

## Warm-up

January 19, 2017

1. I will give you a cup of Skittles.

**DO NOT EAT UNTIL I SAY SO!!!**

2. Sort the Skittles by color, and copy down the following questions as you answer them.

3. How many of each Skittle do you have?

4. If you combined your Skittles with a partner, how many of each would you now have?

5. If you won the lottery and you now had 5 times the amount of each you had in the beginning, how many of each would you have?

6. Is there a more efficient way of calculating these answers?

$$\begin{array}{l} O_r \\ R \\ P \\ Y \\ G \end{array} \begin{bmatrix} 7 \\ 5 \\ 5 \\ 8 \\ 6 \end{bmatrix} + \begin{bmatrix} 4 \\ 4 \\ 3 \\ 6 \\ 7 \end{bmatrix} + \begin{bmatrix} 8 \\ 4 \\ 7 \\ 2 \\ 5 \end{bmatrix} = \begin{bmatrix} 19 \\ 13 \\ 15 \\ 16 \\ 18 \end{bmatrix}$$

$$\begin{array}{c} O \\ R \\ Y \\ D \\ G \end{array} \begin{bmatrix} 4 \\ 2 \\ 9 \\ 4 \\ 3 \end{bmatrix} + \begin{bmatrix} 8 \\ 2 \\ 6 \\ 6 \\ 0 \end{bmatrix} = \begin{bmatrix} 12 \\ 4 \\ 15 \\ 7 \\ 3 \end{bmatrix}$$

$$\begin{array}{c} O_r \\ R \\ Y \\ P \\ G \end{array} \quad 5 \quad \begin{bmatrix} 7 \\ 3 \\ 5 \\ 3 \end{bmatrix} = \begin{bmatrix} 35 \\ 15 \\ 25 \\ 15 \end{bmatrix}$$

$$\begin{matrix} S & P & Q & R \\ \begin{bmatrix} 0 & 0 & 2 & 5 \\ 0 & 0 & 2 & 2 \\ 0 & 0 & 2 & 2 \\ 0 & 0 & 2 & 5 \end{bmatrix} & + & \begin{bmatrix} 1 \\ 2 \\ 4 \\ 3 \end{bmatrix} & = & \begin{bmatrix} 6 \\ 4 \\ 6 \\ 3 \end{bmatrix} \end{matrix}$$

$$\begin{matrix} R \\ G \\ Q \\ P \\ S \end{matrix} \quad 5 \quad \begin{bmatrix} 1 \\ 2 \\ 4 \\ 0 \\ 3 \end{bmatrix} = \begin{bmatrix} 5 \\ 10 \\ 20 \\ 0 \\ 15 \end{bmatrix}$$

$$\begin{array}{l} \text{Orange} \\ \text{Red} \\ \text{Green} \\ \text{Yellow} \\ \text{Purple} \end{array} \begin{bmatrix} 7 \\ 4 \\ 3 \\ 7 \\ 5 \end{bmatrix} + \begin{bmatrix} 3 \\ 7 \\ 8 \\ 5 \\ 2 \end{bmatrix} = \begin{bmatrix} 10 \\ 11 \\ 11 \\ 12 \\ 7 \end{bmatrix}$$


Green	}	10	}	+	}	=	}	15	=	25	
Orange		5						5		7	35
Yellow		5						5		8	40
Red		5						5		8	40
Purple		3						5		8	40



Green	$\begin{bmatrix} 4 \\ 3 \\ 5 \\ 6 \\ 3 \end{bmatrix}$	+	$\begin{bmatrix} 5 \\ 4 \\ 3 \\ 4 \\ 6 \end{bmatrix}$	=	$\begin{bmatrix} 9 \\ 7 \\ 8 \\ 10 \\ 9 \end{bmatrix}$
Orange					
Yellow					
Red					
Purple					

