Lexicographic indexing between vectors and matrices

We want to represent an M x N matrix with a 1 x MN vector and allow indexing from $\mathbb{Z}^{M \times N}$ to the appropriate vector index. Assume we can start our indices at 0 as done in C and C++. Let's define a 4 x 5 matrix and store in a 1 x 20 vector.

$$\begin{array}{cccc}
0 & 1 & 2 & 3 \\
1 & 4 & 5 & 6 \\
2 & 7 & 8 & 9 \\
3 & 10 & 11 & 12
\end{array}$$

Index $= m \times N + n$

So to address the value 12 we let $m = 2$, $n = 1$

index $= 2 \times 5 + 1 = 11$

So if we want to find the one of the rows in a mask that is not all zeros (i.e. the mask described in Lecture 28B) and use Matlab s.t.

$$J = \text{find}(R \land \text{mask} == 1)$$

If indexing starts at 0 then $m = \frac{\text{index} - n}{N}$.

For Matlab we will use the first index $J(1)$ and to remove dependency on "n" we will use the ceil function:

$\text{row} = \text{ceil}(J(1)/N^2)$.