

Name (please PRINT) _____

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No electronic devices of any kind. Show all the work and justify your answers unless noted otherwise. Write in complete sentences. Use English.

You may consult the textbook and your class notes. You may not discuss the exam with anyone else. The exam is due at 2pm on Wednesday, November 18 in class (at the start of the lecture).

1 (15 points) Compute $\int_C 7y^3 dx - x^2 dy$, where C is the segment of the parabola $y = x^2$ starting at $(0, 0)$ and ending at $(1, 1)$.

2 (20 points) Evaluate $\iint_D \frac{(2x+y-3)^2}{(2y-x+6)^2} dx dy$ where D is the square with the vertices $(0, 0)$, $(2, 1)$, $(3, -1)$ and $(1, -2)$.

3 (20 points) Evaluate $\int_C (x^4y^5 - 2y) dx + (3x + x^5y^4) dy$, where C is the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, $a, b > 0$, oriented counter-clockwise.

4 (20 points) Which of the two vector fields (if any)

$$F = xy^2z^3\vec{i} + 2x^2y\vec{j} + 3x^2y^2z^2\vec{k}$$

and

$$G = 2xy\vec{i} + (x^2 + 2yz)\vec{j} + y^2\vec{k}$$

is conservative? Find a scalar potential for each of the conservative vector fields among the two vector fields above.

5 Let Σ denote the surface of the cylinder $x^2 + y^2 = 4$, $0 \leq z \leq 2$.

a (10 points) Compute $\int \int_{\Sigma} (z - x^2 - y^2) dS$.

b (10 points) Orient Σ so that the normal points out of the cylinder (away from the z -axis).

Compute $\int \int_{\Sigma} -y dy \wedge dz + x dz \wedge dx$.

c (5 points) Give Σ the orientation opposite from the one in part b.

Compute $\int \int_{\Sigma} (-y, x, 0) \cdot d\vec{S}$.