

Show all work. You may leave arithmetic expressions in any form that a calculator could evaluate. By putting your name on this paper, you agree to abide by the university's code of academic integrity in completing the quiz. Use no books, calculators, cellphones, communication with others, scratchpaper, etc.

Name _____

1. Let $\mathbf{x} = [-3, -4, 2]^T$.

1a. (3) $\|\mathbf{x}\|_1 = |-3| + |-4| + |2| = 9$.

1b. (3) $\|\mathbf{x}\|_\infty = \max(|-3|, |-4|, |2|) = 4$.

1c. (4) What vector has the same direction as \mathbf{x} but 2-norm equal to 1? (In other words, we want the vector \mathbf{x}/c that has 2-norm equal to 1, where c is a constant that you should compute.)

Answer: $\|\mathbf{x}\|_2 = \sqrt{(-3)^2 + (-4)^2 + 2^2} = \sqrt{29}$, so the vector is

$$\frac{1}{\sqrt{29}} \begin{bmatrix} -3 \\ -4 \\ 2 \end{bmatrix}.$$

2. (10) Recall that if \mathbf{A} is an $n \times n$ matrix then

$$\|\mathbf{A}\|_{\infty} = \max_{i=1,\dots,n} \sum_{j=1}^n |a_{ij}|.$$

Suppose that all elements of \mathbf{A} are nonnegative. Write Matlab code to compute $\|\mathbf{A}\|_{\infty}$ using a column oriented algorithm.

- Your code should have only one `for` loop.
- A correct row-oriented algorithm with one `for` loop is worth 5 points.
- A correct column-oriented algorithm with two `for` loops is worth 8 points.

Answer:

```
sums = zeros(n,1);  
for j = 1 : n  
    sums = sums + abs(A(:,j));  
end  
Anorm = max(sums);
```

(The “abs” in this algorithm can be omitted for a nonnegative matrix but is necessary in general.)