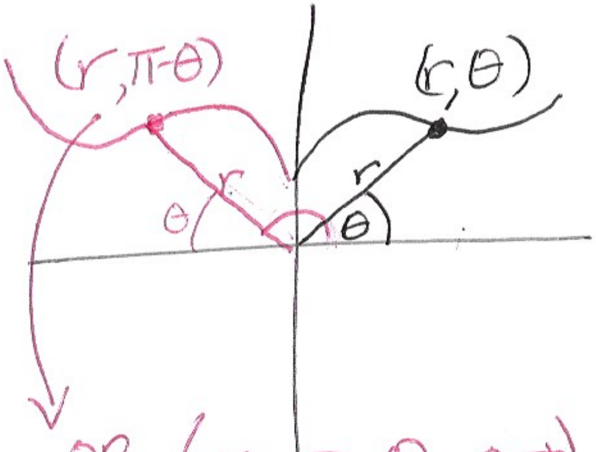
TO TEST IF $f(r,\theta)=c$ IS SYM OVER $\theta=\frac{\pi}{2}$



OR $(r, \pi-\theta+2\pi)$

$(r, \pi-\theta+4\pi)$ + . . .

OR $(-r,-\theta)$

$(-r,-\theta+2\pi)$

$(-r,-\theta+4\pi)$ . . .

IF REPLACING (r,θ) WITH $(r,\pi-\theta)$ OR $(-r,-\theta)$

GIVES AN EQUATION WHICH CAN BE SIMPLIFIED BACK TO THE ORIGINAL EQ'N

THEN THE GRAPH OF $f(r,\theta)=c$ IS SYM OVER $\theta=\frac{\pi}{2}$

eg. $r=\sin\theta$

$(r,\pi-\theta): r=\sin(\pi-\theta)$

$r=\overset{0}{\cancel{\sin\pi}}\cos\theta-\overset{-1}{\cancel{\cos\pi}}\sin\theta$

$r=\sin\theta$ $\boxed{\text{SYM}}$ OVER $\theta=\frac{\pi}{2}$

NO NEED TO RUN OTHER TEST

$(-r,-\theta): -r=\sin(-\theta)$

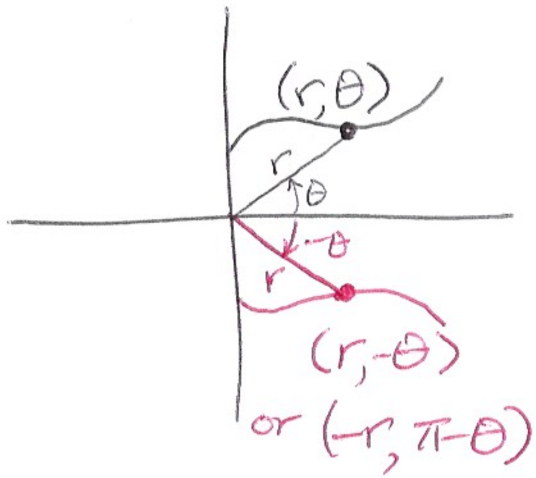
$-r=-\sin\theta$

$r=\sin\theta$ SYM OVER $\theta=\frac{\pi}{2}$

SHOULD HAVE RUN THIS FIRST

GIVES CONCLUSION WITH LESS WORK

TO TEST IF $f(r,\theta)=C$ IS ~~OVER~~ SYM OVER POLAR AXIS



IF REPLACING (r,θ) WITH $(r,-\theta)$ OR $(-r,\pi-\theta)$
GIVES AN EQ'N WHICH CAN BE SIMPLIFIED
BACK TO THE ORIGINAL EQ'N
THEN THE GRAPH OF $f(r,\theta)=C$ IS SYM OVER POLAR AXIS

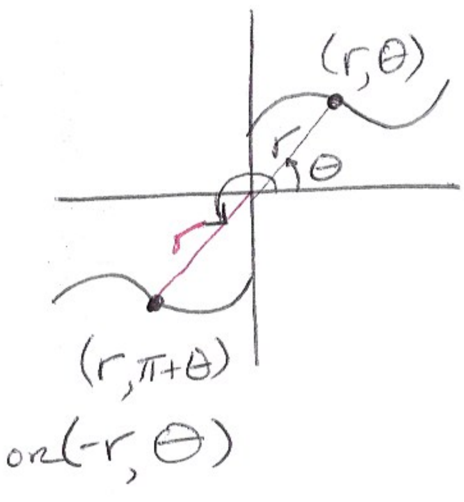
eg. $r=\sin\theta$

$(r,-\theta)$ $r=\sin(-\theta)$
$r=-\sin\theta$ NO CONCLUSION

$(-r,\pi-\theta)$ $-r=\sin(\pi-\theta)$
$-r=\sin\theta$
$r=-\sin\theta$ NO CONCLUSION

