 3 Prob 26) Let \( C \) be the portion of the astroid \( x^{2/3} + y^{2/3} = 1 \) from \((1,0)\) to \((0,1)\), which can be parameterized by the equations

\[ x = \cos^3 t, y = \cos^3 t \]

as \( t \) increases from 0 to \( \frac{\pi}{2} \). Evaluate the integral:

\[ \int_C \left( y \cos xy - 1 \right) dx + \left( 1 + x \cos xy \right) dy \]

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

7. (Week 3 Prob 16) Find all functions \( f(x, y) \) satisfying \( \frac{\partial f}{\partial x}(x, y) = 2x + y, \frac{\partial f}{\partial y}(x, y) = x + 2y \).

(A) \( x^2 + xy + y^2 + C \)  (B) \( x^2 + 2xy + y^2 + C \)  (C) \( 2xy + y^2 + C \)

(D) \( x^3 + xy + y + C \)  (E) \( x^3 + y^3 + C \)

8. (Week 3 Prob 17) Find the point on the plane \( 2x + y + 3z = 3 \) which is closest to the origin.

(A) \( \left( \frac{3}{14}, \frac{3}{14}, \frac{9}{14} \right) \)  (B) \( \left( \frac{3}{7}, \frac{3}{14}, \frac{9}{14} \right) \)  (C) \((0,0,0)\)

(D) \( \left( \frac{3}{7}, \frac{3}{7}, \frac{9}{14} \right) \)  (E) \((1,1,1)\)

9. (Week 3 Prob 19) Set up an integral which represents the volume of the solid bounded above by the graph of \( z = 6 - x^2 - 2y^2 \) and below by the graph of \( z = -2 + x^2 + 2y^2 \).

(A) \( \int_0^1 \int_{\sqrt{\frac{(4-x^2)/2}}^2}^{\frac{(4-x^2)/2}} (6 - x^2 - 2y^2) dx \ dy \)

(B) \( \int_0^{\sqrt{2}} \int_{\sqrt{\frac{(4-x^2)/2}}^2}^{\frac{(4-x^2)/2}} (-2 + x^2 + 2y^2) dx \ dy \)

(C) \( \int_{-\sqrt{2}}^{\sqrt{2}} \int_{\sqrt{\frac{(4-x^2)/2}}^2}^{\frac{(4-x^2)/2}} (8 - 2x^2 - 4y^2) dx \ dy \)

(D) \( \int_0^{\sqrt{2}} \int_{\sqrt{\frac{(4-x^2)/2}}^2}^{\frac{(4-x^2)/2}} (8 - 2x^2 - 4y^2) dx \ dy \)

(E) \( \int_{-\sqrt{2}}^{\sqrt{2}} \int_{\sqrt{\frac{(4-x^2)/2}}^2}^{\frac{(4-x^2)/2}} (6 - x^2 - 2y^2) dx \ dy \)
10. (Week 3 Prob 20) Minimize the function \( f(x, y, z) = x + 4z \) on the curve \( x^2 + y^2 + z^2 \).

\[
\begin{align*}
(A) & \quad -\sqrt{\frac{1}{17}} \\
(B) & \quad -17\sqrt{\frac{1}{17}} \\
(C) & \quad -\sqrt{\frac{2}{17}} \\
(D) & \quad -17\sqrt{\frac{2}{17}} \\
(E) & \quad -17\sqrt{\frac{3}{17}}
\end{align*}
\]
Answer: DEBBC EABCD