Red  
Orange  
Yellow  
Green  
Purple

$$\begin{bmatrix} 5 \\ 2 \\ 7 \\ 9 \\ 5 \end{bmatrix} + \begin{bmatrix} 10 \\ 11 \\ 7 \\ 2 \\ 13 \end{bmatrix} = \begin{bmatrix} 15 \\ 13 \\ 14 \\ 11 \\ 18 \end{bmatrix}$$

$$\begin{bmatrix} 5 & 10 & 15 \\ 2 & 11 & 13 \\ 7 & 7 & 14 \\ 9 & 2 & 11 \\ 5 & 13 & 18 \end{bmatrix} = S$$


Rows x columns

$$5 \times 3$$

$S_{2,6} = \text{undefined}$

Red		9	+	1	=	10
Purple		7		5		12
Orange		4		7		11
Green		6		12		18
Yellow		4		2		6
		$5 \times 1$		$5 \times 1$		$5 \times 1$

$$S = \begin{bmatrix} 9 & 1 & 10 \\ 7 & 5 & 12 \\ 4 & 7 & 11 \\ 6 & 12 & 18 \\ 4 & 2 & 6 \end{bmatrix}$$

$\begin{matrix} \text{Rows} \\ 5 \end{matrix} \times \begin{matrix} \text{Columns} \\ 3 \end{matrix}$

$$S_{3,1} = 4$$

	$D_{2,1}$		$A_{5,1}$ <small>Rows x column</small>		
Red	8		7	15	
Green	11	$2,1$	5		16
Orange	4		4		8
Yellow	5		8		13
Purple	4		4		10
	$5 \times 1$	+	$5 \times 1$	= $5 \times 1$	

$$\begin{bmatrix} 1 & 5 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix} \quad \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} \quad \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

$$5 \times 3$$

$$M_{52} = 6$$

**Determinant:** the product of the elements on the main diagonal minus the product of the elements off the main diagonal

**Dimensions or Order of a Matrix:** the number of rows by the number of columns

**Identity Matrix:** the matrix that has 1's on the main diagonal and 0's elsewhere

**Inverse Matrices:** matrices whose product ( in both orders) is the Identity matrix

**Matrix:** a rectangular arrangement of numbers into rows and columns

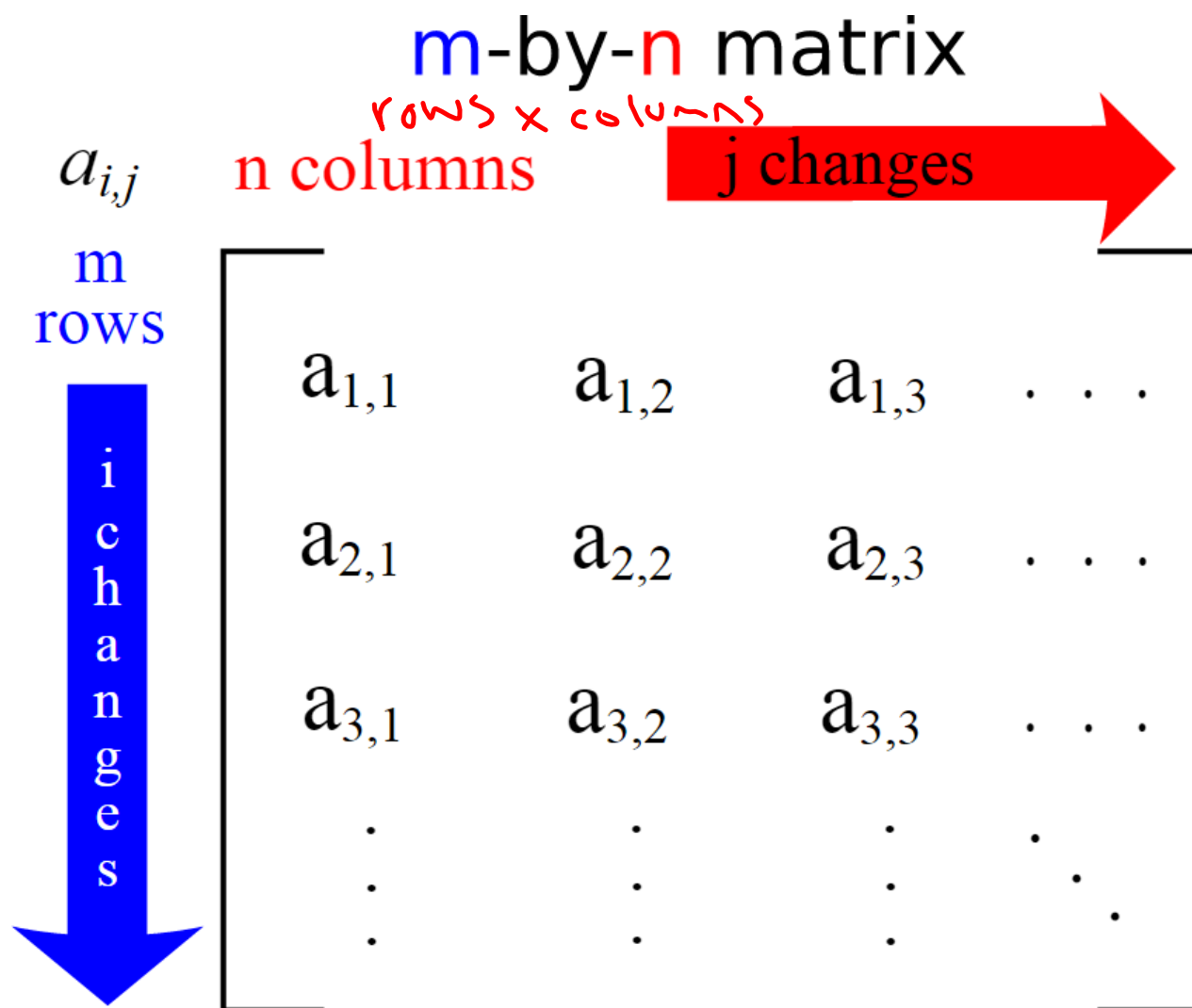
**Scalar:** in matrix algebra, a real number is called a scalar

