Matrices: Part 2 - Secret Codes

Overview

A matrix is a set of data (information) that is laid out on a grid of rows and columns. In computer science, matrices are an important way of representing data so that it can be easily accessed and computed. Many games use matrices to play! For example, in chess, each player chooses the row and column position to move a piece during their turn in order to trap the king. The same thing goes for tic-tac-toe. Each player tries to select the best position on the grid in order to get three symbols in a row, column, or diagonal.

You can also store data values in the positions of the matrices and then select them based on the rows and columns. In this activity we will use the arrangement of a matrix to encode and decode messages. We will use the positions on the matrix to decode a sequence of letters. So review Matrices Part 1, tap into your secret agent spy skills, and get ready to crack some codes!

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Decode a Secret Message

Setting Up
- paper
- pencil

Print the **Matrices Secret Codes templates** (or create your own, based on the templates)

Steps
1. Review the basics of matrices. (You may want to start with the Matrix: Part 1 activities as an introduction or review.) Show the **2x2 Coded Matrix Board** (or the following example matrix) and review: *This is a matrix. A matrix is a way of organizing information. It is a grid, and we can place things in these boxes.* (You can place a small object in a square to demonstrate this.) Each of these squares is a different position on the matrix. *How can we know which position is which?*

Show that there are **rows** (horizontal) and **columns** (vertical), demonstrating with your finger. We label these rows and columns. Each row is numbered, and each column is numbered. Show with your finger how this works. (See the example on the following page, and note that the numbering for the rows and columns starts in the upper left corner. This is different than how we represent coordinates in math and in maps; so we must remember that this is how we represent matrices in computer science.) We can label each box according to its row and its column, and we always say the row first, and the column second. It's just how we all do it, so that we don't get confused!

2. Review how to represent entries on the matrix. We write the labels for the row and the column like this:

1, 2

3. *Can you point to 1, 2 on the 2x2 Coded Matrix Board? What letter is in the box?* We call this an *entry* on the matrix.

4. Explain - This **Matrix Board** contains a secret message! There is a code to figure out what that message is. *Do you know what a code is? Have you ever created a secret code?*

5. Show the boxes at the bottom, the ones with the corresponding coordinates. Explain - this is a code that gives us instructions to figure out the secret message. This is a list of positions on the matrix, and each position contains an entry - a letter. If we follow the order of the entries, we can write the corresponding letter in the box, and when we finish, the secret message is revealed!

6. Allow the child to decode the message, assisting only when needed.

Variations

a. Using the Blank Matrix Board, create a new coded message for your child to decode.

b. Invite the child to create their own secret message on the Blank Matrix Board and share the code with someone else to decode.

Example Matrix

A matrix is a rectangular array of data, seen here with numbers. It is arranged as rows and columns. In the matrix below, there are 3 rows and 3 columns, and so we call it a 3 x 3 matrix. Each number you see inside the brackets is called an *entry*, and it has a specific position on the matrix defined by the row and then the column. For example, the entry in position $1,3$ would be 99. A matrix in computer science is represented with brackets. However, in our activities, we will use a grid so that it is easier to count the entries.

$$\begin{bmatrix} 1 & 14 & 99 \\ 9 & 6 & 83 \\ 70 & -5 & 0 \end{bmatrix}$$