

Polar coordinates

Answers included

Questions

Question 1. Determine which of the following polar coordinates (r, θ) does NOT represent the same point as the other four:

$(3, -5\pi/4), (3, 3\pi/4), (-3, -\pi/4), (-3, 3\pi/4), (-3, 7\pi/4)$

Question 2. What shape in the xy -plane does the polar curve $r = \csc \theta$ describe?

Question 3. On the backside of this sheet of paper, indicate **all** regions in the given r, θ -grid that correspond to the shaded regions A and B in Figure 1.

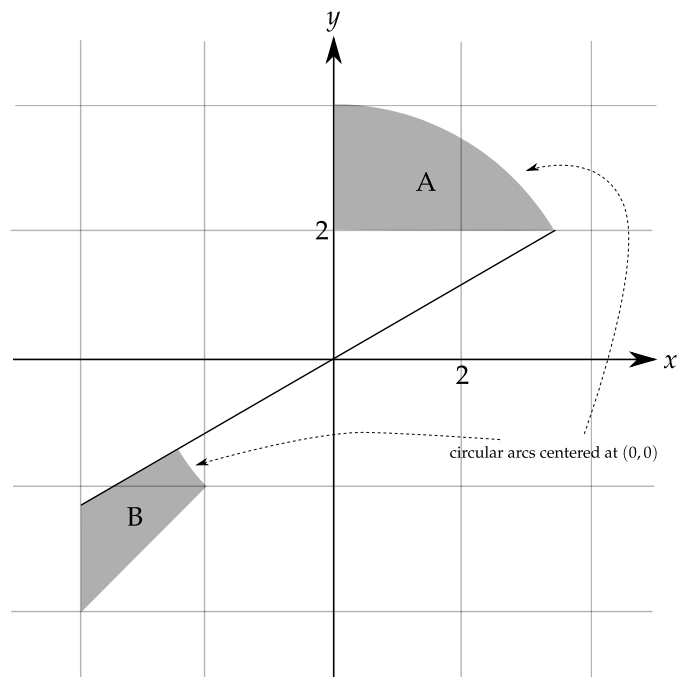


FIGURE 1. The two curved arcs are parts of circles centered at the origin. All other sides are straight lines.

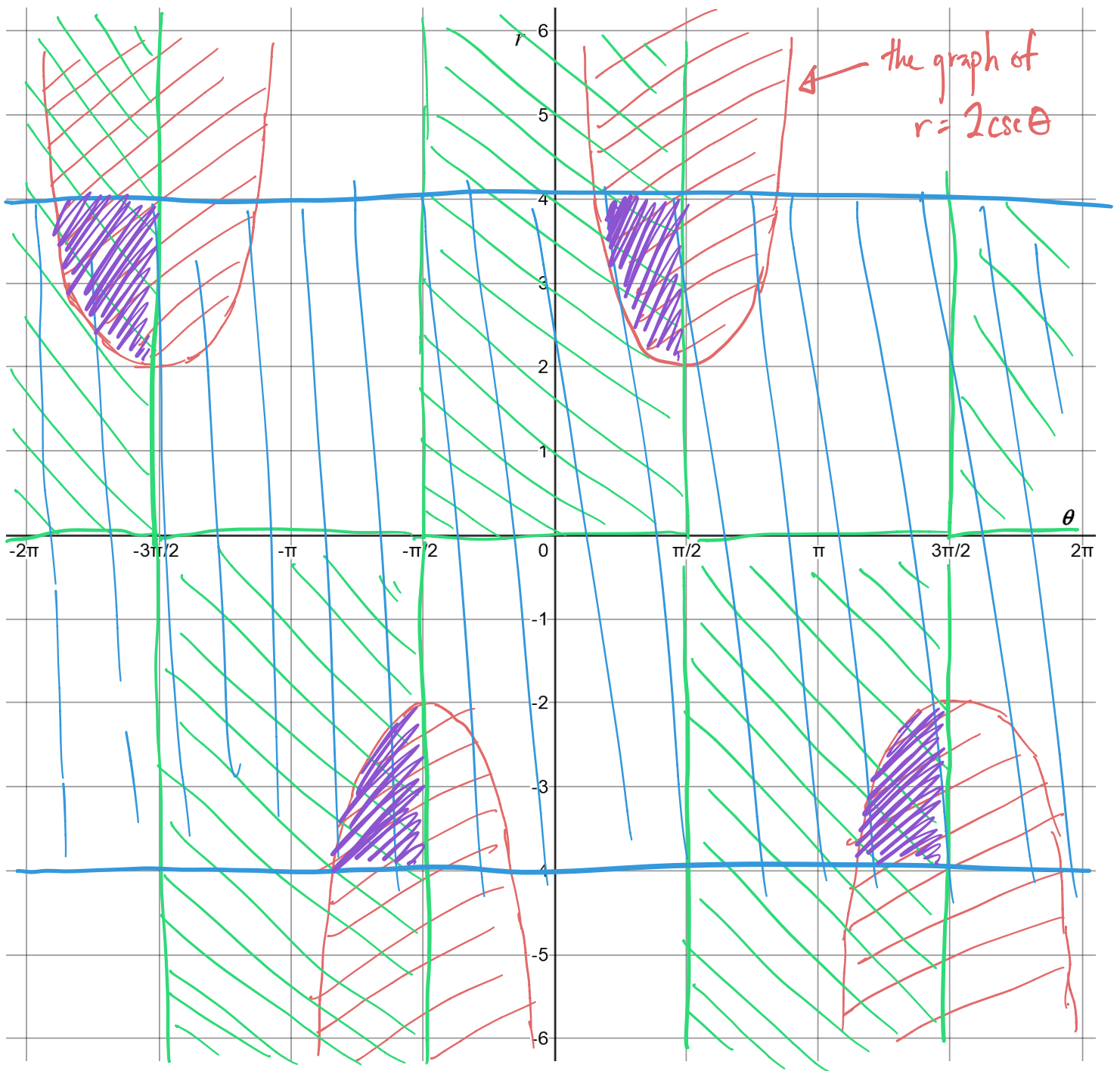
Below are brief answers to the worksheet exercises. If you would like a more detailed solution, feel free to ask me in person. (Do let me know if you catch any mistakes!)

