

Name: \_\_\_\_\_

**Directions:** Show all work. No credit for answers without work.

1. [6 points] Find  $\det \left( \begin{bmatrix} 2 & 1 & 4 & 3 \\ 2 & 1 & 3 & 3 \\ 2 & 1 & 1 & 4 \\ 1 & 3 & 1 & 2 \end{bmatrix} \right)$ . *Hint:* this will be easier if you first perform some elementary operations.

2. Let  $S = \left\{ \begin{bmatrix} x \\ y \end{bmatrix} : (x-3)^2 + (y-2)^2 \leq 9 \right\}$ . That is,  $S$  is the disc centered at  $\begin{bmatrix} 3 \\ 2 \end{bmatrix}$  with radius 3. Let  $A = \begin{bmatrix} 3 & -2 \\ 1 & 1 \end{bmatrix}$ , and let  $T = \{A\mathbf{u} : \mathbf{u} \in S\}$ .

(a) [1 point] Find the area of  $S$ .

(b) Find the area of  $T$ .