SM3H 11.1 Polar Battleship

Memorize: Polar to rectangular: $x = r\cos\theta, \quad y = r\sin\theta$

Rectangular to polar: $r = \sqrt{x^2 + y^2}$, $\theta = \arctan\left(\frac{y}{x}\right) + p$,

where $p = 0$ in Q1, $p = \pi$ in Q2 or Q3, $p = 2\pi$ in Q4

Objective: As an admiral, you fire shots at your opponent's armada until you have completely obliterated their naval force.

Setup: Place a battleship (4 coordinates), frigate (3 coordinates), and destroyer (2 coordinates) onto your sea by drawing an open circle in each position corresponding to one of your ships. Ship coordinates must either have the same radius or the same radian for each segment of ship. Ships may not overlap.

Game Play: Admirals need to have a reasonable name for naval warfare that reflects who they are. For example, Mr. Wytiaz typically sinks destroyers under the monikers Mathbeard (you can add the suffix –"beard" to almost anything) or Admiral Leibniz (my personal mathematics hero).

Once you have figured out your admiral names, randomly determine which admiral will fire first. The attacking admiral calls a polar coordinate in (r, θ) form and then the defending admiral declares whether the shot was a hit or a miss. The attacking admiral records the location of the shot on the Enemy Polar Sea (use O for a miss and X for a hit) and records the shot in polar form in the battle log. The defending admiral records the location of the shot in their sea but is not required to log the shot.

If a shot causes one of your vessels to be completely destroyed (each section has been hit), declare "You just sunk my <ship name>".

When one force has been completely sunk, the game is over.

Class Work

Play a game of polar battleship and record the results. On the battle log, convert all polar coordinates in your game into rectangular coordinates. I suggest converting the coordinates during the game while you have a fellow student to confer with. If this goes unfinished, it becomes home work.

Home Work

Complete the HW11.1 page.

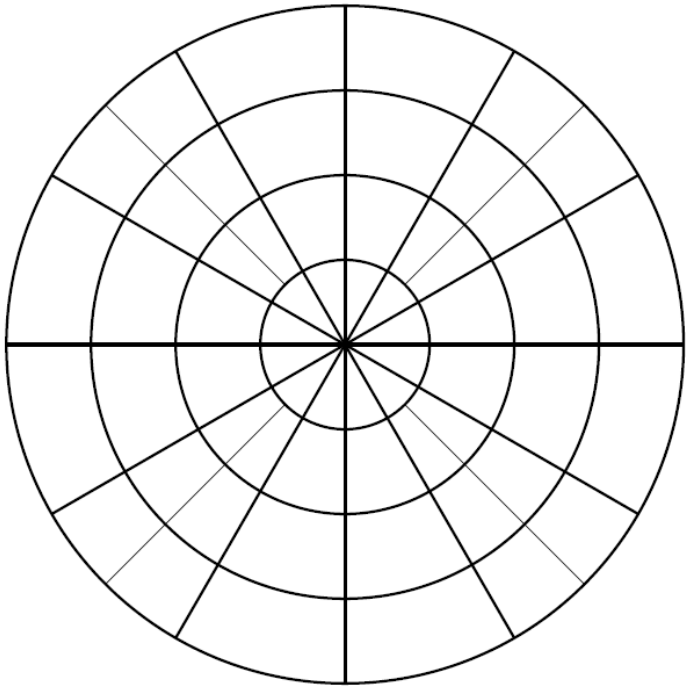
Admiral _____ VS Admiral _____

My Polar Sea

Battleship:
(,),
(,),
(,),
(,)

Frigate:
(,),
(,),
(,)

Destroyer:
(,),
(,)

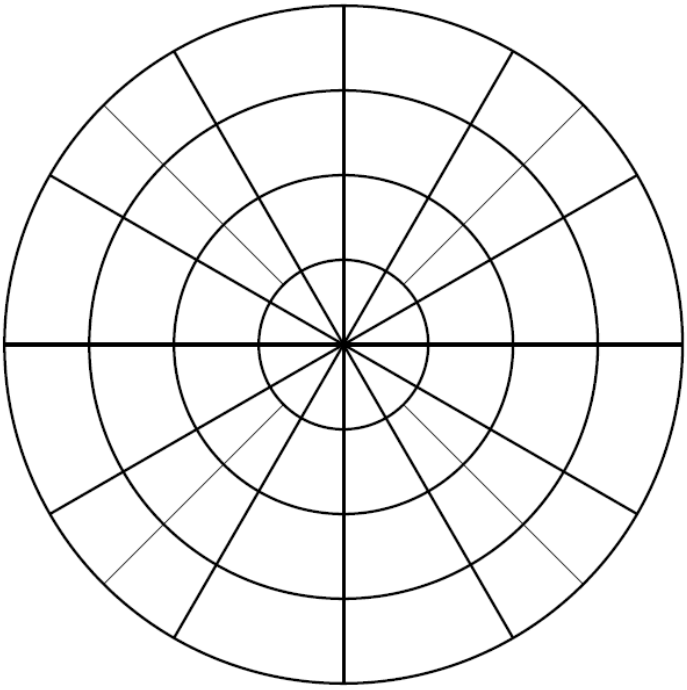


Enemy Polar Sea

Battleship:
(,),
(,),
(,),
(,)

Frigate:
(,),
(,),
(,)

Destroyer:
(,),
(,)



Battle Log

For each shot that you fired using the polar coordinate system, convert the shot into rectangular coordinates.

Polar (r, θ)	**Rect.** (x, y)
(,)	(,)
(,)	(,)
(,)	(,)
(,)	(,)
(,)	(,)
(,)	(,)
(,)	(,)
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(,)	(,)
(,)	(,)
(,)	(,)

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Convert: Convert the polar coordinates to rectangular coordinates:

$\left(3,\frac{\pi}{4}\right)$ $\left(2,\frac{\pi}{6}\right)$ $\left(5,\frac{\pi}{3}\right)$ $(3,\pi)$ $(4,0)$ $\left(2,\frac{2\pi}{3}\right)$

Convert the rectangular coordinates to polar coordinates $(r>0, 0\le\theta<2\pi)$:

$(\sqrt{2},\sqrt{2})$ $(2\sqrt{3},\ 2)$ $(3\sqrt{2},-3\sqrt{2})$ $(2,5)$ $(-10,\ e)$

Problems: State at least 3 more polar coordinate representations for the given polar point:

$\left(3,\frac{\pi}{2}\right)$ $\left(2,\frac{5\pi}{6}\right)$

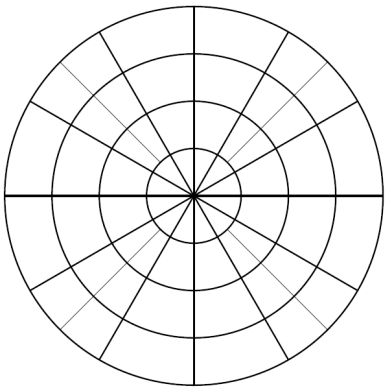
Graph and label each polar point on the polar axis:

A: $\left(3,\frac{4\pi}{3}\right)$

B: $\left(2,-\frac{\pi}{6}\right)$

C: $\left(-2,\frac{\pi}{2}\right)$

D: $\left(-3,-\frac{3\pi}{4}\right)$



Write each rectangular equation as a polar equation (solved for r):

$x=-5$ $y=3$ $x^2+y^2=4$

Write each polar equation as a rectangular equation:

$r=\frac{5}{5\cos\theta+6\sin\theta}$ $r=\frac{2}{3\cos\theta+4\sin\theta}$