Calculate the determinant of $\begin{bmatrix} -4.66666666666667 & 2 \\ -6 & 3 \end{bmatrix}$.

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. 5

Correct Answers:

- `C`

2. **(1 pt) local/Library/UI/Fall14/HW8_2.pg**
Evaluate the following 3×3 determinant. Use the properties of determinants to your advantage.

$$\begin{vmatrix} -2 & 0 & -4 \\ -6 & 0 & 6 \\ -9 & 0 & 4 \end{vmatrix}$$

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

Does the matrix have an inverse?

- A. No
- B. Yes

Correct Answers:

- `E`
- `A`

3. **(1 pt) local/Library/UI/Fall14/HW8_3.pg**
Given the matrix

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

(a) find its determinant

- A. 25
- B. -5
- C. -4
- D. -2
- E. -1
- F. 0
- G. 1
- H. 3
- I. 5
- J. 7
- K. None of those above

(b) does the matrix have an inverse?

- A. No
- B. Yes

Correct Answers:

- `A`
- `B`

4. **(1 pt) local/Library/UI/Fall14/HW8_4.pg**
If A and B are 4×4 matrices, $\det(A) = 4$, $\det(B) = -3$, then $\det(AB) =$

- A. -15
- B. -12
- C. -11
- D. -8
- E. -5
- F. 0
- G. 3
- H. 6
- I. 8
- J. 12
- K. None of those above

$\det(2A) =$

- A. -40
- B. 64
- C. -28
- D. -21
- E. -10
- F. -1
- G. 10
- H. 21
- I. 28
- J. 36
- K. 40
- L. None of those above

$\det(A^T) =$

- A. -3
- B. -2
- C. -1
- D. 0
- E. 1
- F. 2
- G. 3
- H. 4
- I. None of those above

$\det(B^{-1}) =$

- A. -0.5
- B. -0.4
- C. –0.333333333333333
- D. 0
- E. -0.333333333333333
- F. 0.4
- G. 0.5
- H. 1
- I. None of those above

$\det(B^4) =$

- A. -81
- B. -36
- C. -12
- D. 0
- E. 12
- F. 36
- G. 81
- H. 1024
- I. None of those above

Correct Answers:

- B
- B
- H
- E
- G

---

5. (1 pt) local/Library/UI/Fall14/HW8_5.pg

Find the determinant of the matrix

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

$\det(A) =$

- A. -400
- B. -360
- C. -288
- D. -120
- E. 0
- F. 120
- G. 40
- H. 240
- I. 360
- J. 400
- K. None of those above

Correct Answers:

- G

---

6. (1 pt) local/Library/UI/problem7.pg

A and B are $n \times n$ matrices.

Adding a multiple of one row to another does not affect the determinant of a matrix.

- A. True
- B. False

If the columns of A are linearly dependent, then $detA = 0$.

- A. True
- B. False

$det(A+B) = detA + detB.$

- A. True
- B. False

Correct Answers:

- A
- A
- B

---

7. **(1 pt) local/Library/UI/Fall14/HW8_7.pg**

Suppose that a 4×4 matrix A with rows v_1, v_2, v_3, and v_4 has determinant $\det A = -4$. Find the following determinants:

$B = \begin{bmatrix} v_1 \\ v_2 \\ v_3 \\ 2v_4 \end{bmatrix}$ $\det(B) =$

- A. -18
- B. -15
- C. -12
- D. -8
- E. -9
- F. 0
- G. 9
- H. 12
- I. 15
- J. 18
- K. None of those above

$C = \begin{bmatrix} v_4 \\ v_1 \\ v_2 \\ v_3 \end{bmatrix}$ $\det(C) =$

- A. -18
- B. 4
- C. -9
- D. -3
- E. 0
- F. 3
- G. 9
- H. 12
- I. 18
- J. None of those above

$D = \begin{bmatrix} v_1 \\ v_2 \\ v_3 + 6v_4 \\ v_4 \end{bmatrix}$

$\det(D) =$

- A. -18
- B. -4
- C. -9
- D. -3
- E. 0
- F. 3
- G. 9
- H. 12
- I. 18
- J. None of those above

Correct Answers:

- D
- B
- B

---

8. **(1 pt) local/Library/UI/Fall14/HW8_8.pg**

Use determinants to determine whether each of the following sets of vectors is linearly dependent or independent.

