



Matrices

- 1 Find the result of $A + B$, or choose [undefined] if it cannot be computed.

$$A = \begin{bmatrix} -8 & -7 & -9 \\ 4 & 5 & -4 \\ 8 & 6 & 7 \end{bmatrix} \quad B = \begin{bmatrix} -8 & 5 & -5 \\ 8 & -2 & -4 \\ -9 & 0 & 6 \end{bmatrix}$$

[8pt] $A + B = [?]$

A $\begin{bmatrix} -16 & -1 & -14 \\ 12 & 3 & -8 \\ -1 & 6 & 13 \end{bmatrix}$

B $\begin{bmatrix} -16 & -2 & -14 \\ 12 & 3 & -8 \\ -1 & 6 & 13 \end{bmatrix}$

C $\begin{bmatrix} 0 & -12 & -4 \\ -4 & 7 & 0 \\ 17 & 6 & 1 \end{bmatrix}$

- 2 Find the matrix-vector product Av .

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

[8pt] $v = (2, -1)$
[8pt] $Av = [?]$

A $(-8, 8)$

B $(8, -8)$

C $(9, -8)$

- 3 Find the matrix-vector product Av .

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

[8pt] $v = \begin{bmatrix} -6 \\ -2 \\ -1 \end{bmatrix}$
[8pt] $Av = [?]$

A $\begin{bmatrix} -15 \\ 19 \end{bmatrix}$

B $\begin{bmatrix} -19 \\ 15 \end{bmatrix}$

C $\begin{bmatrix} 15 \\ -19 \end{bmatrix}$

D $\begin{bmatrix} 16 \\ -19 \end{bmatrix}$

- 4 What is the entry at row 3, column 1 of the matrix of minors of this matrix?

A -6

B -11

C -13

D -9

E -15

F -12

- 5 What is the determinant of the minor matrix for the entry at row 3, column 1?

A -59

B -55

C -60

D -54

E -52

F -56



Matrices

- 6 Which matrix is the transpose of this matrix?

$$\begin{bmatrix} 0 & -6 & 9 \\ -5 & -7 & -1 \\ -9 & 4 & 5 \end{bmatrix}$$

A

$$\begin{bmatrix} -3 & -5 & -9 \\ -6 & -7 & 4 \\ 9 & -1 & 5 \end{bmatrix}$$

B

$$\begin{bmatrix} 0 & -5 & -1 \\ -6 & -7 & 7 \\ 9 & -1 & 5 \end{bmatrix}$$

C

$$\begin{bmatrix} 0 & -5 & -9 \\ -6 & -7 & 4 \\ 9 & -1 & 5 \end{bmatrix}$$

D

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

- 7 Which is the cofactor matrix of this matrix?

$$\begin{bmatrix} -9 & 5 \\ -7 & -2 \end{bmatrix}$$

A

$$\begin{bmatrix} -2 & 6 \\ -5 & -9 \end{bmatrix}$$

B

$$\begin{bmatrix} -2 & 7 \\ -5 & -9 \end{bmatrix}$$

C

$$\begin{bmatrix} -1 & 7 \\ -5 & -9 \end{bmatrix}$$

D

$$\begin{bmatrix} -2 & 7 \\ -5 & -7 \end{bmatrix}$$

- 8 Which diagram shows how the values move to form the transpose?

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

A

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

B

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

C

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

D

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



Matrices

- 9** Which shows column 3 of the adjoint of this matrix of minors? Fill only that column and leave the other entries blank. Apply the sign pattern $(-1)^{i+j}$ to the matrix of minors to get the cofactor matrix, then transpose it: $\text{adj}(A) = C^T$.

A

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

B

$$\begin{bmatrix} \square & \square & -2 \\ \square & \square & -2 \\ \square & \square & 7 \end{bmatrix}$$

C

$$\begin{bmatrix} \square & \square & -1 \\ \square & \square & -5 \\ \square & \square & 10 \end{bmatrix}$$

D

$$\begin{bmatrix} \square & \square & -4 \\ \square & \square & -3 \\ \square & \square & 10 \end{bmatrix}$$

- 12** What is the determinant of this matrix?

$$\begin{bmatrix} 0 & 6 & 6 \\ -6 & -7 & 5 \\ -9 & 7 & -6 \end{bmatrix}$$

A -1118

B -1116

C -1113

D -1112

E -1119

F -1121

- 14** Choose the product with the highlighted entry filled in correctly.

