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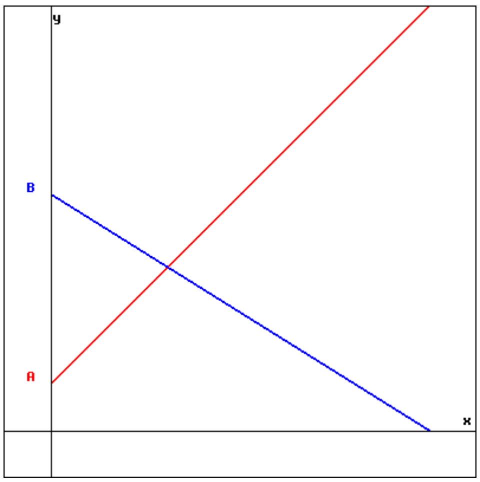
1. **(1 pt) UIOWA.pg**

Use Cramer's rule to find the point of intersection of the lines in the figure, given that line A, in red, has equation $y = x + 1$ and line B, in blue, has equation $2x + 3y = 10$.

x = _____
y = _____



(Click on graph to enlarge)

Correct Answers:

- `-7 / -5`
- `-12 / -5`

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2. **(1 pt) local/Library/UI/ur_la_6_25.pg**

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

Find the following:

(a) $\det(A) =$ _____,

(b) the matrix of cofactors $C = \begin{bmatrix} \_\_\_ & \_\_\_ & \_\_\_ \\ \_\_\_ & \_\_\_ & \_\_\_ \\ \_\_\_ & \_\_\_ & \_\_\_ \end{bmatrix}$,

Hint: These are the same cofactors you used to find the determinant. Put these cofactors into the above matrix C.

(c) $\text{adj}(A) = \begin{bmatrix} \_\_\_ & \_\_\_ & \_\_\_ \\ \_\_\_ & \_\_\_ & \_\_\_ \\ \_\_\_ & \_\_\_ & \_\_\_ \end{bmatrix}$,

Hint: $Adj(A) = C^T$.

(d) $A^{-1} = \begin{bmatrix} \_\_\_ & \_\_\_ & \_\_\_ \\ \_\_\_ & \_\_\_ & \_\_\_ \\ \_\_\_ & \_\_\_ & \_\_\_ \end{bmatrix}$.

Hint: Divide $Adj(A)$ by the determinant.

Correct Answers:

- `-13`
- `4`
- `-2`
- `1`
- `-2`
- `1`
- `6`
- `-3`
- `-5`
- `-4`
- `4`
- `-2`
- `-3`
- `-2`
- `1`
- `-5`
- `1`
- `6`
- `-4`
- `-0.307692307692308`
- `0.153846153846154`
- `0.230769230769231`
- `0.153846153846154`
- `-0.0769230769230769`
- `0.384615384615385`
- `-0.0769230769230769`
- `-0.461538461538462`
- `0.307692307692308`

---

3. **(1 pt) local/Library/UI/ur_la_6_26.pg**

Let $A = \begin{bmatrix} -3e^{3t} & 4e^{2t} \\ -6e^{3t} & -3e^{2t} \end{bmatrix}$.

Find the following:

(a) $\det(A) =$ _________,

(b) the matrix of cofactors $C = \begin{bmatrix} \_\_\_\_\_ & \_\_\_\_\_ \\ \_\_\_\_\_ & \_\_\_\_\_ \end{bmatrix}$
,

Hint: These are the same cofactors you used to find the determinant. Put these cofactors into the above matrix C.

(c) $\text{adj}(A) = \begin{bmatrix} \_\_\_\_\_ & \_\_\_\_\_ \\ \_\_\_\_\_ & \_\_\_\_\_ \end{bmatrix}$,

Hint: $Adj(A) = C^T$.

(d) $A^{-1} = \begin{bmatrix} \_\_\_\_\_ & \_\_\_\_\_ \\ \_\_\_\_\_ & \_\_\_\_\_ \end{bmatrix}$.

Hint: Divide $Adj(A)$ by the determinant.

Correct Answers:

- `33 * 2.71828182845905**(5*t)`
- `-3 * 2.71828182845905**(2*t)`
- `- -6 * 2.71828182845905**(3*t)`
- `- 4 * 2.71828182845905**(2*t)`
- `-3 * 2.71828182845905**(3*t)`
- `-3 * 2.71828182845905**(2*t)`
- `- 4 * 2.71828182845905**(2*t)`
- `- -6 * 2.71828182845905**(3*t)`
- `-3 * 2.71828182845905**(3*t)`
- `-3 * 2.71828182845905**(- 3*t)/33`
- `- 4 * 2.71828182845905**(- 3*t)/33`
- `- -6 * 2.71828182845905**(- 2*t)/33`
- `-3 * 2.71828182845905**(- 2*t)/33`

---

4. **(1 pt) Library/Rochester/setLinearAlgebra4InverseMatrix-/ur_la_4_11.pg**

If $A = \begin{bmatrix} 2e^{2t}\sin(8t) & -2e^{3t}\cos(8t) \\ -5e^{2t}\cos(8t) & -5e^{3t}\sin(8t) \end{bmatrix}$

then $A^{-1} = \begin{bmatrix} \_\_\_ & \_\_\_ \\ \_\_\_ & \_\_\_ \end{bmatrix}$.

