F14 8:40 Final Exam Problem 1
Linear Algebra, Dave Bayer

exam01a4p1

[Reserved for Score]

Exam 01

Name _____ Uni _____

[1] Find the intersection of the following two affine subspaces of $\mathbb{R}^4$.

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} w \\ x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$$\begin{bmatrix} w \\ x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ -2 \\ 1 \end{bmatrix} + \begin{bmatrix} 1 & 1 \\ 1 & 0 \\ 0 & 1 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} r \\ s \end{bmatrix}$$

$$\begin{bmatrix} w \\ x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \end{bmatrix} + \begin{bmatrix} \\ \\ \\ \end{bmatrix} t$$

F14 8:40 Final Exam Problem 2
Linear Algebra, Dave Bayer

exam01a4p2

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Exam 01

[2] Find the 3×3 matrix A that maps the vector $(1, 2, 1)$ to $(3, 6, 3)$, and maps each point on the plane $x + y + z = 0$ to the zero vector.

$$A = \frac{1}{\square} \begin{bmatrix} \square & \square & \square \\ \square & \square & \square \\ \square & \square & \square \end{bmatrix}$$

F14 8:40 Final Exam Problem 3
Linear Algebra, Dave Bayer

exam01a4p3

[Reserved for Score]

Exam 01

[3] Find the inverse of the matrix

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 2 & 0 & 1 \\ 3 & 1 & 2 \end{bmatrix}$$

$$A^{-1} = \frac{1}{\square} \begin{bmatrix} \square & \square & \square \\ \square & \square & \square \\ \square & \square & \square \end{bmatrix}$$

F14 8:40 Final Exam Problem 4
Linear Algebra, Dave Bayer

exam01a4p4

[Reserved for Score]

Exam 01

[4] Find A^n where A is the matrix

$$A = \begin{bmatrix} 3 & 2 \\ -2 & -2 \end{bmatrix}$$

$$A^n = \frac{(\quad)^n}{\quad} \begin{bmatrix} \quad & \quad \\ \quad & \quad \end{bmatrix} + \frac{(\quad)^n}{\quad} \begin{bmatrix} \quad & \quad \\ \quad & \quad \end{bmatrix}$$

F14 8:40 Final Exam Problem 5
Linear Algebra, Dave Bayer

exam01a4p5

[Reserved for Score]

Exam 01

[5] Solve the differential equation $y' = Ay$ where

$$A = \begin{bmatrix} 0 & 3 \\ 2 & -1 \end{bmatrix}, \qquad y(0) = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$

$$y = \frac{\quad}{\quad}\begin{bmatrix} \quad \\ \quad \end{bmatrix} + \frac{\quad}{\quad}\begin{bmatrix} \quad \\ \quad \end{bmatrix}$$

F14 8:40 Final Exam Problem 6
Linear Algebra, Dave Bayer

exam01a4p6

[Reserved for Score]

Exam 01

[6] Find e^{At} where A is the matrix

$$A = \begin{bmatrix} 2 & 1 & 2 \\ 0 & 2 & 1 \\ 0 & 1 & 2 \end{bmatrix}$$

$$e^{At} = \frac{\square}{\square}\begin{bmatrix} \square & \square & \square \\ \square & \square & \square \\ \square & \square & \square \end{bmatrix} + \frac{\square}{\square}\begin{bmatrix} \square & \square & \square \\ \square & \square & \square \\ \square & \square & \square \end{bmatrix} + \frac{\square}{\square}\begin{bmatrix} \square & \square & \square \\ \square & \square & \square \\ \square & \square & \square \end{bmatrix}$$

F14 8:40 Final Exam Problem 7
Linear Algebra, Dave Bayer

exam01a4p7

[Reserved for Score]

Exam 01

[7] Solve the differential equation $y' = Ay$ where

$$A = \begin{bmatrix} 2 & 0 & 1 \\ 1 & 1 & 1 \\ 0 & 1 & 2 \end{bmatrix}, \qquad y(0) = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$$

$$y = \frac{\quad}{\quad}\begin{bmatrix} \quad \\ \quad \\ \quad \end{bmatrix} + \frac{\quad}{\quad}\begin{bmatrix} \quad \\ \quad \\ \quad \end{bmatrix} + \frac{\quad}{\quad}\begin{bmatrix} \quad \\ \quad \\ \quad \end{bmatrix}$$

F14 8:40 Final Exam Problem 8
Linear Algebra, Dave Bayer

exam01a4p8

[Reserved for Score]

Exam 01

[8] Express the quadratic form

$$2x^2 - 2xy + 3y^2 + 2yz + 2z^2$$

as a sum of squares of orthogonal linear forms.

$\square\left(\square\right)^2 + \square\left(\square\right)^2 + \square\left(\square\right)^2$