

$$3. \iint_R \left(\frac{\partial y}{x^2+y^2} \right) dA$$

R: TRAPEZOID

$$y = \frac{1}{3}x, y = 3x, x = 1, x = 4$$

$$\int_{x=1}^{x=4} \int_{y=\frac{1}{3}x}^{y=3x} \left(\frac{\partial y}{x^2+y^2} \right) dy dx$$

$$u = x^2 + y^2 \quad du = 2y dy$$

$$\int_{x=1}^{x=4} \int_{y=\frac{1}{3}x}^{y=3x} \frac{1}{u} du dx$$

$$\int_{x=1}^{x=4} [LW]_{y=\frac{1}{3}x}^{y=3x} dx$$

$$\int_{x=1}^{x=4} [LW(x^2+y^2)]_{y=\frac{1}{3}x}^{y=3x} dx$$

$$\int_{x=1}^{x=4} [LW(x^2+(3x)^2) - LW(x^2+(\frac{1}{3}x)^2)] dx$$

$$\int_{x=1}^{x=4} [LW(10x^2) - LW(\frac{5}{4}x^2)] dx$$

$$\int_{x=1}^{x=4} LW \frac{10x^2}{\frac{5}{4}x^2} dx$$

$$\int_{x=1}^{x=4} LW(10 \cdot \frac{4}{5}) dx$$

$$\int_{x=1}^{x=4} LW8 dx$$

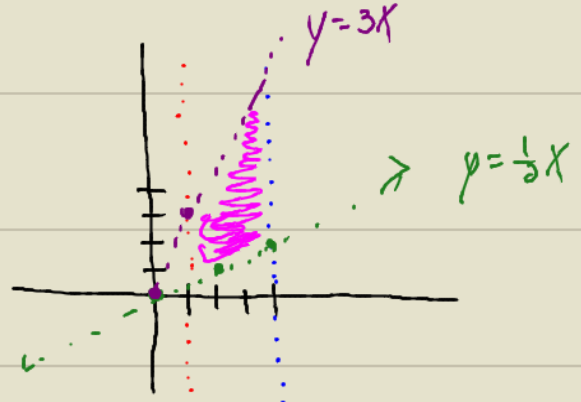
$$= [xLW8]_{x=1}^{x=4}$$

$$\rightarrow 4LW8 - 1LW8$$

$$= 3LW8$$

$$= LW8^3$$

$$= LW512$$



$$y = \frac{1}{3}x \quad y = \frac{1}{3}(1) \quad y = \frac{1}{3}(4) \quad \partial y = x \quad y = 3x \quad y = 3(1) \quad \frac{4}{3} = x$$

$$\int_{y=\frac{1}{3}}^{y=2} \int_{x=\frac{1}{3}y}^{x=y} \left(\frac{\partial y}{x^2+y^2} \right) dx dy + \int_{y=2}^{y=10} \int_{x=\frac{y}{3}}^{x=4} \left(\frac{\partial y}{x^2+y^2} \right) dx dy$$

$$\frac{64}{8}$$