Correct Answers:

- `sin(8*t)/2/2.71828182845905^{2 t}`
- `- cos(8 t)/5/2.71828182845905^{2 t}`
- `- cos(8 t)/2/2.71828182845905^{3 t}`
- `sin(8*t)/-5/2.71828182845905^{3 t}`

---

5. **(1 pt) Library/ASU-topics/set119MatrixAlgebra/p13.pg**

Consider the following two systems.

(a)

$$\begin{cases} -6x+4y & = & -3 \\ x-y & = & 3 \end{cases}$$

(b)

$$\begin{cases} -6x+4y & = & 3 \\ x-y & = & 1 \end{cases}$$

(i) Find the inverse of the (common) coefficient matrix of the two systems.

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

(ii) Find the solutions to the two systems by using the inverse, i.e. by evaluating $A^{-1}B$ where B represents the right hand side (i.e. $B = \begin{bmatrix} -3 \\ 3 \end{bmatrix}$ for system (a) and $B = \begin{bmatrix} 3 \\ 1 \end{bmatrix}$ for system (b)).

Solution to system (a): $x =$ ____ , $y =$____

Solution to system (b): $x =$ ____ , $y =$____

Correct Answers:

- `-0.5`
- `-2`
- `-0.5`
- `-3`
- `-4.5`
- `-7.5`
- `-3.5`
- `-4.5`

---

6. **(1 pt) Library/NAU/setLinearAlgebra/systemEquivalent.pg**

Determine the following equivalent representations of the following system of equations:

$$7x+7y=0$$

$$-2x+4y=-18$$

a. Find the augmented matrix of the system.

$$\begin{bmatrix} \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \end{bmatrix}$$

b. Find the matrix form of the system.

$$\begin{bmatrix} \_\_ & \_\_ \\ \_\_ & \_\_ \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix}$$

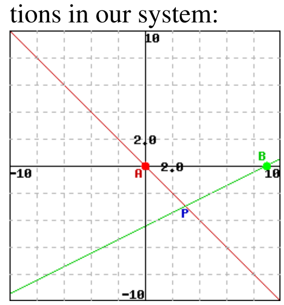
c. Find a matrix that satisfies the following matrix equation.

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} \_\_ & \_\_ \\ \_\_ & \_\_ \end{bmatrix} \begin{bmatrix} 0 \\ -18 \end{bmatrix}$$

d. Find matrices that satisfy the following matrix equation.

$$x \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix} + y \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix} = \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix}$$

e. The graph below shows the lines determined by the two equations in our system:



Find the coordinates of

$P =$(___,___)

Find the coordinates of y-intercept of the red line.

$A =$(0, ___)

Find the coordinates of x-intercept of the green line.

$B =$(___,0)

Correct Answers:

- $$\begin{bmatrix} 7 & 7 & 0 \\ -2 & 4 & -18 \end{bmatrix}$$
- $$\begin{bmatrix} 7 & 7 \\ -2 & 4 \end{bmatrix}$$
- $$\begin{bmatrix} 0 \\ -18 \end{bmatrix}$$
- $$\begin{bmatrix} 0.0952381 & -0.166667 \\ 0.047619 & 0.166667 \end{bmatrix}$$

- $\begin{bmatrix} 7 \\ -2 \end{bmatrix}$
- $\begin{bmatrix} 7 \\ 4 \end{bmatrix}$
- $\begin{bmatrix} 0 \\ -18 \end{bmatrix}$

- 3
- -3
- 0
- 9

7. **(1 pt) Library/Rochester/setLinearAlgebra3Matrices/ur_la_3_15.pg**

Find a and b such that

$$\begin{bmatrix} 9 \\ 12 \\ 2 \end{bmatrix} = a \begin{bmatrix} 1 \\ 4 \\ -1 \end{bmatrix} + b \begin{bmatrix} 4 \\ -8 \\ 7 \end{bmatrix}.$$

$a =$ _____
$b =$ _____

Correct Answers:

- 5
- 1

8. **(1 pt) Library/NAU/setLinearAlgebra/HomLinEq.pg**

Solve the equation

$$-8x + 6y + 5z = 0$$

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

Correct Answers:

- \(\displaystyle\left.\begin{array}{c}
\mbox{6} \cr
\mbox{8} \cr
\mbox{0} \cr
\end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c}
\mbox{5} \cr
\mbox{0} \cr
\mbox{8} \cr
\end{array}\right.\)

9. **(1 pt) Library/Rochester/setAlgebra34Matrices/scalarmult3.pg**

If $A = \begin{bmatrix} -2 & 4 & 4 \\ 2 & -2 & -3 \\ -3 & 2 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 & 0 \\ -4 & -3 & -2 \\ 1 & 2 & 2 \end{bmatrix}$, then

$3A - 4B = \begin{bmatrix} \_ & \_ & \_ \\ \_ & \_ & \_ \\ \_ & \_ & \_ \end{bmatrix}$ and

$A^T = \begin{bmatrix} \_ & \_ & \_ \\ \_ & \_ & \_ \\ \_ & \_ & \_ \end{bmatrix}$.