A

$$\begin{bmatrix} ? & ? & -17 \\ ? & ? & ? \\ ? & ? & ? \\ ? & ? & ? \end{bmatrix}$$

B

$$\begin{bmatrix} ? & ? & 9 \\ ? & ? & ? \\ ? & ? & ? \\ ? & ? & ? \end{bmatrix}$$

- 10** What is the determinant of this matrix?

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

A	B	C
13	16	5
D	E	F
8	15	10

- 11** What is the determinant of this matrix?

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

A	B	C
588	-583	-584
D	E	F
578	-590	-580

- 13** Choose the product with the highlighted column filled in correctly.

A

$$\begin{bmatrix} ? & ? & ? & -13 \\ ? & ? & ? & 2 \end{bmatrix}$$

B

$$\begin{bmatrix} ? & ? & ? & -13 \\ ? & ? & ? & 6 \end{bmatrix}$$

- 15** Identify the dimensions of this matrix

$$\begin{bmatrix} 6 & 1 & 5 & 5 \\ 8 & 5 & 5 & 1 \\ 0 & 2 & 9 & 1 \\ 5 & 3 & 9 & 2 \\ 3 & 4 & 8 & 1 \end{bmatrix}$$

A	B
5×4	3×6
C	D
5×3	3×5
E	F
6×5	4×6



Matrices

16 Which is the inverse of this matrix? Use $A^{-1} = \frac{1}{|\text{A}|} \text{adj}(A)$.

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

A

$$\begin{bmatrix} 0.09 & -0.36 \\ -0.18 & -0.27 \end{bmatrix}$$

B

$$\begin{bmatrix} 0.09 & -0.36 \\ -0.18 & 0.73 \end{bmatrix}$$

C

$$\begin{bmatrix} 0.09 & -0.36 \\ 1.82 & -0.27 \end{bmatrix}$$

D

$$\begin{bmatrix} 0.09 & 2.64 \\ -0.18 & -0.27 \end{bmatrix}$$

17 The determinant is -80 and the adjoint is shown. Which is the inverse matrix?

$$\begin{bmatrix} -8 & 8 \\ 5 & 5 \end{bmatrix}$$

A

$$\begin{bmatrix} 0.1 & -0.1 \\ -0.06 & -0.06 \end{bmatrix}$$

B

$$\begin{bmatrix} 0.1 & -0.1 \\ 0.94 & -0.06 \end{bmatrix}$$

C

$$\begin{bmatrix} 1.1 & -0.1 \\ -0.06 & -0.06 \end{bmatrix}$$

D

$$\begin{bmatrix} 0.1 & 2.9 \\ -3.06 & -0.06 \end{bmatrix}$$



Matrices

- 18** The determinant is -40 and the adjoint is shown. Which is the inverse matrix? Use $A^{-1} = \frac{1}{\det A} \text{adj}(A)$.

$$\begin{bmatrix} 4 & 2 \\ 2 & -9 \end{bmatrix}$$

A

$$\begin{bmatrix} -0.1 & -0.05 \\ -0.05 & 0.22 \end{bmatrix}$$

B

$$\begin{bmatrix} -0.1 & -0.05 \\ 0.95 & 0.22 \end{bmatrix}$$

C

$$\begin{bmatrix} 0.9 & -0.05 \\ -0.05 & 0.22 \end{bmatrix}$$

D

$$\begin{bmatrix} -0.1 & -0.05 \\ -0.05 & -1.78 \end{bmatrix}$$

- 19** Which is the inverse of this matrix? Use $A^{-1} = \frac{1}{\det A} \text{adj}(A)$.

$$\begin{bmatrix} -1 & -1 & -7 \\ 6 & 3 & 3 \\ -4 & -5 & -4 \end{bmatrix}$$

A

$$\begin{bmatrix} 0.03 & 0.28 & 0.16 \\ 0.11 & 1.78 & -0.35 \\ -0.16 & -0.01 & 0.03 \end{bmatrix}$$

B

$$\begin{bmatrix} 0.03 & 0.28 & 0.16 \\ 0.11 & -0.22 & -0.35 \\ -0.16 & -0.01 & 2.03 \end{bmatrix}$$

C

$$\begin{bmatrix} 0.03 & -1.72 & 0.16 \\ 1.11 & -0.22 & -0.35 \\ -0.16 & -0.01 & 0.03 \end{bmatrix}$$

D

$$\begin{bmatrix} 0.03 & 0.28 & 0.16 \\ 0.11 & -0.22 & -0.35 \\ -0.16 & -0.01 & 0.03 \end{bmatrix}$$