**Square Matrix:** a matrix with the same number of rows and columns

**Zero Matrix:** a matrix whose entries are all zeros

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





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

Dimension :  $a_{2,4} = 3$   
 $2 \times 4$

$$\begin{bmatrix} 3 & 5 & 8 \\ 1 & 6 & -7 \end{bmatrix} + \begin{bmatrix} 1 & 0 & 7 \\ 2 & 3 & 5 \end{bmatrix} = \begin{bmatrix} 4 & 5 & 15 \\ 3 & 9 & -2 \end{bmatrix}$$

$2 \times 3$ 
 $2 \times 3$ 
 $2 \times 3$

④

$$\begin{bmatrix} 6 & 3 \\ 2 & -6 \\ 3 & -2 \end{bmatrix} - \begin{bmatrix} 3 & -1 \\ -3 & -5 \\ -1 & -6 \\ -3 & -2 \end{bmatrix} = \begin{bmatrix} 3 & 4 \\ 8 & -1 \\ 3 & 12 \\ 6 & 0 \end{bmatrix}$$

$4 \times 2$ 
 $4 \times 2$ 
 $4 \times 2$

⑨

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

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

 $2 \times 3$  $4 \times 2$ 

undefined

$$\begin{bmatrix} 4 & 2 \\ 0 & 17 \\ 3 & -5 \end{bmatrix}$$

Dimension:  $3 \times 2$



Add

$$\begin{bmatrix} 3 & 1 \\ 2 & -4 \end{bmatrix} + \begin{bmatrix} 5 & 6 \\ 7 & 0 \end{bmatrix} = \begin{bmatrix} 8 & 7 \\ 9 & -4 \end{bmatrix}$$

$2 \times 2$                        $2 \times 2$                        $2 \times 2$   
R C                                      R C                                      R C

$$\begin{bmatrix} 4 & 5 & 3 \end{bmatrix} + \begin{bmatrix} 6 & 9 & -2 \\ 1 & 5 & 4 \end{bmatrix} = \text{no solution undefined}$$

$1 \times 3$                                        $2 \times 3$

# Try #4.

$$\begin{bmatrix} 6 & 3 \\ 5 & 6 \\ 2 & 6 \\ 3 & -2 \end{bmatrix} - \begin{bmatrix} 3 & -1 \\ -3 & -5 \\ -1 & -6 \\ -3 & -2 \end{bmatrix} =$$