$\begin{bmatrix} 7 \\ -4 \end{bmatrix}, \begin{bmatrix} -1 \\ -9 \end{bmatrix},$

- A. Linearly Dependent
- B. Linearly Independent

$\begin{bmatrix} 1 \\ 5 \\ -1 \end{bmatrix}, \begin{bmatrix} -2 \\ -13 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 3 \\ 3 \end{bmatrix},$

- A. Linearly Dependent
- B. Linearly Independent

$\begin{bmatrix} -3 \\ -9 \end{bmatrix}, \begin{bmatrix} -3 \\ -9 \end{bmatrix},$

- A. Linearly Dependent
- B. Linearly Independent

$\begin{bmatrix} 1 \\ 3 \\ 4 \end{bmatrix}, \begin{bmatrix} -2 \\ -6 \\ -8 \end{bmatrix}, \begin{bmatrix} 3 \\ 9 \\ 12 \end{bmatrix},$

- A. Linearly Dependent
- B. Linearly Independent

Correct Answers:

- B
- B
- A
- A

9. **(1 pt) local/Library/UI/Fall14/HW8_10.pg**

$$A = \begin{bmatrix} 3 & 3 & 0 & -9 \\ 5 & -9 & 0 & 0 \\ 0 & -9 & 0 & 0 \\ -2 & 1 & -3 & -9 \end{bmatrix}$$

The determinant of the matrix is

- A. -1890
- B. -1024
- C. -630
- D. 1215
- E. -210
- F. 0
- G. 324
- H. 630
- I. 1024
- J. None of those above

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

Correct Answers:

- D

10. **(1 pt) local/Library/UI/Fall14/HW8_11.pg**

Find the determinant of the matrix

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

$\det(M) =$

- A. -48
- B. -35
- C. -20
- D. -5
- E. 5
- F. 18
- G. 20
- H. 81
- I. None of those above

Correct Answers:

- C

11. **(1 pt) local/Library/UI/Fall14/HW8_12.pg**

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \end{bmatrix}$$

And now for the grand finale: The determinant of the matrix is

- A. -362880
- B. -5
- C. 0
- D. 5
- E. 20
- F. 30
- G. 40
- H. 362880
- I. None of the above

Hint: Remember that a square linear system has a unique solution if the determinant of the coefficient matrix is non-zero.

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

Solution: Since all the rows are the same a linear system with A as its coefficient matrix cannot have a unique solution and therefore the determinant of A is zero.

Correct Answers:

- C

12. **(1 pt) local/Library/UI/4.3.1a.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.

$$\text{A} = \begin{bmatrix} 1 & 2 & 9 \\ 3 & 3 & 18 \\ 2 & 6 & 24 \end{bmatrix} \begin{bmatrix} 1 & 0 & 3 \\ 0 & 1 & 3 \\ 0 & 0 & 0 \end{bmatrix}$$

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

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

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

$$\left\{ \begin{bmatrix} 1 \\ 3 \\ 2 \end{bmatrix}, \begin{bmatrix} 2 \\ 3 \\ 6 \end{bmatrix} \right\}$$

Solve $A\mathbf{x} = \mathbf{0}$, to obtain $\mathbf{x} = s \begin{bmatrix} -3 \\ -3 \\ 1 \end{bmatrix}$, and so the nullspace basis is $\left\{ \begin{bmatrix} -3 \\ -3 \\ 1 \end{bmatrix} \right\}$.

