

Activity 5: Linear Transformations and Levels Sets

Names: _____ Date: October 15, 2009 Score: _____

Show your work or explain your answer for each of the following. You should submit one copy for your group. Feel free to ask your instructor for advice if you need it.

1. (4 pts) Let $T(x_1, x_2, x_3) = (x_3 - x_2, x_2 - 3x_1, 5x_1)$ What is the volume of the image of the parallelepiped with vertices $(1, 0, 0)$, $(1, 1, 0)$, $(0, 1, 0)$, $(0, 0, 0)$, $(1, 0, 1)$, $(1, 1, 1)$, $(0, 1, 1)$, and $(0, 0, 1)$?

2. (2 pts) Give an example for each of the following.

- (a) A linear transformation S and another linear transformation T such that $S \circ T$ makes sense and $T \circ S$ is nonsense.

- (b) A function with the same level sets as $f(x, y) = \frac{1}{1+x^2+y^4}$.

- (c) A linear transformation T on \mathbb{R}^2 for which the area of the image of a parallelogram is 0.

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3. (bonus) Find an affine transformation that sends $(1, 1)$ to $(3, 1)$, $(2, 0)$ to $(4, -6)$, and $(0, 1)$ to $(1, 4)$.