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

*Answer*  
*John*  
*Smith*



10)

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

$$\begin{bmatrix} -25 & -30 \\ -30 & 30 \end{bmatrix}$$

$$5 \left( \begin{bmatrix} 3 & 2 \\ -3 & -6 \end{bmatrix} + \begin{bmatrix} 3 & 3 \\ 3 & -3 \end{bmatrix} \right)$$

$$5 \left( \begin{bmatrix} 6 & 5 \\ 0 & -9 \end{bmatrix} \right) = \begin{bmatrix} 30 & 25 \\ 0 & -45 \end{bmatrix}$$

$$\begin{array}{l} 2[1 \quad -3] - [-2 \quad 1] \\ [2 \quad -6] - [-2 \quad 1] \\ [4 \quad -7] \end{array}$$

.

$$\begin{aligned} [5 \ 6] - 5[2 \ 1] \\ [5 \ 6] - [10 \ 5] \\ [-5 \ 1] \end{aligned}$$

$$\begin{bmatrix} 2 & 6 \\ x & 5 \end{bmatrix} + \begin{bmatrix} y & -1 \\ 3 & 0 \end{bmatrix} = \begin{bmatrix} 2 & 5 \\ 8 & 5 \end{bmatrix}$$

$$\begin{array}{r} 2 + y = 7 \\ -2 \quad -2 \end{array}$$

$$y = 5$$

$$\begin{array}{r} x + 3 = 8 \\ -3 \quad -3 \end{array}$$

$$x = 5$$

$$2 \begin{bmatrix} 4 & z \\ x & -1 \end{bmatrix} - \begin{bmatrix} y & -8 \\ 3 & -7 \end{bmatrix} = \begin{bmatrix} 2 & 6 \\ 13 & a \end{bmatrix}$$

Find  $x, y, z,$  &  $a$  .

$$\begin{array}{l} x = 8 \\ y = 6 \\ z = -1 \\ a = 5 \end{array} \left( \begin{array}{l} -2 - (-7) = a \\ -2 + 7 = a \\ 5 = a \end{array} \right) \left| \begin{array}{l} 2z - (-8) = 6 \\ 2z + 8 = 6 \\ -8 - 8 \\ 2z = -2 \\ z = -1 \end{array} \right.$$

$$2Y - \begin{bmatrix} 9 & 8 \\ 3 & -7 \end{bmatrix} = \begin{bmatrix} 5 & 7 \\ 15 & 9 \end{bmatrix}$$

$$+ \begin{bmatrix} 9 & 8 \\ 3 & -7 \end{bmatrix} + \begin{bmatrix} 9 & 8 \\ 3 & -7 \end{bmatrix}$$

NO DIVISION  $\frac{1}{2}$

$$2Y = \begin{bmatrix} 14 & 15 \\ 18 & 2 \end{bmatrix} \cdot \frac{1}{2}$$

$$= \begin{bmatrix} 7 & \frac{15}{2} \\ 9 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 6 & 3 \\ 5 & -6 \\ 2 & 6 \\ 3 & -2 \end{bmatrix} - \begin{bmatrix} 3 & -1 \\ -3 & -5 \\ -1 & -6 \\ -3 & -2 \end{bmatrix} = \begin{bmatrix} 3 & 4 \\ 8 & -1 \\ 3 & 12 \\ 6 & 0 \end{bmatrix}$$

$4 \times 2$                        $4 \times 2$                        $4 \times 2$



①

$$\begin{bmatrix} -3 & 3 & 2 \\ -4 & -1 & 1 \\ 3 & 6 & 0 \\ -2 & 4 & 4 \end{bmatrix} = \begin{bmatrix} -1 & 9 \\ -1 & 2 \\ 6 & 9 \\ 10 & 6 \end{bmatrix}$$

②

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

$$\begin{bmatrix} 8 & -20 & 24 & -16 \end{bmatrix}$$

7. Order your Skittles in a matrix with rows and columns. What is the dimension?
8. Create another matrix with dimensions.
9. Match your dimension with someone else's.

