

# Matrix sheet hints for #4-6:

Clearly show all steps for #4-6.

4. A  $2 \times 2$  matrix is defined as  $T = \begin{bmatrix} x & 2 \\ 3 & y \end{bmatrix}$ . Find the values of  $x$  and  $y$  if  $T^2 = \begin{bmatrix} 7 & 16 \\ 24 & 87 \end{bmatrix}$ .

*Solve for  $T^2$ , then set equal to, + solve for  $x$  and  $y$*

$$\begin{bmatrix} x & 2 \\ 3 & y \end{bmatrix} \cdot \begin{bmatrix} x & 2 \\ 3 & y \end{bmatrix} = \begin{bmatrix} x^2 + 6 & \dots \\ \dots & \dots \end{bmatrix}$$

5. Let  $P = \begin{bmatrix} 1 & 4 \\ -2 & 3 \end{bmatrix}$  and  $O = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ . Given that  $P^2 - 4P + kI = O$ , find  $k$ . **NOTE:**  $I = \text{identity matrix}$

*Substitute*

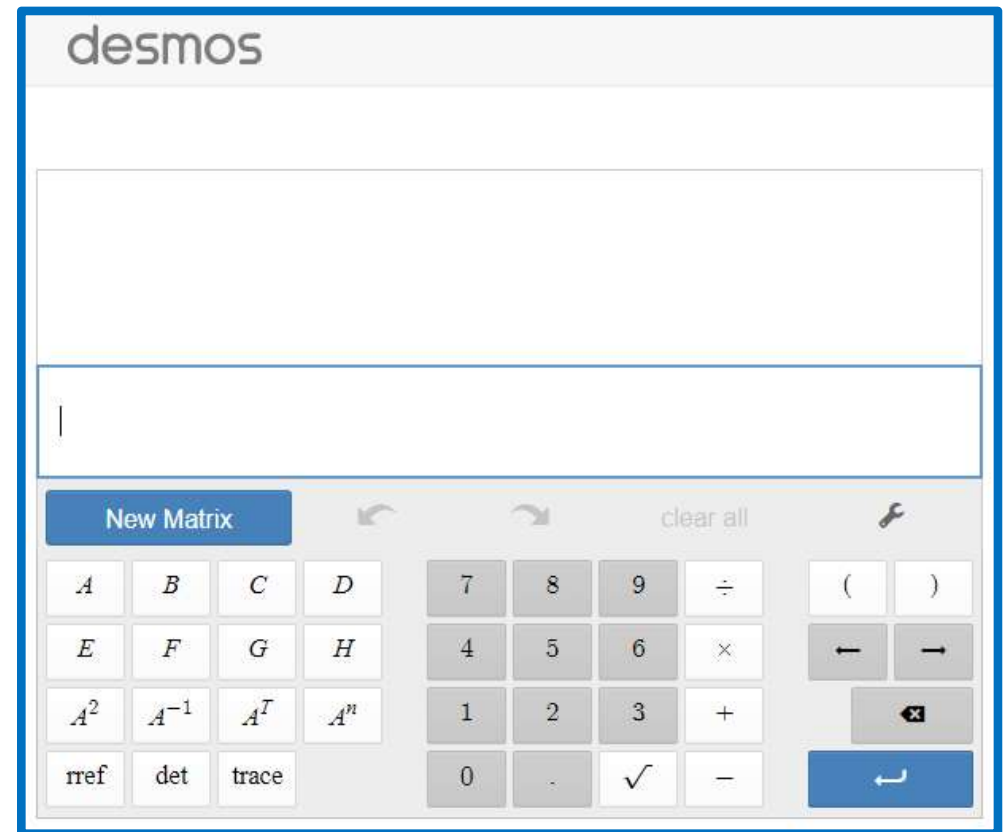
$$\left[ \begin{bmatrix} 1 & 4 \\ -2 & 3 \end{bmatrix} \right]^2 - 4 \left[ \begin{bmatrix} 1 & 4 \\ -2 & 3 \end{bmatrix} \right] + k \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

6. Let  $R = \begin{bmatrix} -1 & 7 \\ 6 & -2 \end{bmatrix}$  and  $O = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ . Given that  $R^2 + 3R + kI = O$ , find  $k$ .