Correct Answers:

- $\begin{bmatrix} -10 & 4 & 12 \\ 22 & 6 & -1 \\ -13 & -2 & 4 \end{bmatrix}$
- $\begin{bmatrix} -2 & 2 & -3 \\ 4 & -2 & 2 \\ 4 & -3 & 4 \end{bmatrix}$

10. **(1 pt) Library/Rochester/setLinearAlgebra9Dependence-/ur_la_9_3.pg**

Let $A = \begin{bmatrix} -14 \\ 26 \\ 30 \\ 2 \end{bmatrix}$, $B = \begin{bmatrix} 0 \\ -1 \\ -3 \\ 5 \end{bmatrix}$, $C = \begin{bmatrix} -4 \\ 7 \\ 7 \\ 3 \end{bmatrix}$, and $D = \begin{bmatrix} 2 \\ -3 \\ -3 \\ -3 \end{bmatrix}$.

[?] 1. Determine whether or not the four vectors listed above are linearly independent or linearly dependent.

If they are linearly dependent, determine a non-trivial linear relation - (a non-trivial relation is three numbers which are not all three zero.) Otherwise, if the vectors are linearly independent, enter 0's for the coefficients, since that relationship **always** holds.

____$A+$ ____$B+$ ____$C+$ ____$D = 0$.

Correct Answers:

- Dependent
- -1; -2; 3; -1

11. **(1 pt) Library/Rochester/setLinearAlgebra10Bases/ur_la_10_26.pg**

Find a basis of the subspace of $\mathbb{R}^4$ defined by the equation $4x_1 + 5x_2 + 2x_3 - 2x_4 = 0$.

$$\begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix}, \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix}, \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix}.$$

Correct Answers:

- \(\displaystyle\left.\begin{array}{c}
\mbox{5} \cr
\mbox{-4} \cr
\mbox{0} \cr
\mbox{0} \cr
\end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c
\mbox{2} \cr
\mbox{0} \cr
\mbox{-4} \cr
\mbox{0} \cr
\end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c
\mbox{-2} \cr
\mbox{0} \cr
\mbox{0} \cr
\mbox{-4} \cr
\end{array}\right.\)

12. **(1 pt) Library/Rochester/setLinearAlgebra10Bases/ur_la_10_30.pg**
Find a basis of the column space of the matrix
$A = \begin{bmatrix} 2 & 4 & 0 & -3 \\ -2 & 3 & -2 & -1 \\ -6 & -5 & -2 & 5 \end{bmatrix}$.

$\begin{bmatrix} \_ \\ \_ \\ \_ \end{bmatrix}, \begin{bmatrix} \_ \\ \_ \\ \_ \end{bmatrix}$.

Correct Answers:

- ```
  \(\displaystyle\left.\begin{array}{c}
  \mbox{0} \cr
  \mbox{-2} \cr
  \mbox{-2} \cr
  \end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c}
  \mbox{2} \cr
  \mbox{-2} \cr
  \mbox{-6} \cr
  \end{array}\right.\)
  ```

13. **(1 pt) Library/Rochester/setLinearAlgebra11Eigenvalues-/ur_la_11_1.pg**
Find the characteristic polynomial of the matrix
$A = \begin{bmatrix} -4 & -3 \\ 7 & -2 \end{bmatrix}$.
$p(x) =$ ________.

Correct Answers:

- `x**2 + 6 * x + 29`

14. **(1 pt) Library/Rochester/setLinearAlgebra11Eigenvalues-/ur_la_11_7.pg**
The matrix
$C = \begin{bmatrix} 4 & 0 & -9 \\ -18 & -5 & 18 \\ 0 & 0 & -5 \end{bmatrix}$
has two distinct eigenvalues, $\lambda_1 < \lambda_2$:
$\lambda_1 =$ ___ has multiplicity ___. The dimension of the corresponding eigenspace is ___.
$\lambda_2 =$ ___ has multiplicity ___. The dimension of the corresponding eigenspace is ___.
Is the matrix C diagonalizable? (enter YES or NO) ___

Correct Answers:

- -5
- 2
- 2
- 4
- 1
- 1
- yes

15. **(1 pt) Library/Rochester/setLinearAlgebra11Eigenvalues-/ur_la_11_18.pg**
The matrix $A = \begin{bmatrix} -2 & 0 & 0 \\ 0 & -2 & 0 \\ -2 & 0 & -2 \end{bmatrix}$
has one real eigenvalue. Find this eigenvalue and a basis of the eigenspace.

eigenvalue = ____,
Basis: $\begin{bmatrix} \_ \\ \_ \\ \_ \end{bmatrix}, \begin{bmatrix} \_ \\ \_ \\ \_ \end{bmatrix}$.

Correct Answers:

- -2
- ```
  \(\displaystyle\left.\begin{array}{c}
  \mbox{0} \cr
  \mbox{-1} \cr
  \mbox{-1} \cr
  \end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c
  \mbox{0} \cr
  \mbox{0} \cr
  \mbox{-1} \cr
  \end{array}\right.\)
  ```

16. **(1 pt) Library/Rochester/setLinearAlgebra11Eigenvalues-/ur_la_11_24.pg**
The matrix $A = \begin{bmatrix} -5 & 0 & 5 & -5 \\ 0 & -5 & -10 & 10 \\ 0 & 0 & 5 & -10 \\ 0 & 0 & 5 & -10 \end{bmatrix}$. has two distinct eigenvalues $\lambda_1 < \lambda_2$. Find the eigenvalues and a basis of each eigenspace.

