

Quiz # for Lecture 16

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SECTION 22  
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1. compute the Jacobian of the transformation.

$$\phi(r, s) = (rs, rs)$$

$$x - r = s \quad x - s = r$$

$$y - r = 1 \quad y - s = 1$$

$$\text{Jacobian} = s \cdot 1 - r \cdot 1 = s - r$$

Ans:  $s - r$ .

2. Let  $D = \phi(R)$  where  $\phi(u, v) = (u + v, v^2)$  and  $R = [0, 6] \times [1, 2]$ , calculate.

$$\iint_D y \, dA$$

Ans: 45

(Note: it is not ~~needed~~ necessary to compute  $D$ .)

$$y = v^2$$

~~Ans~~

$$x - u = 1 \quad x - v = 1$$

$$y - u = 0 \quad y - v = 2v$$

$$\text{Jacobian} = 2v - 0 = 2v$$

$$\iint_D y \, dA$$

$$= \int_1^2 \int_0^6 2v \cdot v^2 \, du \, dv$$

$$= \int_1^2 \int_0^6 2v^3 \, du \, dv$$

$$= \int_1^2 12v^3 \, dv$$

$$= \left. \frac{3}{4} v^4 \right|_1^2 = 3 \cdot (2^4 - 1^4) = 3 \cdot (16 - 1) = 3 \cdot 15 = 45$$