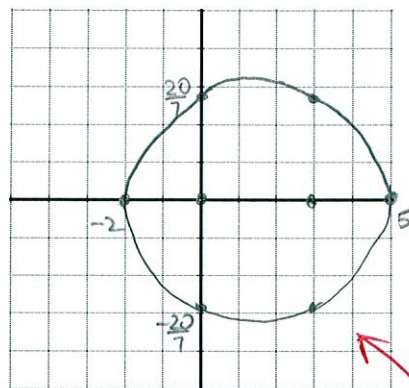


Consider the graph of the polar equation $r = \frac{20}{7-3\cos\theta} = \frac{\frac{20}{7}}{1-\frac{3}{7}\cos\theta}$

SCORE: ____ / 9 PTS



[a] Fill in the blanks.

[i] The eccentricity is $\frac{3}{7}$ ①

[ii] The shape of the graph is a/an ELLIPSE ①

[iii] The equation of the directrix is $x = -\frac{20}{3}$ ①

[iv] Find the **rectangular** coordinates of the

x - intercept(s)

$(-2, 0), (5, 0)$ ①

y - intercept(s)

$(0, \frac{20}{7}), (0, -\frac{20}{7})$ ①

focus/foci $-2+5=3$

$(0, 0), (3, 0)$ ①

endpoints of the latus rectum/latera recta

$(0, \pm \frac{20}{7}), (3, \pm \frac{20}{7})$ ①

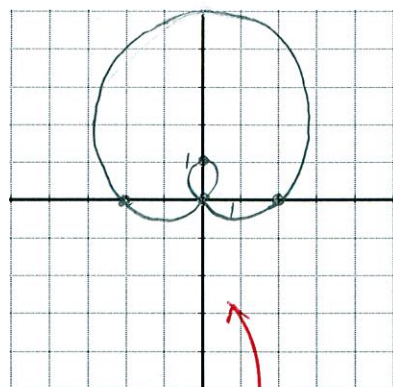
θ	r
0	$\frac{20}{4} = 5$
$\frac{\pi}{2}$	$\frac{20}{7} = 2\frac{6}{7}$
π	$\frac{20}{10} = 2$
$\frac{3\pi}{2}$	$\frac{20}{7} = 2\frac{6}{7}$

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[b] Sketch the graph on the grid provided above. **You must provide a scale for the axes & plot all points from part [a][iv] above.**

Consider the graph of the polar equation $r = 2 + 3\sin\theta$. $0 < |\frac{2}{3}| < 1$

SCORE: ____ / 6 PTS



[a] Fill in the blanks.

[i] The shape of the graph is a/an LIMACON WITH LOOP ①

[ii] The graph DOES ① pass through the pole.
does / does not

[iii] Find the **rectangular** coordinates of the

x - intercept(s)

$(0, 0), (2, 0), (-2, 0)$ ①

y - intercept(s)

$(0, 0), (0, 5), (0, -1)$ ①

θ	r
0	2
$\frac{\pi}{2}$	5
π	2
$\frac{3\pi}{2}$	-1

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[b] Sketch the graph on the grid provided above. **You must provide a scale for the axes & plot all points from part [a][iii] above.**

Consider the graph of the polar equation $r = 2 - 2\sin 2\theta$.

SCORE: ____ / 15 PTS

NOTE: $(r, \pi - \theta)$ and $(-r, \pi - \theta)$ tests do NOT show that the graph is symmetric

- [a] Using the information above, and the tests and shortcuts shown in lecture, test if the graph is symmetric over the pole, the polar axis, and/or $\theta = \frac{\pi}{2}$. State your conclusions in the table. **NOTE: Run as FEW tests as needed to prove your answers are correct.**

$$\theta = \frac{\pi}{2}: -r = 2 - 2\sin 2(-\theta)$$

$$-r = 2 + 2\sin 2\theta$$

$$\textcircled{1} r = -2 - 2\sin 2\theta \quad \times$$

$$\text{POLAR AXIS: } r = 2 - 2\sin 2(-\theta)$$


$$\textcircled{1} r = 2 + 2\sin 2\theta \quad \times$$

$$\text{POLE: } r = 2 - 2\sin 2(\pi + \theta)$$

$$r = 2 - 2\sin (2\pi + 2\theta)$$

$$r = 2 - 2[\sin 2\pi \cos 2\theta + \cos 2\pi \sin 2\theta]$$

$$\textcircled{1} r = 2 - 2\sin 2\theta \quad \checkmark$$


"NO"
AND
"NOT
SYMMETRIC"
ARE INCORRECT

Type of symmetry	Conclusion
Over the polar axis	NO CONCLUSION
Over $\theta = \frac{\pi}{2}$	NO CONCLUSION
Over the pole	SYMMETRIC

$\textcircled{2}$ IF ALL 3 CORRECT
 $\textcircled{1}$ IF 2 OF 3 CORRECT
 $\textcircled{0}$ IF NONE OR ONLY 1 CORRECT

- [b] Based on the results of part [a], what is the minimum interval of the graph you need to plot first (before using reflections to draw the rest of the graph)?

$[0, \pi]$ OR $[-\frac{\pi}{2}, \frac{\pi}{2}]$ $\textcircled{1}$ EITHER ANSWER IS OK

- [c] Find the angles in the minimum interval in part [b] at which the graph goes through the pole.

$$0 = 2 - 2\sin 2\theta$$

$$\textcircled{1} \sin 2\theta = 1$$

IF USING $[0, \pi]$,

$$0 \leq 2\theta \leq 2\pi$$

$$\text{so } 2\theta = \frac{\pi}{2}$$

$$\textcircled{1} \theta = \frac{\pi}{4}$$

IF USING $[-\frac{\pi}{2}, \frac{\pi}{2}]$

$$-\pi \leq 2\theta \leq \pi$$

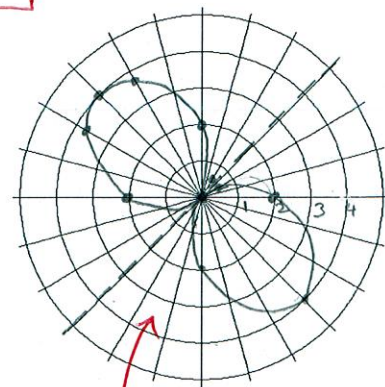
$$\text{so } 2\theta = \frac{\pi}{2}$$

$$\theta = \frac{\pi}{4}$$

- [d] Find the value of r for all common angles in the minimum interval in part [b].

$\frac{\theta}{0}$	$\frac{r}{\textcircled{2}} [2$
$\frac{\pi}{6}$	$\textcircled{2} [2 - \sqrt{3} \approx 0.2$
$\frac{\pi}{4}$	0
$\frac{\pi}{3}$	$\textcircled{2} [2 - \sqrt{3} \approx 0.2$
$\frac{\pi}{2}$	$\textcircled{2} [2$

$\frac{\theta}{-\frac{\pi}{2} \text{ or } \frac{2\pi}{3}}$	$\frac{r}{\textcircled{2}} [2 + \sqrt{3} \approx 3.8$
$-\frac{\pi}{4} \text{ or } \frac{3\pi}{4}$	$\textcircled{2} [4$
$-\frac{\pi}{6} \text{ or } \frac{5\pi}{6}$	$\textcircled{2} [2 + \sqrt{3} \approx 3.8$
$-\frac{\pi}{2} \text{ or } \pi$	$\textcircled{2} [2$



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- [d] Sketch the graph on the grid provided below. **You must provide a scale for the polar axis & plot all points from part [c] above.**