2×2 Exercise Set A (distinct roots)

Linear Algebra, Dave Bayer, November 24, 2013

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2×2 Exercise Set B (distinct roots)

Linear Algebra, Dave Bayer, November 24, 2013

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2×2 Exercise Set C (distinct roots)

Linear Algebra, Dave Bayer, November 24, 2013

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2×2 Exercise Set D (repeated roots)

Linear Algebra, Dave Bayer, November 24, 2013

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

$$A = \begin{bmatrix} 1 & 3 \\ -3 & -5 \end{bmatrix}$$

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

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

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

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

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

$$A = \begin{bmatrix} 2 & -1 \\ 4 & 6 \end{bmatrix}$$

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

$$A = \begin{bmatrix} 6 & 5 \\ -5 & -4 \end{bmatrix}$$

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

$$A = \begin{bmatrix} 6 & 1 \\ -1 & 4 \end{bmatrix}$$

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

$$A = \begin{bmatrix} 4 & -5 \\ 5 & -6 \end{bmatrix}$$

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

$$A = \begin{bmatrix} -5 & -4 \\ 1 & -1 \end{bmatrix}$$

2×2 Exercise Set E (repeated roots)

Linear Algebra, Dave Bayer, November 24, 2013

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

$$A = \begin{bmatrix} 5 & -4 \\ 4 & -3 \end{bmatrix}$$

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

$$A = \begin{bmatrix} -5 & -4 \\ 4 & 3 \end{bmatrix}$$

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

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

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

$$A = \begin{bmatrix} 5 & 1 \\ -1 & 3 \end{bmatrix}$$

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

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

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

$$A = \begin{bmatrix} -4 & 3 \\ -3 & 2 \end{bmatrix}$$

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

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

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

$$A = \begin{bmatrix} -1 & 2 \\ -2 & -5 \end{bmatrix}$$

2×2 Exercise Set F (repeated roots)

Linear Algebra, Dave Bayer, November 24, 2013

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

$$A = \begin{bmatrix} 5 & 4 \\ -4 & -3 \end{bmatrix}, \qquad y(0) = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

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

$$A = \begin{bmatrix} 2 & -4 \\ 1 & 6 \end{bmatrix}, \qquad y(0) = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$$

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

$$A = \begin{bmatrix} -1 & 4 \\ -1 & -5 \end{bmatrix}, \qquad y(0) = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

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

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

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

$$A = \begin{bmatrix} -2 & -1 \\ 4 & 2 \end{bmatrix}, \qquad y(0) = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

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

$$A = \begin{bmatrix} 2 & -4 \\ 1 & -2 \end{bmatrix}, \qquad y(0) = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

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

$$A = \begin{bmatrix} -5 & -4 \\ 4 & 3 \end{bmatrix}, \qquad y(0) = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$

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

$$A = \begin{bmatrix} -4 & -3 \\ 3 & 2 \end{bmatrix}, \qquad y(0) = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$

2×2 Exercise Set G (symmetric matrices)

Linear Algebra, Dave Bayer, November 24, 2013

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

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

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

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

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

$$A = \begin{bmatrix} 1 & -2 \\ -2 & 4 \end{bmatrix}$$

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

$$A = \begin{bmatrix} -4 & -2 \\ -2 & -1 \end{bmatrix}$$

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

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

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

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

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

$$A = \begin{bmatrix} -4 & 1 \\ 1 & -4 \end{bmatrix}$$

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

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

2×2 Exercise Set H (symmetric matrices)

Linear Algebra, Dave Bayer, November 24, 2013

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

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

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

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

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

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

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

$$A = \begin{bmatrix} -1 & 2 \\ 2 & -4 \end{bmatrix}$$

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

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

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

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

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

$$A = \begin{bmatrix} -5 & -2 \\ -2 & -2 \end{bmatrix}$$

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

$$A = \begin{bmatrix} -2 & -2 \\ -2 & -5 \end{bmatrix}$$

2×2 Exercise Set I (quadratic forms)

Linear Algebra, Dave Bayer, November 24, 2013

[1] Express the quadratic form

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

as a sum of squares of othogonal linear forms.

[2] Express the quadratic form

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

as a sum of squares of othogonal linear forms.

[3] Express the quadratic form

$$-x^2 - 4xy - y^2$$

as a sum of squares of othogonal linear forms.