$\lambda_1 =$ ___,
Basis: $\begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix}, \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix}, \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix}$,

$\lambda_2 =$ ___,
Basis: $\begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix}$.

Correct Answers:

- -5
- ```
  \(\displaystyle\left.\begin{array}{c}
  \mbox{0} \cr
  \mbox{0} \cr
  \mbox{-1} \cr
  \mbox{-1} \cr
  \end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c
  \mbox{1} \cr
  \mbox{0} \cr
  \mbox{0} \cr
  \mbox{0} \cr
  \end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c
  \mbox{0} \cr
  \mbox{1} \cr
  \mbox{0} \cr
  \mbox{0} \cr
  \end{array}\right.\)
  ```
- 0
- ```
  \(\displaystyle\left.\begin{array}{c}
  \mbox{-1} \cr
  \mbox{2} \cr
  ```

```
\mbox{-2} \cr
\mbox{-1} \cr
\end{array}\right.\)
```

17. **(1 pt) Library/Rochester/setLinearAlgebra12Diagonalization-/ur_la_12_1.pg**

Let $M = \begin{bmatrix} 6 & 2 \\ -1 & 9 \end{bmatrix}$.

Find formulas for the entries of M^n, where n is a positive integer.

$M^n = \begin{bmatrix} \_\_\_\_ & \_\_\_\_ \\ \_\_\_\_ & \_\_\_\_ \end{bmatrix}$.

Correct Answers:

- `2*(7**n) - 8**n`
- `1*2*(8**n) - 1*2*(7**n)`
- `1*1*(7**n) - 1*1*(8**n)`
- `2*(8**n) - 7**n`

18. **(1 pt) Library/Rochester/setLinearAlgebra17DotProductRn-/ur_la_17_2.pg**

Let $x = \begin{bmatrix} 5 \\ 5 \\ -1 \\ 5 \end{bmatrix}$.

Find the norm of x and the unit vector in the direction of x.

$||x|| = \_\_\_\_$,

$u = \begin{bmatrix} \_\_\_\_ \\ \_\_\_\_ \\ \_\_\_\_ \\ \_\_\_\_ \end{bmatrix}$.

Correct Answers:

- `8.71779788708135`
- `0.573539334676404`
- `0.573539334676404`
- `-0.114707866935281`
- `0.573539334676404`

19. **(1 pt) Library/Rochester/setLinearAlgebra17DotProductRn-/ur_la_17_6.pg**

Find a vector v perpendicular to the vector $u = \begin{bmatrix} -3 \\ 4 \end{bmatrix}$.

$v = \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix}$.

Correct Answers:

- ```
  \(\displaystyle\left.\begin{array}{c}
  \mbox{4} \cr
  \mbox{3} \cr
  \end{array}\right.\)
  ```

20. **(1 pt) Library/Rochester/setLinearAlgebra17DotProductRn-/ur_la_17_7.pg**

Find the value of k for which the vectors

$x = \begin{bmatrix} 4 \\ 0 \\ -1 \\ -4 \end{bmatrix}$ and $y = \begin{bmatrix} -3 \\ 1 \\ 3 \\ k \end{bmatrix}$ are orthogonal.

$k = \_\_\_\_$.

Correct Answers:

- `-3.75`

21. **(1 pt) Library/Rochester/setLinearAlgebra18OrthogonalBases-/ur_la_18_7.pg**

Let $A = \begin{bmatrix} -2 & -3 & -4 & 1 \\ 3 & 6 & 6 & -2 \end{bmatrix}$.

Find an orthonormal basis of the kernel of A.

$\begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}, \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$.

Correct Answers:

- ```
  \(\displaystyle\left.\begin{array}{c}
  \mbox{-0.894427190999916} \cr
  \mbox{0} \cr
  \mbox{0.447213595499958} \cr
  \mbox{0} \cr
  \end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c
  \mbox{0} \cr
  \mbox{0.316227766016838} \cr
  \mbox{0} \cr
  \mbox{0.948683298050514} \cr
  \end{array}\right.\)
  ```

22. **(1 pt) Library/Rochester/setLinearAlgebra18OrthogonalBases-/ur_la_18_11.pg**

Let $A = \begin{bmatrix} 1 & 0 & 3 \\ -1 & -3 & 3 \\ 3 & 10 & -11 \end{bmatrix}$.

Find an orthonormal basis of the column space of A.

$\begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}, \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$.

Correct Answers:

- ```
  \(\displaystyle\left.\begin{array}{c}
  \mbox{0.301511344577764} \cr
  \mbox{-0.301511344577764} \cr
  \mbox{0.904534033733291} \cr
  \end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c
  \mbox{-0.948683298050514} \cr
  \mbox{0} \cr
  \mbox{0.316227766016838} \cr
  \end{array}\right.\)
  ```

23. **(1 pt) Library/TCNJ/TCNJ_CharacteristicPolynomial-/problem5.pg**

The matrix.

$$A = \begin{bmatrix} 7 & 2 \\ -2 & 3 \end{bmatrix}.$$

has an eigenvalue λ of multiplicity 2 with corresponding eigenvector $\vec{v}$. Find λ and $\vec{v}$.

$\lambda = \_\_$ has an eigenvector $\vec{v} = \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix}$.