*Similar to #5*

# Solving matrices with technology:

You may use a graphing calculator or the online Desmos matrix calculator



To clear **matrices**:

2<sup>nd</sup> MEM (above + symbol)

2: Mem Mgmt / Del

5: Matrix

push delete to clear the matrix  
next to the arrow



## CH. 2 MATRICES → GETTING STARTED:

- \*Clear your screen, then push 2nd MATRIX.
- \*Push the ► right arrow key twice to highlight EDIT. Use ▲ ▼ up/down arrows to highlight the name of your matrix. Press ENTER.
- \*Enter the dimensions of your matrix, then enter your values for each element. (*Push enter after each input. The cursor will automatically move to the next space.*)
- \*Once all elements are entered, push 2nd QUIT to finalize your entry.
- \*Repeat the process to input the other matrices.
- \* To solve #1-15, push 2<sup>nd</sup> MATRIX, then NAME → now choose proper matrices  
(Hint: use the  $x^{-1}$  button when finding the inverse)

Enter the following values into your calculator:

$$A = \begin{bmatrix} 6 & 3 \\ 7 & 5 \end{bmatrix}$$

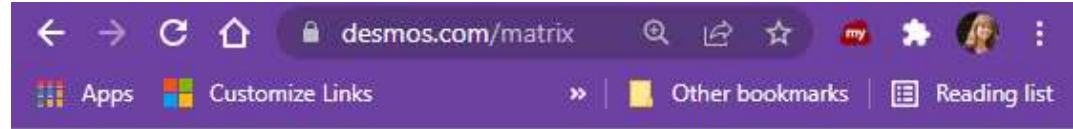
$$B = \begin{bmatrix} -4 & -7 \\ 5 & 7 \end{bmatrix}$$

$$C = \begin{bmatrix} -2 & -7 & 11 \\ 4 & 3 & -8 \end{bmatrix}$$

$$D = \begin{bmatrix} 2 & -5 & 10 \\ 3 & 1 & -12 \\ -7 & 6 & 8 \end{bmatrix}$$



# desmos.com/matrix



OR

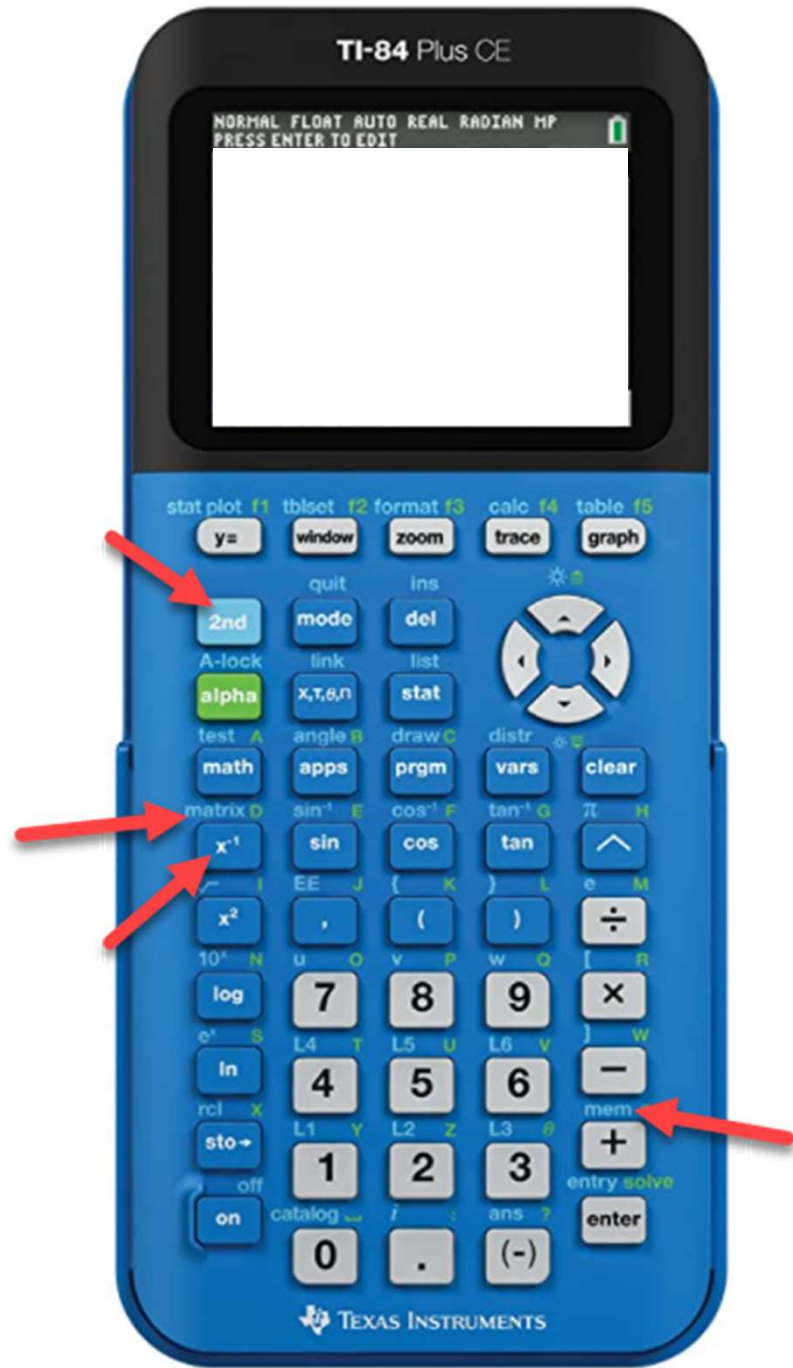
$$A = \begin{bmatrix} 6 & 3 \\ 7 & 5 \end{bmatrix}$$