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix} \quad 3 \times 2$$
  
$$\begin{bmatrix} 4 & 6 \\ 8 & 12 \end{bmatrix} \quad 2 \times 2$$

$$\begin{bmatrix} \underline{1} & 5 \\ 2 & \underline{2} \\ 3 & 4 \end{bmatrix} + \begin{bmatrix} \underline{1} & 2 \\ 3 & \underline{4} \\ 5 & 6 \end{bmatrix} = \begin{bmatrix} \underline{2} & \underline{7} \\ \underline{5} & \underline{6} \\ \underline{8} & \underline{10} \end{bmatrix}$$

$3 \times 2$                        $3 \times 2$                        $3 \times 2$

$$\begin{bmatrix} \underline{1} & 5 \\ 2 & 2 \\ 3 & 4 \end{bmatrix} + \begin{bmatrix} \underline{1} \\ 3 \\ 5 \end{bmatrix} = \text{no solution}$$

$3 \times 2$                        $3 \times 1$                       "undefined"

$$\begin{bmatrix} 3 \\ 2 \\ -1 \end{bmatrix} + \begin{bmatrix} 5 \\ 6 \end{bmatrix} = \text{no solution}$$

$3 \times 1$                        $2 \times 1$

Add/subt. → SAME DIMENSIONS

$$\textcircled{1} \begin{bmatrix} -4 & 1 \\ -6 & 3 \end{bmatrix} + \begin{bmatrix} -6 & -5 \\ -2 & -1 \end{bmatrix}$$

$2 \times 2$                        $2 \times 2$

$$\begin{bmatrix} -10 & -4 \\ -8 & 2 \end{bmatrix}$$

$$4 - 3 = 1$$

$$4 + (-3) = 1$$

$$4 - (-3) = 7$$

4 + 3

$$4 + (-1 \cdot -3)$$

4 + 3



9

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

$2 \times 3$   $4 \times 2$

Not same dimensions

UNDEFINED

# Scalar Multiplication

A handwritten diagram illustrating scalar multiplication. On the left, a red-outlined vertical column matrix contains the numbers 0, 6, 1, 4, and 4 from top to bottom. To its left, a red number '5' is written. Blue lines connect the '5' to each element in the matrix, indicating multiplication. An equals sign is placed between the two matrices. On the right, a blue-outlined vertical column matrix contains the results: 0, 30, 5, 20, and 20 from top to bottom.

$$5 \begin{bmatrix} 0 \\ 6 \\ 1 \\ 4 \\ 4 \end{bmatrix} = \begin{bmatrix} 0 \\ 30 \\ 5 \\ 20 \\ 20 \end{bmatrix}$$

6

$$-2 \begin{bmatrix} -6 & 2 \\ 5 & 6 \\ -1 & -1 \end{bmatrix} =$$

# Simplify

$$\textcircled{1} \quad 5 \left( \begin{bmatrix} 3 & 2 \\ -3 & -6 \end{bmatrix} + \begin{bmatrix} 3 & 3 \\ 3 & -3 \end{bmatrix} \right)$$

DISTRIBUTION

$$5 \begin{bmatrix} 6 & 5 \\ 0 & -9 \end{bmatrix}$$
$$\begin{bmatrix} 30 & 25 \\ 0 & -45 \end{bmatrix}$$

$$\begin{aligned} \textcircled{7} \quad [5 \ 6] - 5[2 \ 1] \\ [5 \ 6] - [10 \ 5] \\ [-5 \ 1] \end{aligned} \quad \textcircled{4}$$

6)

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

POS. scalar

Subtract

ADD

$$\begin{bmatrix} -12 \\ 3 \end{bmatrix} - \begin{bmatrix} +24 \\ +12 \end{bmatrix}$$
$$\begin{bmatrix} -36 \\ -9 \end{bmatrix}$$

