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1. Suppose I first execute the following Octave/Matlab commands:

```
1 A = [1 2; 3 4; 5 6];  
2 B = [1 2 3; 4 5 6];
```

Which of the following are then valid commands? Check all that apply. (Hint: A' denotes the transpose of A.)

☒ C = A \* B;

☒ C = B' + A;

☐ C = A' \* B;

☐ C = B + A;

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2. Let  $A = \begin{bmatrix} 16 & 2 & 3 & 13 \\ 5 & 11 & 10 & 8 \\ 9 & 7 & 6 & 12 \\ 4 & 14 & 15 & 1 \end{bmatrix}$ .

Which of the following indexing expressions gives  $B = \begin{bmatrix} 16 & 2 \\ 5 & 11 \\ 9 & 7 \\ 4 & 14 \end{bmatrix}$ ? Check all that apply.

☒ B = A(:, 1:2);

☒ B = A(1:4, 1:2);

☐ B = A(:, 0:2);

☐ B = A(0:4, 0:2);

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3. Let  $A$  be a 10x10 matrix and  $x$  be a 10-element vector. Your friend wants to compute the product  $Ax$  and writes the following code:

```
1 v = zeros(10, 1);
2 for i = 1:10
3     for j = 1:10
4         v(i) = v(i) + A(i, j) * x(j);
5     end
6 end
```

How would you vectorize this code to run without any for loops? Check all that apply.

- ☒  $v = A * x;$
- ☐  $v = Ax;$
- ☐  $v = x' * A;$
- ☐  $v = \text{sum}(A * x);$

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4. Say you have two column vectors  $v$  and  $w$ , each with 7 elements (i.e., they have dimensions 7x1). Consider the following code:

```
1 z = 0;
2 for i = 1:7
3     z = z + v(i) * w(i)
4 end
```

Which of the following vectorizations correctly compute  $z$ ? Check all that apply.

- ☒  $z = \text{sum}(v .* w);$
- ☒  $z = v' * w;$
- ☐  $z = v * w';$
- ☐  $z = v .* w;$

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5. In Octave/Matlab, many functions work on single numbers, vectors, and matrices. For example, the `sin` function when applied to a matrix will return a new matrix with the `sin` of each element. But you have to be careful, as certain functions have different behavior. Suppose you have an  $7 \times 7$  matrix  $X$ . You want to compute the log of every element, the square of every element, add 1 to every element, and divide every element by 4. You will store the results in four matrices,  $A$ ,  $B$ ,  $C$ ,  $D$ . One way to do so is the following code:

```
1 for i = 1:7
2   for j = 1:7
3     A(i, j) = log(X(i, j));
4     B(i, j) = X(i, j) ^ 2;
5     C(i, j) = X(i, j) + 1;
6     D(i, j) = X(i, j) / 4;
7   end
8 end
```

Which of the following correctly compute  $A$ ,  $B$ ,  $C$ , or  $D$ ? Check all that apply.

☒  $C = X + 1;$

☒  $D = X / 4;$

☒  $B = X.^2;$

☐  $B = X^2;$