$$B = \begin{bmatrix} -4 & -7 \\ 5 & 7 \end{bmatrix}$$

$$C = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$D = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$A + B = \begin{bmatrix} 2 & -4 \\ 12 & 12 \end{bmatrix}$$



## Helpful hints:

\*use your **TAB** key when entering values into each matrix

\***clear** will delete items where cursor is placed

\***convert to fraction** icon is next to decimal answer (far right)

\*must use **uppercase letters**

\*resize window so calculator is more compact

The screenshot shows the Desmos Matrix Calculator interface. The browser address bar displays "desmos.com/matrix". The interface includes a navigation bar with "Apps", "Customize Links", "Other bookmarks", and "Reading list". The main area displays four matrices:

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

Below the matrices, the expression  $A + B$  is shown, with the result  $\begin{bmatrix} 2 & -4 \\ 12 & 12 \end{bmatrix}$  displayed to the right. The calculator interface includes a "New Matrix" button, a "clear" button, and a keypad with buttons for uppercase letters (A, B, C, D, E, F, G, H), mathematical operations (7, 8, 9, ÷, 4, 5, 6, ×, 1, 2, 3, +, 0, ., √, -), and other functions (A<sup>2</sup>, A<sup>-1</sup>, A<sup>T</sup>, A<sup>n</sup>, rref, det, trace). There are also navigation arrows and a "clear" button.

## Use calculator commands to solve for the following:

(Write given notation and each answer on a separate sheet of paper.)

1.  $A + B$

2.  $B - A$

3.  $BA$

4.  $AB$

5.  $BC$

6.  $AC$

7.  $CD$

8.  $B^2$

9.  $A^2$

10.  $A^{-1}$  (Express your answer with fractions using the MATH button on far left 1: ► Frac)

11.  $D^{-1}$  (Express your answer with fractions)

12.  $DD^{-1}$

13.  $A^{-1}A$

14.  $BB^{-1}$

15.  $\det A$  (determinant can be found using the matrix menu and highlighting “math” at the top)

16.  $\det D$

17. Write a **matrix equation**, then solve for  $(x, y, z)$  using your calculator.

$$-x - 2y + 9z = 13$$

$$2x + y - 2z = 11$$

$$x - 3z = 7$$

*Be sure to use proper notation. On your paper, please **write the command** that you are using in the calculator.*

**IMPORTANT!!!!** SOLVE 10.3 #30-38even,50,54 WITH A CALCULATOR → write matrix equation, write calculator command, and then solve using matrices. DON'T show all of your work like you did previously in 10.2!



Write given notation and answer on your homework paper like this:

$$1. A + B = \begin{bmatrix} 2 & -4 \\ 12 & 12 \end{bmatrix}$$

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

The screenshot shows the Desmos Matrix Calculator interface. At the top, the browser address bar displays "desmos.com/matrix". Below the address bar are navigation icons and a search bar. The main workspace contains four matrix definitions:

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

Below these definitions, a calculation is shown:

$$A + B = \begin{bmatrix} 2 & -4 \\ 12 & 12 \end{bmatrix}$$

The calculator interface includes a "New Matrix" button, navigation arrows, a "clear" button, and a grid of buttons for matrix variables (A, B, C, D, E, F, G, H), operations (7, 8, 9, ÷, 4, 5, 6, ×, 1, 2, 3, +, 0, ., √, -), and other functions (A<sup>2</sup>, A<sup>-1</sup>, A<sup>T</sup>, A<sup>n</sup>, rref, det, trace). A large blue arrow button is at the bottom right.