4

# Solve

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

$$\begin{array}{r} 2 + y = 2 \\ -2 \quad -2 \\ \hline 5 = 0 \end{array}$$

$$6 + -1 = 5$$

$$\begin{array}{r} x + 3 = 8 \\ -3 \quad -3 \\ \hline x = 5 \end{array}$$

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

$$2z - (-8) = 6$$

$$2z + 8 = 6$$

$$\frac{2z}{2} = \frac{-2}{2}$$

$$z = -1$$



$$4. \quad 2Y - \begin{bmatrix} 9 & 8 \\ 3 & 7 \end{bmatrix} = \begin{bmatrix} 5 & 7 \\ 5 & 9 \end{bmatrix} + \begin{bmatrix} 9 & 8 \\ 3 & 7 \end{bmatrix}$$

↑ (1113TT)  
↑ inverse

You CANNOT DIVIDE! Y

$$\frac{1}{2} 2Y = \begin{bmatrix} 14 & 15 \\ 18 & 2 \end{bmatrix}$$

$$3 \left( \begin{bmatrix} 2 & 6 \\ 5 & -1 \end{bmatrix} - \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \right) + X = \begin{bmatrix} 0 & 1 \\ 2 & 0 \end{bmatrix}$$

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

$$\begin{array}{r} \begin{bmatrix} 3 & 12 \\ 6 & -15 \end{bmatrix} + X = \begin{bmatrix} 0 & 1 \\ 2 & 0 \end{bmatrix} \\ - \begin{bmatrix} 3 & 12 \\ 6 & -15 \end{bmatrix} \quad - \begin{bmatrix} -3 & -12 \\ 4 & -15 \end{bmatrix} \end{array}$$

$$X = \begin{bmatrix} -3 & -11 \\ 4 & -15 \end{bmatrix}$$

# Add.

$$\textcircled{1} \begin{bmatrix} -4 & \textcircled{1} \\ -6 & 3 \end{bmatrix} + \begin{bmatrix} -6 & \textcircled{-5} \\ -2 & -1 \end{bmatrix} = \begin{bmatrix} -10 & -4 \\ -8 & 2 \end{bmatrix}$$

$2 \times 2$                        $2 \times 2$                        $2 \times 2$

$$\begin{bmatrix} -4 & 1 \\ -6 & 3 \end{bmatrix} + \begin{bmatrix} 3 & 1 & 4 \end{bmatrix} = \text{undefined}$$

$2 \times 2$                        $1 \times 3$

# Multiply by a scalar.

①

$$\begin{bmatrix} -3 & 3 & 2 \\ -4 & 1 & 1 \\ 3 & 0 & 0 \\ -2 & 4 & 1 \end{bmatrix} = \begin{bmatrix} -9 & -6 \\ 12 & -3 \\ -9 & 0 \\ 6 & -12 \end{bmatrix}$$

$4 \times 2$   $4 \times 2$

$$\textcircled{3} \quad -5 \begin{bmatrix} 4 & 4 & -1 \end{bmatrix} = \begin{bmatrix} -20 & -20 & 5 \end{bmatrix}$$

Simplify expressions.

$$5 \left( \begin{bmatrix} 3 & 2 \\ -3 & -6 \end{bmatrix} + \begin{bmatrix} 3 & 3 \\ 3 & -3 \end{bmatrix} \right) :$$

$$5 \begin{bmatrix} 6 & 5 \\ \emptyset & -9 \end{bmatrix} = \begin{bmatrix} 30 & 25 \\ \emptyset & -45 \end{bmatrix}$$

$$\begin{aligned} \textcircled{3} \quad & 2 \overbrace{[1 \quad -3]} - [-2 \quad 1] \\ & [2 \quad -6] + [+2 \quad -1] \\ & [4 \quad -7] \end{aligned}$$

Solve equations.

