Math 263A - Quiz # 3 - Wi09(OSU)
February 5, 2009

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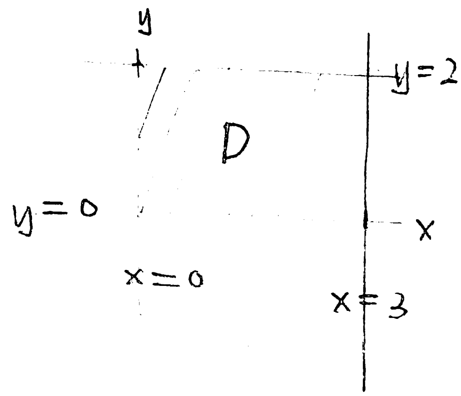
Instructions. The point value of each problem is indicated in square brackets. To obtain full credit, you must have the correct answers along with relevant supporting work to justify them. Partial credit will be given based on the work that is shown. However, **answers without supporting work will receive no credit.**

Find the volume V of the solid bounded by the elliptic paraboloid $z = 1 + (x-1)^2 + 4y^2$, the planes $x = 3$ and $y = 2$, and the coordinate planes. Show all your calculations. [15pts]

Since the solid is bounded below by the xy-plane and $z = 1+(x-1)^2+4y^2 > 0$ everywhere, the volume is given by



$$V = \iint_D z\,dA$$

$$= \int_0^2\int_0^3 [1+(x-1)^2+4y^2]\,dx\,dy$$

$$= \int_0^2 \left[x + \frac{(x-1)^3}{3} + 4xy^2\right]_{x=0}^{3} dy$$

$$= \int_0^2 (12y^2+6)\,dy$$

$$= 6\int_0^2 (2y^2+1)\,dy$$

$$= 6\left[\frac{2y^3}{3} + y\right]_0^2$$

$$= 44$$

Alternatively

$$V = \int_0^3\int_0^2 [1+(x-1)^2+4y^2]\,dy\,dx$$

$$= \int_0^3 \left[y + y(x-1)^2 + \frac{4}{3}y^3\right]_{y=0}^{2} dx$$

$$= \int_0^3 \left[\frac{38}{3} + 2(x-1)^2\right] dx$$

$$= \left[\frac{38}{3}x + \frac{2(x-1)^3}{3}\right]_0^3$$

$$= 44$$