Correct Answers:

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

---

13. **(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:

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

---

14. **(1 pt) Library/Rochester/setLinearAlgebra10Bases/ur_la_10_30.pg**

Find a basis of the column space of the matrix

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

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

Correct Answers:

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

---

**15.** **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/4.1.27.pg**

Find the null space for $A = \begin{bmatrix} 1 & 1 \\ -7 & -6 \\ -6 & -2 \end{bmatrix}$.

What is null$(A)$?
```

- A. span$\left\{\begin{bmatrix}-1\\1\end{bmatrix}\right\}$
- B. $\mathbb{R}^3$
- C. span$\left\{\begin{bmatrix}1\\-7\\-6\end{bmatrix}\right\}$
- D. $\mathbb{R}^2$
- E. span$\left\{\begin{bmatrix}0\\0\\0\end{bmatrix}\right\}$
- F. span$\left\{\begin{bmatrix}1\\1\end{bmatrix}\right\}$
- G. $\left\{\begin{bmatrix}0\\0\end{bmatrix}\right\}$
- H. none of the above

.

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

SOLUTION

A is row reduces to $\begin{bmatrix}1&0\\0&1\\0&0\end{bmatrix}$. The basis of the null space has one element for each column without a leading one in the row reduced matrix.
Thus $A\mathbf{x}=\mathbf{0}$ has a zero dimentional null space,
and null(A) is the zero vector $\begin{bmatrix}0\\0\end{bmatrix}$.

Correct Answers:

- G

---

16. **(1 pt) local/Library/UI/4.1.23.pg**

Find the null space for $A=\begin{bmatrix}1&0&-3\\0&1&8\end{bmatrix}$.
What is null(A)?

- A. span$\left\{\begin{bmatrix}-8\\+3\end{bmatrix}\right\}$
- B. span$\left\{\begin{bmatrix}-8\\+3\\1\end{bmatrix}\right\}$
- C. $\mathbb{R}^2$
- D. $\mathbb{R}^3$
- E. span$\left\{\begin{bmatrix}1\\0\\+3\end{bmatrix},\begin{bmatrix}0\\1\\-8\end{bmatrix}\right\}$
- F. span$\left\{\begin{bmatrix}+3\\-8\\1\end{bmatrix}\right\}$
- G. span$\left\{\begin{bmatrix}+3\\-8\end{bmatrix}\right\}$
- H. none of the above

.

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

SOLUTION

A is row reduced. The basis of the null space has one element for each column without a leading one in the row reduced matrix.
Thus $A\mathbf{x}=\mathbf{0}$ has a one dimentional null space,
and thus, null(A) is the subspace generated by $\begin{bmatrix}1-3\\18\\1\end{bmatrix}$.

Correct Answers:

- F

---

17. **(1 pt) Library/WHFreeman/Holt_linear_algebra/Chaps_1-4-/4.3.47.pg**

Indicate whether the following statement is true or false.

[?] 1. If A and B are equivalent matrices, then col(A) = col(B).

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

SOLUTION:

FALSE. Consider $A=\begin{bmatrix}2&3&4\\2&3&4\end{bmatrix}$ and $B=\begin{bmatrix}2&3&4\\0&0&0\end{bmatrix}$

Correct Answers:

- F

---

18. **(1 pt) local/Library/UI/Fall14/HW7_27.pg**

Determine the rank and nullity of the matrix.

$$\begin{bmatrix}2&-1&0&1\\5&2&1&-4\\-1&-4&-1&6\\-8&-5&-2&9\end{bmatrix}$$

The rank of the matrix is

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

The nullity of the matrix is

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0

- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

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

SOLUTION:

When reduced to row-echelon form, there are two non-zero rows, so the rank of the matrix is 2 and the nullity is 2.

$$\begin{bmatrix} 2 & -1 & 0 & 1 \\ 5 & 2 & 1 & -4 \\ -1 & -4 & -1 & 6 \\ -8 & -5 & -2 & 9 \end{bmatrix} \sim \begin{bmatrix} 1 & 4 & 1 & -6 \\ 0 & 9 & 2 & -13 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Correct Answers:

- G
- G