[4] Express the quadratic form

$$2x^2 - 4xy + 5y^2$$

as a sum of squares of othogonal linear forms.

[5] Express the quadratic form

$$2x^2 + 4xy - y^2$$

as a sum of squares of othogonal linear forms.

[6] Express the quadratic form

$$3x^2 + 2xy + 3y^2$$

as a sum of squares of othogonal linear forms.

[7] Express the quadratic form

$$-2x^2 + 4xy + y^2$$

as a sum of squares of othogonal linear forms.

[8] Express the quadratic form

$$-x^2 - 8xy - y^2$$

as a sum of squares of othogonal linear forms.

2×2 Exercise Set J (recurrence relations)

Linear Algebra, Dave Bayer, November 24, 2013

[1] Solve the recurrence relation

$$f(0) = a, \quad f(1) = b, \quad f(n) = -5\,f(n-1) - 4\,f(n-2)$$

[2] Solve the recurrence relation

$$f(0) = a, \quad f(1) = b, \quad f(n) = 6\,f(n-1) - 5\,f(n-2)$$

[3] Solve the recurrence relation

$$f(0) = a, \quad f(1) = b, \quad f(n) = -6\,f(n-1) - 8\,f(n-2)$$

[4] Solve the recurrence relation

$$f(0) = a, \quad f(1) = b, \quad f(n) = -4\,f(n-1) + 5\,f(n-2)$$

[5] Solve the recurrence relation

$$f(0) = a, \quad f(1) = b, \quad f(n) = -f(n-1) + 6\,f(n-2)$$

[6] Solve the recurrence relation

$$f(0) = a, \quad f(1) = b, \quad f(n) = -6\,f(n-1) + 7\,f(n-2)$$

[7] Solve the recurrence relation

$$f(0) = a, \quad f(1) = b, \quad f(n) = -6\,f(n-1) - 5\,f(n-2)$$

[8] Solve the recurrence relation

$$f(0) = a, \quad f(1) = b, \quad f(n) = f(n-1) + 6\,f(n-2)$$

3×3 Exercise Set A (distinct roots)

Linear Algebra, Dave Bayer, November 24, 2013

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3×3 Exercise Set B (distinct roots)

Linear Algebra, Dave Bayer, November 24, 2013

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3×3 Exercise Set C (distinct roots)

Linear Algebra, Dave Bayer, November 24, 2013

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3×3 Exercise Set D (repeated roots)

Linear Algebra, Dave Bayer, November 24, 2013

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3×3 Exercise Set E (repeated roots)

Linear Algebra, Dave Bayer, November 24, 2013

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3×3 Exercise Set F (repeated roots)

Linear Algebra, Dave Bayer, November 24, 2013

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3×3 Exercise Set G (identical roots)

Linear Algebra, Dave Bayer, November 24, 2013

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3×3 Exercise Set H (identical roots)

Linear Algebra, Dave Bayer, November 24, 2013

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3×3 Exercise Set I (identical roots)

Linear Algebra, Dave Bayer, November 24, 2013

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3×3 Exercise Set J (symmetric matrices)

Linear Algebra, Dave Bayer, November 24, 2013

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3×3 Exercise Set K (symmetric matrices)

Linear Algebra, Dave Bayer, November 24, 2013

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3×3 Exercise Set L (quadratic forms)

Linear Algebra, Dave Bayer, November 24, 2013

[1] Express the quadratic form

$$2x^2 + 2y^2 + 2xz + 2yz + z^2$$

as a sum of squares of othogonal linear forms.

[2] Express the quadratic form

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

as a sum of squares of othogonal linear forms.

[3] Express the quadratic form

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

as a sum of squares of othogonal linear forms.

[4] Express the quadratic form

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

as a sum of squares of othogonal linear forms.

[5] Express the quadratic form

$$-x^2 - y^2 + 2xz - 2yz - 2z^2$$

as a sum of squares of othogonal linear forms.

[6] Express the quadratic form

$$2x^2 - 2xy + y^2 + 2xz + z^2$$

as a sum of squares of othogonal linear forms.

[7] Express the quadratic form

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

as a sum of squares of othogonal linear forms.

[8] Express the quadratic form

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

as a sum of squares of othogonal linear forms.