1. Consider the regions

$$D = \{(x, y) | x^2 + y^2 \leq 4, y \geq 0\}$$
$$D_1 = \{(x, y) | x^2 + y^2 \leq 1, y \geq\}$$
$$D_2 = \{(x, y) | 1 \leq x^2 + y^2 \leq 4, y \geq 0\}$$

Suppose we know that

$$\int\int_D f(x, y)\, dA = 7, \quad \int\int_{D_1} f(x, y)\, dA = -3, \quad \int\int_{D_2} g(x, y)\, dA = 3$$

(a) Find $\int\int_{D_2} (3 - g(x, y))\, dA$

(b) Find $\int\int_{D_2} (5f(x, y) + 2g(x, y))\, dA$

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2. (a) For what interval I in the x-axis will the following integral be minimized? [Note that this is a calculus 1 problem!]

$$\int_I (x^2 - 16)\, dx$$

(b) For what region D in the xy-plane will the following integral be maximized?

$$\int\int_D (9 - x^2 - y^2)\, dA$$

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3. Without doing any calculus, evaluate $\int\int_D dA$, where D is the triangle in the xy-plane with vertices $(0, 0), (2, 2), (0, 2)$.

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4. Let D be the region in the xy-plane bounded by the curves $x = -2y$ and $x = y^2 - 3y$. Find the volume of the solid that lies directly above D and below the graph of $f(x, y) = y^2$.