Matrices

20 The determinant is -112 and the adjoint is shown. Which is the inverse matrix?

$$\begin{bmatrix} 0 & 28 & 28 \\ -20 & -73 & -45 \\ -4 & -37 & -9 \end{bmatrix}$$

A

$$\begin{bmatrix} 0 & -0.25 & 1.75 \\ 0.18 & 0.65 & 0.4 \\ 0.04 & 0.33 & 0.08 \end{bmatrix}$$

B

$$\begin{bmatrix} 0 & -0.25 & -0.25 \\ 0.18 & 0.65 & 0.4 \\ 0.04 & 0.33 & 0.08 \end{bmatrix}$$

C

$$\begin{bmatrix} 0 & -0.25 & -0.25 \\ 0.18 & 0.65 & -1.6 \\ 0.04 & 0.33 & 0.08 \end{bmatrix}$$

D

$$\begin{bmatrix} 0 & -3.25 & -0.25 \\ -1.82 & 0.65 & 0.4 \\ 0.04 & 0.33 & 0.08 \end{bmatrix}$$

21 What are the dimensions of the matrix product AB?

$$A = \begin{bmatrix} 9 & 6 & -8 & 0 \\ 7 & -3 & -5 & -4 \end{bmatrix}$$

$$[8pt] B = \begin{bmatrix} 4 & -6 \\ -5 & -7 \\ -3 & 5 \\ -2 & -8 \end{bmatrix}$$

A

$$(2 \times 4)$$

B

[undefined]

C

$$(4 \times 2)$$

D

$$(2 \times 2)$$

22 What are the dimensions of the matrix product AB?

A is a (2×4) matrix

[6pt] B is a (4×2) matrix

A

$$(4 \times 2)$$

B

$$(2 \times 2)$$

C

$$(2 \times 4)$$

D

[undefined]



Matrices

- 23** Which grid shows the cofactor signs for a matrix of this size?

$$\begin{bmatrix} -1 & 2 & -7 \\ 3 & -1 & 4 \\ -9 & 8 & -7 \end{bmatrix}$$

A $\begin{bmatrix} - & + & - \\ + & - & + \\ - & + & - \end{bmatrix}$

B $\begin{bmatrix} + & - & + \\ - & + & - \\ + & - & + \end{bmatrix}$

- 24** Is the matrix product AB defined?

A is a (2×3) matrix

[6pt] B is a (2×4) matrix

A Yes

B No

- 25** Which is the cofactor matrix of this matrix of minors? Apply the sign pattern $(-1)^{i+j}$ to each entry of the matrix of minors.

$$\begin{bmatrix} 1 & -6 & 6 \\ 1 & -5 & 7 \\ -6 & 1 & 6 \end{bmatrix}$$

A $\begin{bmatrix} 1 & 6 & 6 \\ -1 & -5 & -7 \\ -8 & -1 & 6 \end{bmatrix}$

B $\begin{bmatrix} 1 & 6 & 6 \\ -1 & -5 & -7 \\ -6 & -1 & 6 \end{bmatrix}$

C $\begin{bmatrix} 1 & 4 & 6 \\ -1 & -5 & -7 \\ -6 & 0 & 6 \end{bmatrix}$

- 26** Which is the adjoint of this cofactor matrix? The adjoint is the transpose of the cofactor matrix: $\text{adj}(A) = C^T$.

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

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

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

C $\begin{bmatrix} 7 & 5 & 4 \\ 1 & 5 & 0 \\ 5 & 9 & -3 \end{bmatrix}$

D $\begin{bmatrix} 7 & 5 & 4 \\ 1 & 5 & -2 \\ 5 & 8 & -5 \end{bmatrix}$

- 27** Which is the adjoint of this cofactor matrix? The adjoint is the transpose of the cofactor matrix: $\text{adj}(A) = C^T$.

$$\begin{bmatrix} 0 & 6 \\ -8 & 6 \end{bmatrix}$$

A $\begin{bmatrix} 2 & -8 \\ 6 & 7 \end{bmatrix}$

B $\begin{bmatrix} 1 & -8 \\ 6 & 6 \end{bmatrix}$

C $\begin{bmatrix} 0 & -6 \\ 6 & 6 \end{bmatrix}$

D $\begin{bmatrix} 0 & -8 \\ 6 & 6 \end{bmatrix}$



Matrices

28 Is the matrix product AB defined?

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

$$[8pt]B = \begin{bmatrix} 1 & -4 \\ -2 & 7 \\ -6 & -3 \\ -8 & -7 \end{bmatrix}$$

A	B
No	Yes

29 Use the row-column notation to find the value of the entry.

$$\begin{bmatrix} 44 & 60 & 24 \\ 14 & 73 & 92 \\ 54 & 13 & 7 \\ 52 & 1 & 25 \\ 41 & 48 & 19 \end{bmatrix} \quad a_{5,3} = ?$$

A	41	B	19
C	60	D	7

30 Identify what type this matrix is

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

A	Identity	B	Row
C	Zero	D	Lower Triangular
E	Upper Triangular	F	Diagonal

32 Matrix A shows the cups sold of 3 drinks at 2 cafes. Matrix B shows the revenue and cost per drink. What does the product AB represent?