Answers to conceptual questions

Question 2. The fourth point is the odd one out. It corresponds to $(x, y) = (3\sqrt{2}, -3\sqrt{2})$ whereas all the others represent $(x, y) = (-3\sqrt{2}, 3\sqrt{2})$.

Question 3. We can rearrange the equation as $r \sin \theta = 1$, which is just $y = 1$. So this is a line.

Question 4. See the following pages.



Region A is defined by

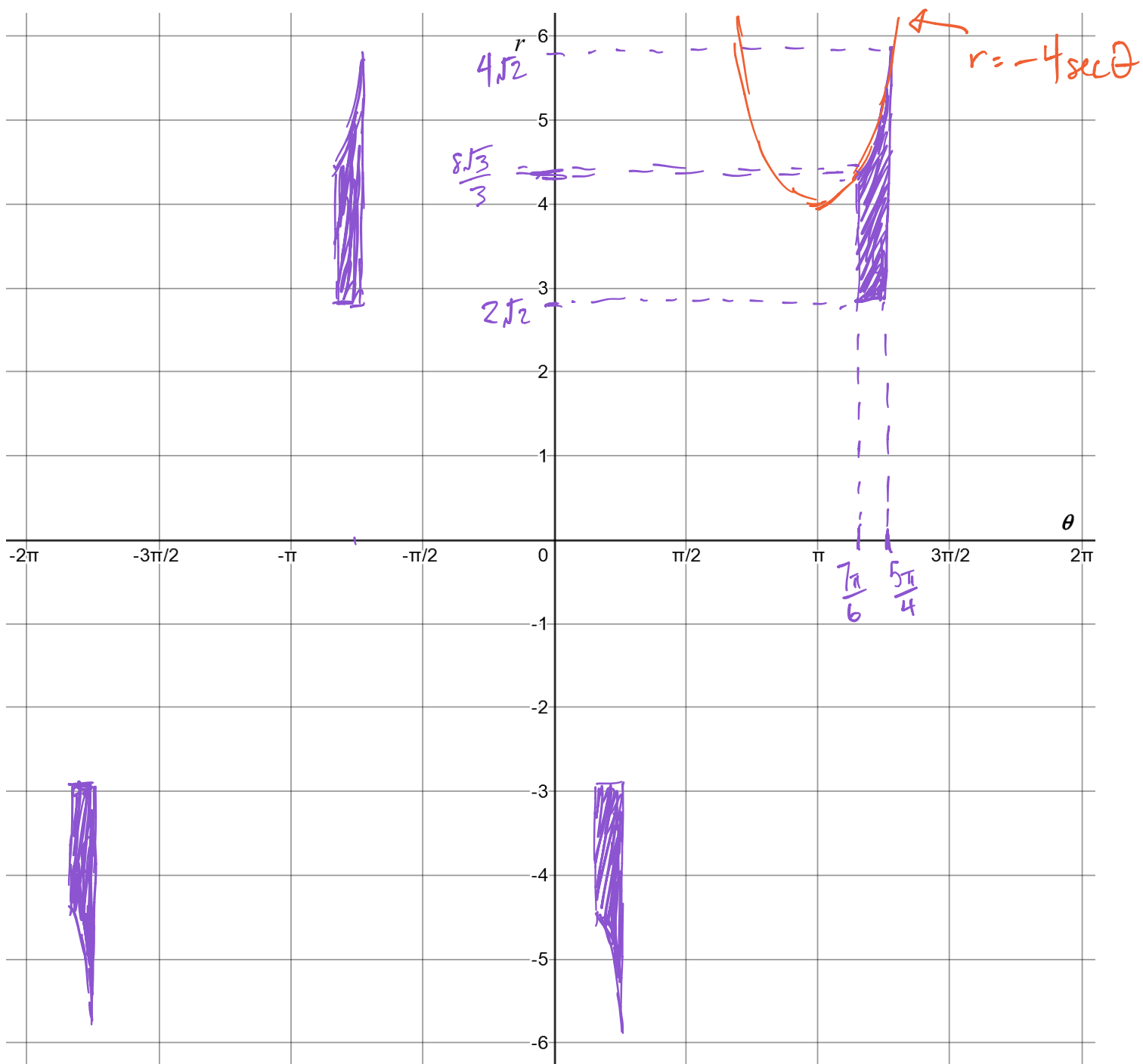
$$\begin{aligned}
 y &\geq 2 \\
 x &\geq 0 \\
 x^2 + y^2 &\leq 16
 \end{aligned}$$

i.e.

$$\begin{aligned}
 r \sin \theta &> 2 \\
 r \cos \theta &\geq 0 \\
 |r| &\leq 4
 \end{aligned}$$

The regions satisfying all three constraints has been shaded in purple.

(\geq vs $>$ is not important in this problem)



I'll let you check that this is the answer for region B.