$$\textcircled{1} \begin{bmatrix} \underline{2} & \underline{6} \\ \underline{x} & \underline{5} \end{bmatrix} + \begin{bmatrix} \underline{5} & \underline{-1} \\ \underline{3} & \underline{0} \end{bmatrix} = \begin{bmatrix} \underline{2} & \underline{5} \\ \underline{8} & \underline{5} \end{bmatrix}$$

$$2 + 5 = 7$$

$$6 + (-1) = 5$$

$$x + 3 = 8$$

$$5 + 0 = 5$$

$$\begin{array}{r} 2 + 5 = 7 \\ -2 \\ \hline 5 = 0 \end{array}$$

$$\begin{array}{r} x + 3 = 8 \\ -3 \quad -3 \\ \hline x = 5 \end{array}$$



$$\textcircled{2} \quad 2 \begin{bmatrix} 4 & z \\ x & -1 \end{bmatrix} - \begin{bmatrix} 5 & -8 \\ 3 & -2 \end{bmatrix} = \begin{bmatrix} 2 & 6 \\ 13 & a \end{bmatrix}$$

$$2(4) - 5 = 2$$

$$8 - 5 = 2$$

$$4 = 5$$

$$2x - 3 = 13$$

$$\frac{2x}{2} = \frac{16}{2}$$

$$x = 8$$

$$2z + 8 = 6$$

$$\frac{2z}{2} = \frac{-2}{2}$$

$$z = -1$$

$$2(-1) - (-7) = a$$

$$-2 + 7 = a$$

$$5 = a$$

$$2Y - \begin{bmatrix} 9 & 8 \\ 3 & -7 \end{bmatrix} = \begin{bmatrix} 5 & 7 \\ 15 & 9 \end{bmatrix}$$

$$+ \begin{bmatrix} 9 & 8 \\ 3 & -7 \end{bmatrix} \quad + \begin{bmatrix} 9 & 8 \\ 3 & -7 \end{bmatrix}$$

3 EQUATIONS  
↑

$$\cancel{\left(\frac{1}{2}\right)} 2Y = \left(\frac{1}{2}\right) \begin{bmatrix} 14 & 15 \\ 18 & 2 \end{bmatrix}$$

$$Y = \begin{bmatrix} 7 & \frac{15}{2} \\ 9 & 1 \end{bmatrix}$$

$$\textcircled{1} \quad 5 \left( \begin{bmatrix} 3 & 2 \\ -3 & -6 \end{bmatrix} + \begin{bmatrix} 3 & 3 \\ 3 & -3 \end{bmatrix} \right)$$

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

$$\begin{bmatrix} 30 & 25 \\ 0 & -45 \end{bmatrix}$$

ADDED  
SAD3EP

③

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

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

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

WAD3FD

⑦

$$\begin{bmatrix} 5 & 6 \end{bmatrix} - 5 \begin{bmatrix} 2 & 1 \end{bmatrix} \text{ scalar}$$

$$\begin{bmatrix} 5 & 6 \end{bmatrix} - \begin{bmatrix} 10 & 5 \end{bmatrix} \text{ subtra.}$$

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

Solve.

$$\textcircled{1} \begin{bmatrix} 2 & 5 \\ x & 5 \end{bmatrix} + \begin{bmatrix} 3 & -1 \\ 3 & 0 \end{bmatrix} = \begin{bmatrix} 2 & 5 \\ 8 & 5 \end{bmatrix}$$

TL:  $2 + 3 = 5$   
 $\frac{-2 \quad -2}{5 = 0}$

BL:

$$\begin{array}{r} x + 3 = 8 \\ -3 \quad -3 \\ \hline x = 5 \end{array}$$

②

$$2 \begin{bmatrix} 4 & 2 \\ x & -1 \end{bmatrix} - \begin{bmatrix} 5 & -8 \\ 3 & -7 \end{bmatrix} = \begin{bmatrix} 2 & 6 \\ 13 & a \end{bmatrix}$$

$$\begin{array}{r} 2x - 3 = 13 \\ + 3 \quad + 3 \\ \hline \end{array}$$

Find  
y, z, and a.

$$\begin{array}{r} 2x = 16 \\ \frac{2}{2} \quad \frac{16}{2} \\ \hline \end{array}$$

$x = 8$

④

$$2Y - \begin{bmatrix} 9 & 8 \\ 3 & -7 \end{bmatrix} = \begin{bmatrix} 5 & 7 \\ 15 & 9 \end{bmatrix}$$

$$+ \begin{bmatrix} 9 & 8 \\ 3 & -7 \end{bmatrix} + \begin{bmatrix} 9 & 8 \\ 3 & -7 \end{bmatrix}$$


