Name _____ Honors Pre-Calculus Test Answers
April 5, 2002 Chapter 7

Part A. Matrix multiplication

1. $\begin{bmatrix} 121 & 184 & 32 \\ 183 & 160 & 25 \end{bmatrix} \cdot \begin{bmatrix} 3 \\ 7 \\ 4 \end{bmatrix} = \begin{bmatrix} 121\cdot 3 + 184\cdot 7 + 32\cdot 4 \\ 183\cdot 3 + 160\cdot 7 + 25\cdot 4 \end{bmatrix} = \begin{bmatrix} 1779 \\ 1769 \end{bmatrix}$

2. $\begin{bmatrix} 1 & 2 \end{bmatrix} \cdot \begin{bmatrix} \cos 140^\circ & \sin 140^\circ \\ -\sin 140^\circ & \cos 140^\circ \end{bmatrix} \approx \begin{bmatrix} -2.05 & -0.89 \end{bmatrix}$

Part B. Solving a linear system

1. Many sequences of row operations are possible. In any case, your beginning and ending matrices should be:

$$\begin{bmatrix} 2 & 2 & -1 & -8 \\ 1 & -2 & 0 & 7 \\ -5 & 3 & 2 & -6 \end{bmatrix} \rightarrow \begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & -3 \\ 0 & 0 & 1 & 4 \end{bmatrix}$$

giving the solution $(x, y, z) = (1, -3, 4)$.

2. $\begin{bmatrix} 2 & 2 & -1 \\ 1 & -2 & 0 \\ -5 & 3 & 2 \end{bmatrix}^{-1} \cdot \begin{bmatrix} -8 \\ 7 \\ -6 \end{bmatrix} = \begin{bmatrix} 1 \\ -3 \\ 4 \end{bmatrix}.$

Part C. Applications of linear systems

1. Let x and y denote the percentages. Solve this system of equations by any method:

$$\begin{aligned} x + \ y \ &= 1 \\ 1.8x + 4.5y &= 2.88 \end{aligned}$$

The solution is $(x, y) = (.6, .4)$. Thus the percentages are 60% peanuts, 40% cashews.

2. Let x, y, z denote the numbers of \$1, \$5, and \$10 bills.

a. $x + y + z = 20$; $x + 5y + 10z = 92$. Since there are fewer equations than variables (2 equations, 3 variables) the system cannot have a unique solution.

b. $rref\begin{bmatrix} 1 & 1 & 1 & 20 \\ 1 & 5 & 10 & 92 \end{bmatrix} = \begin{bmatrix} 1 & 0 & -1.25 & 2 \\ 0 & 1 & 2.25 & 18 \end{bmatrix}$.

This gives equations $x - 1.25z = 2$; $y + 2.25z = 18$.

Solve these for z: $x = 2 + 1.25z$; $y = 18 - 2.25z$.

Solutions: $(2 + 1.25z, 18 - 2.25z, z)$ for all real numbers z.

c. Three possible answers: (2, 18, 0); (7, 9, 4); (12, 0, 8).

Part D. More uses of linear systems

1. $\dfrac{3x+5}{x^2-4x+3} = \dfrac{7}{x-3} - \dfrac{4}{x-1}.$

2. Solution region should be a quadrilateral with vertices at (0, 0), (0, 100), (40, 60), (80, 0).