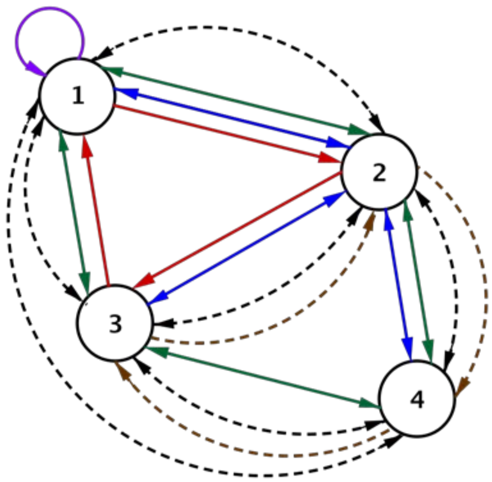
4.3: The Matrix Reloaded

Matrix Arithmetic

Suppose a subway line also connects the four cities. Here is the subway and bus line network. The bus routes connecting the cities are represented by solid lines, and the subway routes are represented by dashed arcs.



Write a matrix B to represent the bus routes and a matrix S to represent the subway lines connecting the four cities.

Matrix Arithmetic

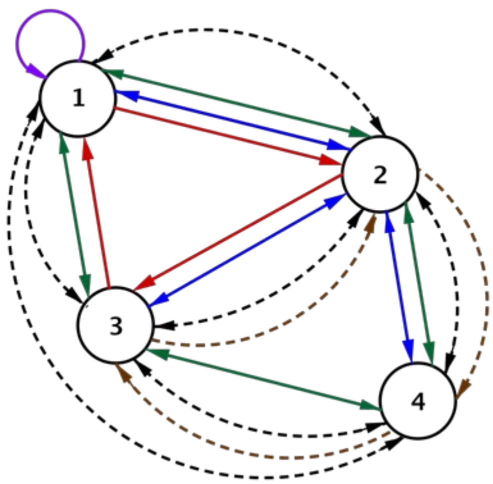
Use the network diagram from the Opening Exercise and your answers to help you complete this challenge with your group.

1. Suppose the number of bus routes between each city were doubled.
   a. What would the new bus route matrix be?

   b. Mathematicians call this matrix $2B$. Why do you think they call it that?

2. What would be the meaning of $10B$ in this situation?

3. Write the matrix $10B$.



4. Ignore whether or not a line connecting cities represents a bus or subway route.
   a. Create one matrix that represents all the routes between the cities in this transportation network.

   b. Why would it be appropriate to call this matrix $B + S$? Explain your reasoning.

5. What would be the meaning of $4B + 2S$ in this situation?

6. Write the matrix $4B + 2S$. Show work and explain how you found your answer.

7. Complete this graphic organizer.

Matrix Operations Graphic Organizer

Operation	**Symbols**	**Describe How to Calculate**	**Example Using 3×3 Matrices**
Scalar Multiplication	kA		
The Sum of Two Matrices	$A + B$		
The Difference of Two Matrices	$A - B$ $= A + (-1)B$		

Lesson Summary

MATRIX SCALAR MULTIPLICATION: Let k be a real number, and let A be an $m \times n$ matrix whose entry in row i and column j is $a_{i,j}$. Then the *scalar product* $k \cdot A$ is the $m \times n$ matrix whose entry in row i and column j is $k \cdot a_{i,j}$.

MATRIX SUM: Let A be an $m \times n$ matrix whose entry in row i and column j is $a_{i,j}$, and let B be an $m \times n$ matrix whose entry in row i and column j is $b_{i,j}$. Then the *matrix sum* $A + B$ is the $m \times n$ matrix whose entry in row i and column j is $a_{i,j} + b_{i,j}$.

MATRIX DIFFERENCE: Let A be an $m \times n$ matrix whose entry in row i and column j is $a_{i,j}$, and let B be an $m \times n$ matrix whose entry in row i and column j is $b_{i,j}$. Then the *matrix difference* $A - B$ is the $m \times n$ matrix whose entry in row i and column j is $a_{i,j} - b_{i,j}$.