

Name \_\_\_\_\_

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April 5, 2002

Honors Pre-Calculus Test

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Part A (25%)	_____
Part B (25%)	_____
Part C (25%)	_____
Part D (25%)	_____
grade	_____

### Part A. Matrix multiplication

1. Tickets to a school play cost \$3.00 for students, \$7.00 for adults, and \$4.00 for senior citizens. At Friday's performance, there were 121 students, 184 adults, and 32 senior citizens. At Saturday's performance, there were 183 students, 160 adults, and 25 senior citizens.

a. Display the above information in matrix form.

b. Use matrix multiplication to find the ticket sales revenue for each of the two performances. Perform the matrix multiplication **by hand** (you may use your calculator for arithmetic only). Show all steps on paper in an organized way.

2. A  $140^\circ$  counterclockwise rotation centered at the origin transforms the point  $(1, 2)$  to the point  $(a, b)$ . Find the coordinates  $(a, b)$ . You may use your calculator for matrix multiplication, provided you tell what matrices you multiplied.

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## Part B. Solving a linear system

The questions on this page ask you to show two different ways to solve this system of equations:

$$2x + 2y - z = -8$$

$$x - 2y = 7$$

$$-5x + 3y + 2z = -6$$

1. Solve the system of equations using a sequence of row operations **performed by hand**. Identify each row operation used (you may write abbreviations like  $R_1 + 2R_2 \rightarrow R_1$ ). You may wish to use `rref` on your calculator to check your final answer.

2. Solve the same system of equations using a method involving an **inverse matrix**. You may use your calculator, but you must tell what matrices you entered in your calculator, and what calculation you used to get your answer.

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### Part C. Applications of linear systems

Solve each problem by setting up and solving a system of linear equations. You may use any solving method, but you must show the system of equations and tell what solving method you used.

1. A nut mixture contains peanuts and cashew nuts. Peanuts are worth \$1.80 per pound, and cashew nuts are worth \$4.50 per pound. The value of the mixture is \$2.88 per pound.

Find the percentage of each type of nut in the mixture.

2. "A woman has a collection of bills in her wallet. Each bill is worth either \$1, \$5, or \$10. There are 20 bills in all, and their total value is \$92. How many of each type of bill does she have?"

- a. Write a system of linear equations representing this problem. Explain why this system cannot have a unique solution.

- b. Find the solutions to your system of equations.

State your answer in the form (\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_).

- c. Of course, the actual quantity of each type of bill must be a whole number. State at least two possible whole-number solutions to the problem.

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**Part D. More uses of linear systems**

1. Find the partial fraction decomposition of  $\frac{3x + 5}{x^2 - 4x + 3}$ .

2. Graph the solution to this system of inequalities. Give the coordinates of all corner points.

$$x \geq 0$$

$$y \geq 0$$

$$x + y \leq 100$$

$$3x + 2y \leq 240$$