1. (5 pts.) Suppose that $A$ and $B$ are 4 x 4 matrices with $\det(A) = -2$ and $\det(B) = 3$. Using appropriate properties of the determinant, compute each of the following.

(a) $\det(AB) = \ $ \\
(b) $\det(A^{-1}) = \ $ \\
(c) $\det(B^5) = \ $ \\
(d) $\det(A^5) = \ $ \\
(e) $\det(5A) = \ $ \\

2. (5 pts.) For what value(s) of the parameter $s$ does the following system have a unique solution, and what is the unique solution in terms of $s$? (For the first part, after you figure out what is going on, using a complete sentence, write your answer so that there is no ambiguity concerning your intentions.)

$$
\begin{align*}
2s \cdot x_1 + 3s \cdot x_2 &= -1 \\
4 \cdot x_1 + 3s \cdot x_2 &= 1
\end{align*}
$$
3. (6 pts.) **Jeopardy!** Suppose that the answer to $A\mathbf{x} = \mathbf{b}$ is $\mathbf{x}$ with

\[
\begin{bmatrix}
3 & 15 & 0 \\
-4 & -8 & 0 \\
3 & 25 & 5
\end{bmatrix}
\begin{bmatrix}
x_2
\end{bmatrix}
= 
\begin{bmatrix}
3 & 0 & 0 \\
-4 & -4 & 0 \\
3 & -5 & 5
\end{bmatrix}
\begin{bmatrix}
300
\end{bmatrix}.
\]

(a) What are $A$ and $\mathbf{b}$?

(b) Compute $\text{adj}(A)$.

(c) Using your results from part (b), not row reduction, compute $A^{-1}$.

\[
A^{-1} =
\]

4. (2 pts.) Write the recursive definition of the determinant function.

5. (2 pts.) Suppose the standard matrix for the linear transformation $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$ is the matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$.

If $S$ is a circular region with radius $r = \pi$, what is the area of the region $T(S)$?

\[
\text{Area}(T(S)) =
\]