---

NO DIVISION ALLOWED.

$$\left(\frac{1}{2}\right) 2Y = \left(\frac{1}{2}\right) \begin{bmatrix} 14 & 15 \\ 18 & 2 \end{bmatrix}$$

$$Y = \begin{bmatrix} 7 & \frac{15}{2} \\ 9 & 1 \end{bmatrix}$$

ADDED



⑥

$$-2 \begin{bmatrix} -6 & 2 \\ 5 & 6 \\ -1 & -1 \end{bmatrix} = \begin{bmatrix} 12 & -4 \\ -10 & -12 \\ 2 & -2 \end{bmatrix}$$

$$\textcircled{1} \quad S \left( \begin{bmatrix} 3 & 2 \\ -3 & -6 \end{bmatrix} + \begin{bmatrix} 3 & 3 \\ 3 & -3 \end{bmatrix} \right) = \begin{bmatrix} 30 & 25 \\ 0 & -45 \end{bmatrix}$$

$$\textcircled{3} \quad \begin{aligned} & 2 \begin{bmatrix} 1 & -3 \end{bmatrix} - \begin{bmatrix} -2 & 1 \end{bmatrix} \\ & \begin{bmatrix} 2 & -6 \end{bmatrix} - \begin{bmatrix} -2 & 1 \end{bmatrix} \\ & \begin{bmatrix} 4 & -7 \end{bmatrix} \end{aligned}$$

ANSWER

$$2 \left( [1 \ 5 \ -7] + [2 \ -2 \ 10] \right)$$
$$2 [3 \ 3 \ 3]$$
$$[6 \ 6 \ 6]$$

↓  
S  
A  
D  
D  
3  
E  
P

$$\begin{aligned} \textcircled{7} \quad & [5 \ 6] - \textcircled{5}[2 \ 1] \\ & [5 \ 6] - [10 \ 5] \\ & [-5 \ 1] \end{aligned}$$

Solve.

$$\textcircled{1} \begin{bmatrix} 2 & 6 \\ x & 5 \end{bmatrix} + \begin{bmatrix} 5 & -1 \\ 3 & 0 \end{bmatrix} = \begin{bmatrix} 7 & 5 \\ 8 & 5 \end{bmatrix}$$

$$\underline{2 + 5 = 7}$$

$$5 = 0$$

$$6 + -1 = 5$$

$$x = 5$$

$$x + 3 = 8$$

$$5 + 0 = 5$$

$$\textcircled{2} \quad 2 \begin{bmatrix} 4 & 2 \\ x & -1 \end{bmatrix} - \begin{bmatrix} 5 & -8 \\ 3 & -7 \end{bmatrix} = \begin{bmatrix} 2 & 6 \\ 13 & 9 \end{bmatrix}$$

$$2z - 8 = 6$$

$$2z + 8 = 6$$

$$-8 \quad -8$$

$$\frac{2z}{2} = \frac{-2}{2}$$

$$z = -1$$

$$2x - 3 = 13$$

$$\quad +3 \quad +3$$


---

$$2x = 16$$

$$\frac{2x}{2} = \frac{16}{2}$$

$$x = 8$$

$$\textcircled{4} \quad 2Y - \begin{bmatrix} 1 & 8 \\ 3 & -7 \end{bmatrix} = \begin{bmatrix} 5 & 7 \\ 15 & 9 \end{bmatrix}$$

$$+ \begin{bmatrix} 9 & 8 \\ 3 & -7 \end{bmatrix} + \begin{bmatrix} 9 & 8 \\ 3 & -7 \end{bmatrix}$$

No  
Division  
allowed!

$$\cancel{\left(\frac{1}{2}\right)} 2Y = \frac{1}{2} \begin{bmatrix} 14 & 15 \\ 18 & 2 \end{bmatrix}$$

$$Y = \begin{bmatrix} 7 & \frac{15}{2} \\ 9 & 1 \end{bmatrix}$$