

# Assignment 1 - MA 108

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D3-T5 TA

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If you're finding Q.1. really difficult, you may attempt Q.0. as well. This will help me in figuring out what you didn't understand. If you're fairly confident with Q.1., then you need not do it.  
There is no need to submit the additional questions.

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Q.0. Let  $S \subset \mathbb{R}^2$ . State what it means for  $S$  to be star-shaped.

Q.1. Show that  $\mathbb{R}^2 \setminus \{(0,0)\}$  is not star shaped.

*Bonus.* Let  $S$  be any finite subset of  $\mathbb{R}^2$ .

Prove or disprove that  $\mathbb{R}^2 \setminus S$  is star-shaped.

Q.2. Solve Q.10.(i) of Sheet-1 to completion.

Additional:

1. Let  $S$  be a nonempty subset of  $\mathbb{R}^2$ .

Show that if  $S$  is convex, then  $S$  is star-shaped.

2. Show that the converse of the above is not true.

3. Let  $T : \mathbb{R}^2 \rightarrow \mathbb{R}^2$  be a linear transformation. Let  $S \subset \mathbb{R}^2$  be convex.

Show that  $T(S) = \{T(s) \mid s \in S\}$  is also convex.

That is, a linear transformation maps convex domains to convex domains.

4. Is the above true if we replace “convex” with “star-shaped”?