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

A	the total revenue and cost at each cafe
B	the revenue and cost per drink

33 Matrix A shows the grams of 3 ingredients at 2 recipes. Matrix B shows the calories and protein per ingredient. What does the value 125 in AB represent?

$$A = \begin{bmatrix} 3 & 2 & 6 \\ 7 & 4 & 8 \end{bmatrix} \quad B = \begin{bmatrix} 2 & 7 \\ 8 & 9 \\ 4 & 5 \end{bmatrix} \quad AB = \begin{bmatrix} 46 & 69 \\ 78 & 125 \end{bmatrix}$$

A	the total protein at recipe 2
B	the total calories at recipe 2

31 Which shows column 3 of the matrix of minors of this matrix? Fill only that column and leave the other entries blank.

A	$\begin{bmatrix} \square & \square & -24 \\ \square & \square & 12 \\ \square & \square & 30 \end{bmatrix}$	B	$\begin{bmatrix} \square & \square & -21 \\ \square & \square & 9 \\ \square & \square & 27 \end{bmatrix}$
C	$\begin{bmatrix} \square & \square & -27 \\ \square & \square & 15 \\ \square & \square & 28 \end{bmatrix}$	D	$\begin{bmatrix} \square & \square & -22 \\ \square & \square & 12 \\ \square & \square & 30 \end{bmatrix}$

34 This matrix shows the orders of 2 drinks at 3 cafes. What does the value 35 represent?

$$\begin{bmatrix} 37 & 33 \\ 63 & 30 \\ 35 & 79 \end{bmatrix}$$

A	the orders of drink 2 at cafe 1
B	the orders of drink 1 at cafe 3



Matrices

35 Which matrix has the entry with this row-column notation highlighted?

$$a_{1,4}$$

36 Find the result of $-1A$.

$$A = \begin{bmatrix} 6 & 2 \\ -8 & 5 \end{bmatrix}$$

$$[8pt] -1A = [?]$$

A

$$\begin{bmatrix} -6 & -2 \\ 8 & -5 \end{bmatrix}$$

B

$$\begin{bmatrix} 6 & 2 \\ -8 & 5 \end{bmatrix}$$

C

$$\begin{bmatrix} -12 & -4 \\ 16 & -10 \end{bmatrix}$$

D

$$\begin{bmatrix} -6 & -2 \\ 8 & -6 \end{bmatrix}$$

37 Find the result of $3A + B$, or choose [undefined] if it cannot be computed.

$$A = \begin{bmatrix} -8 & 6 \\ -7 & 0 \end{bmatrix} \quad B = \begin{bmatrix} 5 & 3 \\ 8 & -7 \end{bmatrix}$$

$$[8pt] 3A + B = [?]$$

A

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

B

$$\begin{bmatrix} -19 & 21 \\ -13 & -7 \end{bmatrix}$$

C

$$\begin{bmatrix} -29 & 15 \\ -29 & 7 \end{bmatrix}$$

D

$$\begin{bmatrix} -19 & 21 \\ -14 & -7 \end{bmatrix}$$

38 Find the result of $4A + 4B$, or choose [undefined] if it cannot be computed.

$$A = \begin{bmatrix} -7 & -3 \\ 0 & 6 \\ 4 & -4 \end{bmatrix} \quad B = \begin{bmatrix} 5 & 6 \\ -7 & -5 \\ -8 & 8 \end{bmatrix}$$

$$[8pt] 4A + 4B = [?]$$

A

$$\begin{bmatrix} -8 & 12 \\ -28 & 4 \\ -16 & 16 \end{bmatrix}$$

B

$$\begin{bmatrix} -2 & 3 \\ -7 & 1 \\ -4 & 4 \end{bmatrix}$$

C

$$\begin{bmatrix} -48 & -36 \\ 28 & 44 \\ 48 & -48 \end{bmatrix}$$

D

$$\begin{bmatrix} -7 & 12 \\ -28 & 4 \\ -16 & 16 \end{bmatrix}$$