17. Write a **matrix equation**, then solve for (x, y, z) using your calculator.

$$-x - 2y + 9z = 13$$

$$2x + y - 2z = 11$$

$$x - 3z = 7$$

*Be sure to use proper notation. On your paper, please write the command that you are using in the calculator.*

$$\begin{matrix} E \\ \begin{bmatrix} -1 & -2 & 9 \\ 2 & 1 & -2 \\ 1 & 0 & -3 \end{bmatrix} \end{matrix} \cdot \begin{matrix} F \\ \begin{bmatrix} x \\ y \\ z \end{bmatrix} \end{matrix} = \begin{matrix} \begin{bmatrix} 13 \\ 11 \\ 7 \end{bmatrix} \end{matrix} \rightarrow \begin{matrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} \\ \text{Solution} \end{matrix} = \begin{matrix} \begin{bmatrix} 10 \\ -7 \\ 1 \end{bmatrix} \end{matrix}$$

matrix  
equation

$E^{-1} \cdot F$   
Command

NOTE:

# IGNORE THE BOOK INSTRUCTIONS!!

Just solve 10.3 using a matrix calculator similar to #17 on today's

29–38 Linear Systems with One Solution The system of linear equations has a unique solution. Find the solution using Gaussian elimination or Gauss-Jordan elimination.

30.

$$\begin{cases} x + y + 6z = 3 \\ x + y + 3z = 3 \\ x + 2y + 4z = 7 \end{cases}$$

$$\begin{matrix} A \\ \begin{bmatrix} 1 & 1 & 6 \\ 1 & 1 & 3 \\ 1 & 2 & 4 \end{bmatrix} \end{matrix} \begin{matrix} \\ \begin{bmatrix} X \\ Y \\ Z \end{bmatrix} \end{matrix} = \begin{matrix} B \\ \begin{bmatrix} 3 \\ 3 \\ 7 \end{bmatrix} \end{matrix}$$

\*Write full matrix equation.

\*Write command used to solve in calculator.

\*State solution.

$$A^{-1} \cdot B \begin{matrix} \\ \begin{bmatrix} X \\ Y \\ Z \end{bmatrix} \end{matrix} = \begin{matrix} \\ \begin{bmatrix} ? \\ ? \\ ? \end{bmatrix} \end{matrix}$$

# Be sure to check off answers for all of the book work!!

**CHECK YOUR ANSWERS: worksheet #1-17 AND 10.3 #30-38even, 50,54**

$$\begin{bmatrix} -73 & -47 \\ 79 & 50 \end{bmatrix} \quad \begin{bmatrix} -9 & -21 \\ -3 & -14 \end{bmatrix} \quad \begin{bmatrix} 2 & -4 \\ 12 & 12 \end{bmatrix} \quad \begin{bmatrix} 57 & 33 \\ 77 & 46 \end{bmatrix} \quad \begin{bmatrix} -10 & -10 \\ -2 & 2 \end{bmatrix} \quad \begin{bmatrix} 0 & -33 & 42 \\ 6 & -34 & 37 \end{bmatrix} \quad \begin{bmatrix} -19 & -21 \\ 15 & 14 \end{bmatrix} \quad \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} -20 & 7 & 12 \\ 18 & -14 & -1 \end{bmatrix} \quad \begin{bmatrix} -102 & 69 & 152 \\ 73 & -65 & -60 \end{bmatrix} \quad \begin{bmatrix} \frac{8}{11} & \frac{10}{11} & \frac{5}{11} \\ \frac{6}{11} & \frac{43}{55} & \frac{27}{55} \\ \frac{5}{22} & \frac{23}{110} & \frac{17}{110} \end{bmatrix} \quad \begin{bmatrix} \frac{5}{9} & -\frac{1}{3} \\ -\frac{7}{9} & \frac{2}{3} \end{bmatrix} \quad \begin{bmatrix} -1 & -2 & 9 \\ 2 & 1 & -2 \\ 1 & 0 & -3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 13 \\ 11 \\ 7 \end{bmatrix} \quad A^{-1} \cdot B = \begin{bmatrix} - \\ - \\ - \end{bmatrix}$$

matrix equation                  command, ↑solution

No solution   -7   -2   -2   -1   -1   0   1   1   1   1   1   1   1   2   3   3   3   3   3   4   5   9   10   110