(1) Consider the vector field $F(x, y) = (2x/y, (1 - x^2)/y^2)$ for $y > 0$.

(a) Check that F is potential (conservative) and find a potential function

(b) Let C be the curve $(x - 3)^5 + y^2 = 3$, from $(2, -2)$ to $(2, 2)$. Compute $\int_C \vec{F} \cdot d\vec{r}$.

(2) Evaluate $\int_C F \cdot dr$ where

$$F(x, y) = \left(\frac{1}{y^2 + 1},\ -\frac{2xy}{(y^2 + 1)^2} + ze^{yz},\ ye^{yz} + 2z \right)$$

where C is part of the helix $r(t) = \langle \cos(t), \sin(t), t \rangle$ from $(1, 0, 0)$ to $(1, 0, 2\pi)$.

(3) Find the integral of $f(x, y) = x^2 + y^2$ on the domain

$$D := \{(x, y) \in \mathbb{R}^2 \ : \ 0 \leq x \leq 1,\ x^2 \leq y \leq x\}.$$

Sketch the region of integration.

(4) Find the limits of integration of $\iint_D f(x, y)dxdy$ if

$$D := \{(x, y) \in \mathbb{R}^2 \ : \ \frac{x^2}{9} + \frac{y^2}{4} \leq 1\}$$

when D is considered first as a type I and then as a type II domain.

(5) Sketch the region bounded by the curves $y = \log(x)$, $y = 2\log(x)$ and $x = e$ in the first quadrant. Then express the region's area as an iterated double integral and evaluate.

(6) Consider $\iint_D f dA = \int_0^3 \int_{-2\sqrt{1-(x/3)^2}}^{2(1-x/3)} f(x, y)dydx$.

(a) Sketch the region of integration.

(b) Switch the order of integration in the above integral.

(c) Compute the integral $\iint_D f dA$ if $f(x, y) = xy$.

(7) [1] Suppose f is a continuous invertible function from $[0, 1]$ to $[0, 1]$ such that $f(0) = 0, f(1) = 1$ and $\int_0^1 f(x)dx = 1/6$. Let g denote the inverse function. Evaluate $\int_0^1 g(x)dx$.

[1] Not to appear on the quiz.