Correct Answers:

- 5
- $\begin{bmatrix} -1 \\ 1 \end{bmatrix}$
  ```

24. **(1 pt) Library/TCNJ/TCNJ_Diagonalization/problem4.pg**

Let: $A = \begin{bmatrix} 11 & -9 \\ 18 & -16 \end{bmatrix}$

Find S, D and S^{-1} such that $A = SDS^{-1}$.

$S = \begin{bmatrix} \_\_ & \_\_ \\ \_\_ & \_\_ \end{bmatrix}$, $D = \begin{bmatrix} \_\_ & 0 \\ 0 & \_\_ \end{bmatrix}$, $S^{-1} = \begin{bmatrix} \_\_ & \_\_ \\ \_\_ & \_\_ \end{bmatrix}$

.

Correct Answers:

- `1; -1; 1; -2; 2; -7; 1; -1; 1; -2`

25. **(1 pt) Library/TCNJ/TCNJ_OrthogonalSets/problem9.pg**

Given $v = \begin{bmatrix} -2 \\ 3 \end{bmatrix}$, find the coordinates for v in the subspace W spanned by $u_1 = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$ and $u_2 = \begin{bmatrix} -6 \\ 12 \end{bmatrix}$. Note that u_1 and u_2 are orthogonal.

$v =$ ____ u_1+ ____ u_2

Correct Answers:

- `-0.2`
- `0.266666666666667`

26. **(1 pt) Library/TCNJ/TCNJ_VectorEquations/problem3.pg**

Let $A = \begin{bmatrix} -3 & -3 & 0 \\ -1 & -3 & 2 \\ -3 & -4 & 1 \end{bmatrix}$ and $b = \begin{bmatrix} -8 \\ -4 \\ -14 \end{bmatrix}$.

? 1. Determine if b is a linear combination of a_1, a_2 and a_3, the columns of the matrix A.

If it is a linear combination, determine a non-trivial linear relation - (a non-trivial relation is three numbers which are not all three zero.) Otherwise, enter 0's for the coefficients.

____ a_1+ ____ a_2+ ____$a_3 = b$.

Correct Answers:

- `No`
- `0`
- `0`
- `0`

27. **(1 pt) Library/Utah/College_Algebra/set12_Matrices_and_Determinants-/1050s12p11.pg**

The determinant of the matrix

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

is ____.

Hint: Find a good row or column and expand by minors.

Correct Answers:

- `-30`

28. **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/4.1.77.pg**

The null space for the matrix $\begin{bmatrix} 1 & 7 & -2 & 14 & 0 \\ 3 & 0 & 1 & -2 & 3 \\ 6 & 1 & -1 & 0 & 4 \end{bmatrix}$

is spanA,B where A $= \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$ B $= \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$

Solution: *(Instructor solution preview: show the student solution after due date.)*

SOLUTION:

We can use a CAS to get

$$\text{null}\left(\begin{bmatrix} 1 & 7 & -2 & 14 & 0 \\ 3 & 0 & 1 & -2 & 3 \\ 6 & 1 & -1 & 0 & 4 \end{bmatrix}\right) = \text{span}\left(\begin{bmatrix} 0.428571428571429 \\ -1.85714285714286 \\ 0.714285714285714 \\ 1 \\ 0 \end{bmatrix}, \left[\right.\right.$$

Correct Answers:

- `0.428571428571429`
- `-1.85714285714286`
- `0.714285714285714`
- `1`
- `0`
- `-0.767857142857143`
- `0.0892857142857143`
- `-0.696428571428571`
- `0`
- `1`

29. **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/4.2.29a.pg**

Find a basis for the null space of the matrix.

A = $\begin{bmatrix} -3 & -7 \\ 1 & 9 \end{bmatrix}$

Basis for null(A) $= \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix}$

Solution: *(Instructor solution preview: show the student solution after due date.)*

SOLUTION

This subspace has no basis since $A\mathbf{x} = \mathbf{0}$ has the trivial solution

$\mathbf{x} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$ and null$(A) = \left\{\begin{bmatrix} 0 \\ 0 \end{bmatrix}\right\}$

Correct Answers:

- `0`
- `0`

30. (1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/4.2.32a.pg

Find a basis for the null space of matrix A.

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

$$\text{Basis} = \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \\ \_ \end{bmatrix} \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \\ \_ \end{bmatrix}$$

Solution: *(Instructor solution preview: show the student solution after due date.)*

SOLUTION:

Row-reduce the matrix which has the given vectors as columns.

A is already row-reduced, thus $A\mathbf{x} = \mathbf{0}$ has solutions of the form

$$\mathbf{x} = s_1 \begin{bmatrix} 2 \\ 0 \\ 1 \\ 0 \\ 0 \end{bmatrix} + s_2 \begin{bmatrix} 7 \\ 4 \\ 0 \\ -2 \\ 1 \end{bmatrix}$$

so that a basis for the subspace is

$$\left\{ \begin{bmatrix} 2 \\ 0 \\ 1 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 7 \\ 4 \\ 0 \\ -2 \\ 1 \end{bmatrix} \right\}$$

Correct Answers:

```
\(\displaystyle\left.\begin{array}{c}
\mbox{2} \cr
\mbox{0} \cr
\mbox{1} \cr
\mbox{0} \cr
\mbox{0} \cr
\end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c}
\mbox{7} \cr
\mbox{4} \cr
\mbox{0} \cr
\mbox{-2} \cr
\mbox{1} \cr
\end{array}\right.\)
```

31. (1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/holt_01_04_028.pg

Find the values of the coefficients a, b and c so that the conditions

$$f(0) = 3, \quad f'(0) = 19, \quad \text{and} \quad f''(0) = -9$$

hold for the function

$$f(x) = ae^x + be^{2x} + ce^{-3x}.$$

$a =$___
$b =$___
$c =$___

Solution: *(Instructor solution preview: show the student solution after due date.)*

SOLUTION: Using $f(0) = 3$, we obtain $3 = a + b + c$. Using $f'(0) = 19$ in the derivative $f'(x) = ae^x + 2be^{2x} - 3ce^{-3x}$ we obtain $19 = a + 2b - 3c$. And using $f''(0) = 19$ in the second deriative $f''(x) = ae^x + 4be^{2x} + 9ce^{-3x}$ we obtain $-9 = a + 4b + 9c$. Using a computer algebra system we solve the system of equations

$$a + b + c = 3$$
$$a + 2b - 3c = 19$$
$$a + 4b + 9c = -9$$

to get $a = 2$, $b = 4$, and $c = -3$. Thus $f(x) = 2e^x + 4e^{2x} - 3e^{-3x}$.

Correct Answers:

- `2`
- `4`
- `-3`

32. (1 pt) Library/maCalcDB/setAlgebra34Matrices/det_inv_3x3a.pg

Given the matrix

$$\begin{bmatrix} 1 & 0 & -5 \\ 0 & -3 & -2 \\ 4 & 0 & -3 \end{bmatrix}$$

(a) its determinant is: __________

(b) does the matrix have an inverse? [?]

Correct Answers:

- `-51`
- `Yes`

33. (1 pt) Library/NAU/setLinearAlgebra/diag3x3.pg

Let $A = \begin{bmatrix} 5 & -8 & -12 \\ 4 & -7 & -6 \\ 2 & -2 & -6 \end{bmatrix}$. Find an invertible matrix P and a diagonal matrix D such that $D = P^{-1}AP$.

$$P = \begin{bmatrix} \_ & \_ & \_ \\ \_ & \_ & \_ \\ \_ & \_ & \_ \end{bmatrix} \quad D = \begin{bmatrix} \_ & \_ & \_ \\ \_ & \_ & \_ \\ \_ & \_ & \_ \end{bmatrix}$$

Correct Answers:

```
\(\displaystyle\left.\begin{array}{ccc}
\mbox{4} &\mbox{2} &\mbox{3} \cr
\mbox{2} &\mbox{-1} &\mbox{0} \cr
\mbox{1} &\mbox{2} &\mbox{2} \cr
\end{array}\right.\) \(\displaystyle\left.\begin{array}{cc
\mbox{-2} &\mbox{0} &\mbox{0} \cr
\mbox{0} &\mbox{-3} &\mbox{0} \cr
\mbox{0} &\mbox{0} &\mbox{-3} \cr
\end{array}\right.\)
```

34. **(1 pt) local/Library/UI/LinearSystems/diag.pg**

Given that the matrix A has eigenvalue $\lambda_1 = 2$ with corresponding eigenvector $\begin{bmatrix} 4 \\ 2 \end{bmatrix}$ and eigenvalue $\lambda_2 = -8$ with corresponding eigenvector $\begin{bmatrix} 0 \\ 1 \end{bmatrix}$, find A.

$A = \begin{bmatrix} \_\_\_\_ & \_\_\_\_ \\ \_\_\_\_ & \_\_\_\_ \end{bmatrix}$.

Correct Answers:

- 2
- 0
- 5
- -8

35. **(1 pt) local/Library/UI/LinearSystems/ur_la_1_19AxB.pg**

Solve the system

$$\begin{cases} 4x_1 - 5x_2 + 3x_3 + 2x_4 = 0 \\ -x_1 + x_2 + 2x_3 + 3x_4 = 0 \\ 3x_1 - 4x_2 + 5x_3 + 5x_4 = 0 \\ -3x_1 + 3x_2 + 6x_3 + 9x_4 = 0 \end{cases}$$

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = + \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix} s + \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix} t.$$

Solve the system

$$\begin{cases} 4x_1 - 5x_2 + 3x_3 + 2x_4 = 4 \\ -x_1 + x_2 + 2x_3 + 3x_4 = 2 \\ 3x_1 - 4x_2 + 5x_3 + 5x_4 = 6 \\ -3x_1 + 3x_2 + 6x_3 + 9x_4 = 6 \end{cases}$$

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix} + \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix} s + \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix} t.$$

If the matrix A corresponds to the coefficient matrix for the above system of equations, then given any vector $\vec{b}$, the matrix equation $A\vec{x} = \vec{b}$ will always has an infinite number of solutions.

- A. True
- B. False

Correct Answers:

- ```
  \(\displaystyle\left.\begin{array}{c}
  \mbox{13} \cr
  \mbox{11} \cr
  \mbox{1} \cr
  \mbox{0} \cr
  \end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c
  \mbox{17} \cr
  \mbox{14} \cr
  \mbox{0} \cr
  \mbox{1} \cr
  \end{array}\right.\)
  ```
- ```
  \(\displaystyle\left.\begin{array}{c}
  \mbox{-14} \cr
  \mbox{-12} \cr
  \mbox{0} \cr
  \mbox{0} \cr
  \end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c
  \mbox{13} \cr
  \mbox{11} \cr
  \mbox{1} \cr
  \mbox{0} \cr
  \end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c
  \mbox{17} \cr
  \mbox{14} \cr
  \mbox{0} \cr
  \mbox{1} \cr
  \end{array}\right.\)
  ```
- B

36. **(1 pt) local/Library/UI/LinearSystems/ur_la_1_20vv3.pg**

Solve the system

$$\begin{cases} x_1 + 4x_2 - 2x_3 + 4x_5 + 4x_6 = 0 \\ -x_4 + 5x_5 + 3x_6 = 0 \\ x_1 + 4x_2 - 6x_5 + 8x_6 = 0 \end{cases}$$

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \end{bmatrix} = \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \\ \_ \\ \_ \end{bmatrix} s + \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \\ \_ \\ \_ \end{bmatrix} t + \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \\ \_ \\ \_ \end{bmatrix} u.$$

Solve the system

$$\begin{cases} x_1 + 4x_2 - 2x_3 + 4x_5 + 4x_6 = 0 \\ -x_4 + 5x_5 + 3x_6 = 1 \\ x_1 + 4x_2 - 6x_5 + 8x_6 = 2 \end{cases}$$

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \end{bmatrix} = \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} + \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} s + \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} t$$

$$+ \begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix} u.$$

If the matrix A corresponds to the coefficient matrix for the above system of equations, then given any vector $\vec{b}$, the matrix equation $A\vec{x} = \vec{b}$ will always has an infinite number of solutions.

- A. True
- B. False

Correct Answers:

- ```
  \(\displaystyle\left.\begin{array}{c}
  \mbox{-4} \cr
  \mbox{1} \cr
  \mbox{0} \cr
  \mbox{0} \cr
  \mbox{0} \cr
  \mbox{0} \cr
  \end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c}
  \mbox{6} \cr
  \mbox{0} \cr
  \mbox{5} \cr
  \mbox{5} \cr
  \mbox{1} \cr
  \mbox{0} \cr
  \end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c}
  \mbox{-8} \cr
  \mbox{0} \cr
  \mbox{-2} \cr
  \mbox{3} \cr
  \mbox{0} \cr
  \mbox{1} \cr
  \end{array}\right.\)
  ```
- ```
  \(\displaystyle\left.\begin{array}{c}
  \mbox{2} \cr
  \mbox{0} \cr
  \mbox{1} \cr
  \mbox{-1} \cr
  \mbox{0} \cr
  \mbox{0} \cr
  \end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c}
  \mbox{-4} \cr
  \mbox{1} \cr
  \mbox{0} \cr
  \mbox{0} \cr
  \mbox{0} \cr
  \mbox{0} \cr
  \end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c
  \mbox{6} \cr
  \mbox{0} \cr
  \mbox{5} \cr
  \mbox{5} \cr
  \mbox{1} \cr
  \mbox{0} \cr
  \end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c
  \mbox{-8} \cr
  \mbox{0} \cr
  \mbox{-2} \cr
  \mbox{3} \cr
  \mbox{0} \cr
  \mbox{1} \cr
  \end{array}\right.\)
  ```
- A

---

37. **(1 pt) Library/NAU/setLinearAlgebra/m1.pg**

Find the inverse of AB if

$A^{-1} = \begin{bmatrix} 2 & -5 \\ 3 & 4 \end{bmatrix}$ and $B^{-1} = \begin{bmatrix} 4 & 0 \\ 4 & -2 \end{bmatrix}$.

$(AB)^{-1} = \begin{bmatrix} \_\_\_ & \_\_\_ \\ \_\_\_ & \_\_\_ \end{bmatrix}$

Correct Answers:

- 8
- -20
- 2
- -28

---

38. **(1 pt) Library/Rochester/setAlgebra34Matrices/cubing_2x2.pg**

Given the matrix $A = \begin{bmatrix} 3 & -4 \\ 0 & 2 \end{bmatrix}$, find A^3.

$A^3 = \begin{bmatrix} \_\_ & \_\_ \\ \_\_ & \_\_ \end{bmatrix}$.

Correct Answers:

- 27
- -76
- 0
- 8

---

39. **(1 pt) local/Library/UI/4.1.77.pg**

The null space for the matrix $\begin{bmatrix} 1 & 7 & -2 & 14 & 0 \\ 3 & 0 & 1 & -2 & 3 \\ 6 & 1 & -1 & 0 & 4 \end{bmatrix}$

is spanA,B where A $= \begin{bmatrix} \_\_\_ \\ \_\_\_ \\ \_\_\_ \\ \_\_\_ \\ \_\_\_ \end{bmatrix}$ B $= \begin{bmatrix} \_\_\_ \\ \_\_\_ \\ \_\_\_ \\ \_\_\_ \\ \_\_\_ \end{bmatrix}$

Solution: *(Instructor solution preview: show the student solution after due date.)*

SOLUTION:

We can use a CAS to get

$$\text{null}\left(\begin{bmatrix} 1 & 7 & -2 & 14 & 0 \\ 3 & 0 & 1 & -2 & 3 \\ 6 & 1 & -1 & 0 & 4 \end{bmatrix}\right) = \text{span}\left(\begin{bmatrix} 0.428571428571429 \\ -1.85714285714286 \\ 0.714285714285714 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} -0.767857142857143 \\ -0.0892857142857143 \\ -0.696428571428571 \\ 0 \\ 1 \end{bmatrix}\right)$$

Correct Answers:

- 0.428571428571429
- -1.85714285714286
- 0.714285714285714
- 1
- 0
- -0.767857142857143
- -0.0892857142857143
- -0.696428571428571
- 0
- 1

---

40. **(1 pt) local/Library/UI/4.3.3.pg**

Find bases for the column space and the null space of matrix A. You should verify that the Rank-Nullity Theorem holds. An equivalent echelon form of matrix A is given to make your work easier.

A = $\begin{bmatrix} 1 & 0 & -4 & -3 \\ -2 & 1 & 13 & 5 \\ 0 & 1 & 5 & -1 \end{bmatrix}$ $\begin{bmatrix} 1 & 0 & -4 & -3 \\ 0 & 1 & 5 & -1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

Basis for the column space of A = $\begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$ $\begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$

Basis for the null space of A = $\begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$ $\begin{bmatrix} \_\_ \\ \_\_ \\ \_\_ \\ \_\_ \end{bmatrix}$

Solution: *(Instructor solution preview: show the student solution after due date.)*

SOLUTION:

A basis for the column space, determined from the pivot columns 1 and 2, is

$$\left\{\begin{bmatrix} 1 \\ -2 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}\right\}$$

Solve $A\mathbf{x} = \mathbf{0}$, to obtain $\mathbf{x} = s_1 \begin{bmatrix} +4 \\ -5 \\ 1 \\ 0 \end{bmatrix} + s_2 \begin{bmatrix} +3 \\ +1 \\ 0 \\ 1 \end{bmatrix}$, and so

the nullspace basis is $\left\{\begin{bmatrix} +4 \\ -5 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} +3 \\ +1 \\ 0 \\ 1 \end{bmatrix}\right\}$.

Correct Answers:

- \(\displaystyle\left.\begin{array}{c}
  \mbox{1} \cr
  \mbox{-2} \cr
  \mbox{0} \cr
  \end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c
  \mbox{0} \cr
  \mbox{1} \cr
  \mbox{1} \cr
  \end{array}\right.\)
- \(\displaystyle\left.\begin{array}{c}
  \mbox{4} \cr
  \mbox{-5} \cr
  \mbox{1} \cr
  \mbox{0} \cr
  \end{array}\right.\) ,\(\displaystyle\left.\begin{array}{c
  \mbox{3} \cr
  \mbox{1} \cr
  \mbox{0} \cr
  \mbox{1} \cr
  \end{array}\right.\)

---

41. **(1 pt) local/Library/UI/6a.pg**

The null space for the matrix $\begin{bmatrix} 2 & 0 & 5 \\ -1 & 6 & 2 \\ 4 & 4 & -1 \\ 5 & 1 & 0 \\ 4 & 1 & 1 \end{bmatrix}$

is $\begin{bmatrix} \_\_\_\_ \\ \_\_\_\_ \\ \_\_\_\_ \end{bmatrix}$

Solution: *(Instructor solution preview: show the student solution after due date.)*

SOLUTION:

$$\text{null}\left(\begin{bmatrix} 2 & 0 & 5 \\ -1 & 6 & 2 \\ 4 & 4 & -1 \\ 5 & 1 & 0 \\ 4 & 1 & 1 \end{bmatrix}\right) = \left\{\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}\right\}$$

Correct Answers:

- 0
- 0
- 0

---

42. **(1 pt) Library/Rochester/setLinearAlgebra23QuadraticForms-/ur_la_23_1.pg**

Write the matrix of the quadratic form

$Q(x) = -4x_1^2 + 2x_2^2 - 6x_3^2 - 5x_1x_2 - 9x_1x_3 - 1x_2x_3$.

$$A = \begin{bmatrix} \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \\ \_\_ & \_\_ & \_\_ \end{bmatrix}.$$

Correct Answers:

- -4
- -2.5
- -4.5
- -2.5
- 2

- -0.5
- -4.5
- -0.5
- -6

---

43. **(1 pt) Library/Rochester/setLinearAlgebra23QuadraticForms-/ur_la_23_4.pg**

If $A = \begin{bmatrix} 5 & 8 \\ 8 & -9 \end{bmatrix}$ and $Q(x) = x \cdot Ax$,

Then $Q(e_1) =$ ___ and $Q(e_2) =$ ___.

Correct Answers:

- 5
- -9

---

44. **(1 pt) Library/Rochester/setLinearAlgebra23QuadraticForms-/ur_la_23_5.pg**

If $A = \begin{bmatrix} 7 & 9 & 7 \\ 9 & 5 & -9 \\ 7 & -9 & -9 \end{bmatrix}$ and $Q(x) = x \cdot Ax$,

Then $Q(x_1, x_2, x_3) =$ ___ x_1^2+ ___ x_2^2+ ___ x_3^2+ ___ $x_1 x_2+$ ___ $x_1 x_3+$ ___ $x_2 x_3$.

Correct Answers:

- 7
- 5
- -9
- 18
- 14
- -18