Write your name on the cover of the test booklet and nowhere else. Enclose this sheet with the booklet. Failure to follow these directions will cost you 1 point. The test has 100 points (to be scaled up to 170 points) and is scheduled to take 50 minutes. Therefore, expect to spend 1 minute for every 2 points. For example, a 12-point question should take 6 minutes. I cannot give extra time because some students have a class after your class.

SHOW ALL WORK ON ALL PARTS

2) (10 points) For EITHER the function in Part A OR the function in Part B, what monotonic transformation would you do to this function? Prove that your transformation is one which can be used and then find the transformation of the utility function. Do not worry about finding the slope.
A) $U(K, E) = 12K^{2/5}E^{1/4}$
B) $U(R, W) = 17R^{2/7}W^{1/3}$

2) (14 points) Answer EITHER Part A OR Part B.
A) Use the method of finding minors, cofactors, and adjoint to find the inverse of the first matrix to the right. (Implicitly, I am asking you to prove the inverse we found for the 2x2 matrix is correct.)
B) Find A^{-1} for the 4 x 4 matrix to the far right. Hint, this is only 14 points.

$$\begin{bmatrix} W & X \\ Y & Z \end{bmatrix} \qquad \begin{bmatrix} 3 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 \\ 0 & 0 & 4 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

3) (16 points) Answer EITHER Part A OR Part B.
A) Suppose that $1 of energy uses 10¢ of energy and 20¢ of food. While $1 of food uses 50¢ of energy. Set up the Leontief Input-Output matrix and use it to find how much of each you need to produce in order to sell $240 of energy and $80 of food using Cramer's Rule.
B) Use Cramer's Rule to solve the system of equation W+X+Y+3Z=0, 3W-2X=0, Y+2Z=0, W+3Z=0.

1) (16 points) Answer EITHER Part A OR Part B.
A) Suppose a production function is given by $Q(L, K) = 16L^{1/3}K^{2/3}$. An isoquant is a level curve with L on the X-axis and K on the Y-axis. Use the implicit function theorem to find the $MRTS_{LK}$ = slope of the isoquant without doing a monotonic transformation. Find the value when there are 27 of each. What does the number mean?
B) Suppose a utility function for Grades and time playing Sports is given by $U(G, S) = \ln(2G) + \ln(S)$. Find the MRS_{GS} = slope of the indifference curve which has G on the X-axis and S on the Y-axis. Find the value when there are 10 of each. What does that number mean?

5) (16 points) One of the questions on the exam was the following system of equations. The demand for umbrellas is given by $D_U = 20 + 4P_{RC} - 2P_U$. The demand for raincoats is given by $D_{RC} = -50 - 2P_{RC} + 2P_U$. If a store has 20 umbrellas and 30 raincoats, what prices would mean supply equals demand for both goods. However, this time I want you to set it up in the **Ax=b** format. Solve it **EITHER** by finding A^{-1} and then multiplying the matrices appropriately **OR** by using Cramer's Rule.

4) (28 points) Answer EITHER Part A OR Part B.
A) Suppose $F(X, Y, Z) = 5X^2Y + 2X^3Z$. Find ∇F and $H(F)$.
B) Suppose $F(X, Y, Z) = 2X^4Y^2Z + Z^{1/2}$. Find ∇F and $\nabla^2 F$.