NO CONCLUSION
ABOUT SYM OVER POLAR AXIS

TO TEST IF $f(r,\theta)=c$ IS SYM OVER POLE



eg. $r=\sin\theta$

$(-r,\theta)$ $-r=\sin\theta$

$r=-\sin\theta$ NO CONCLUSION

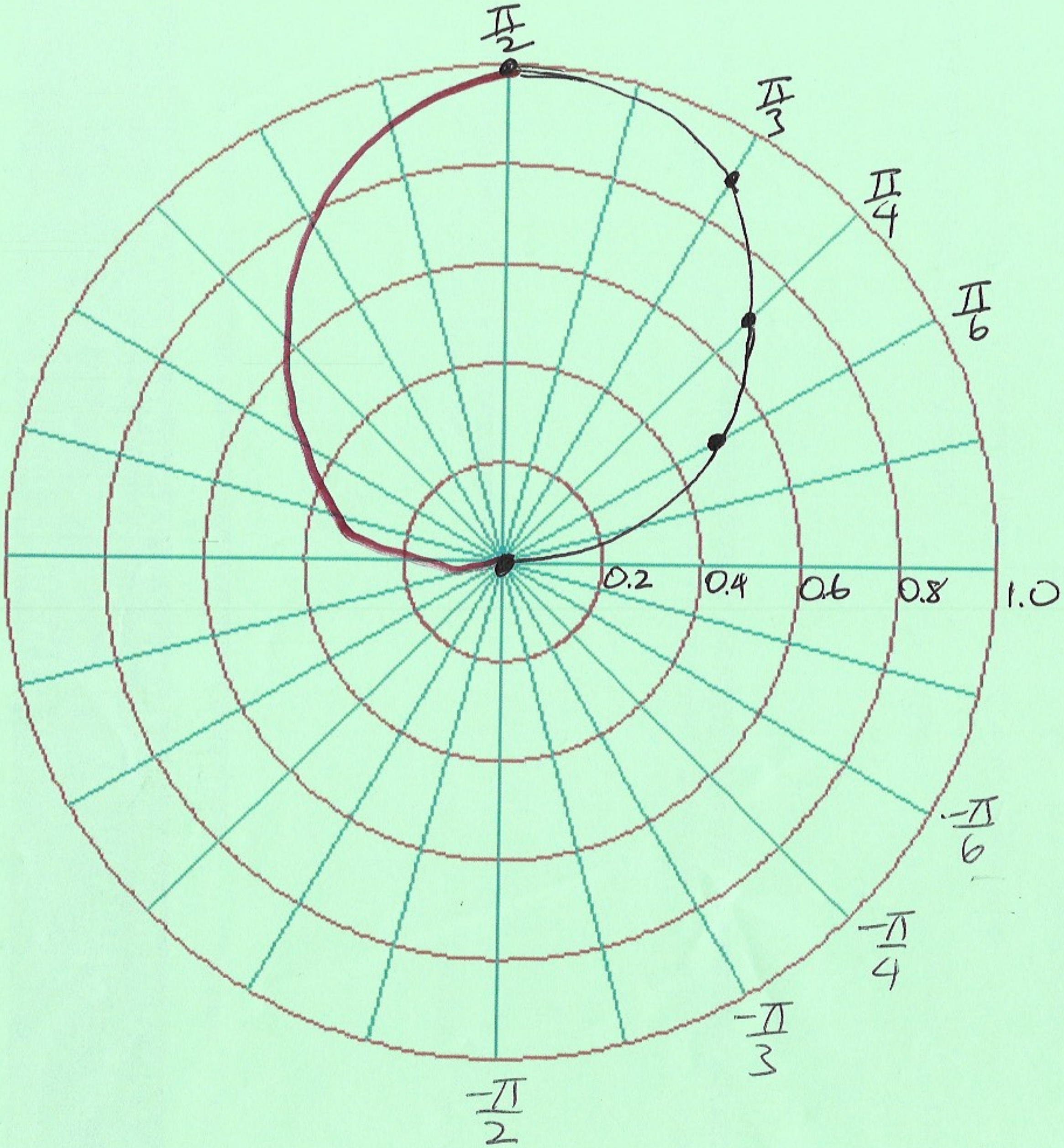
$(r,\pi+\theta)$ $r=\sin(\pi+\theta)$

$r=\underbrace{\cancel{\sin\pi}}_{0}\cos\theta+\underbrace{\cancel{\cos\pi}}_{-1}\sin\theta$

$r=-\sin\theta$ NO CONCLUSION

NO CONCLUSION ABOUT SYM OVER POLE

$r = \sin\theta$



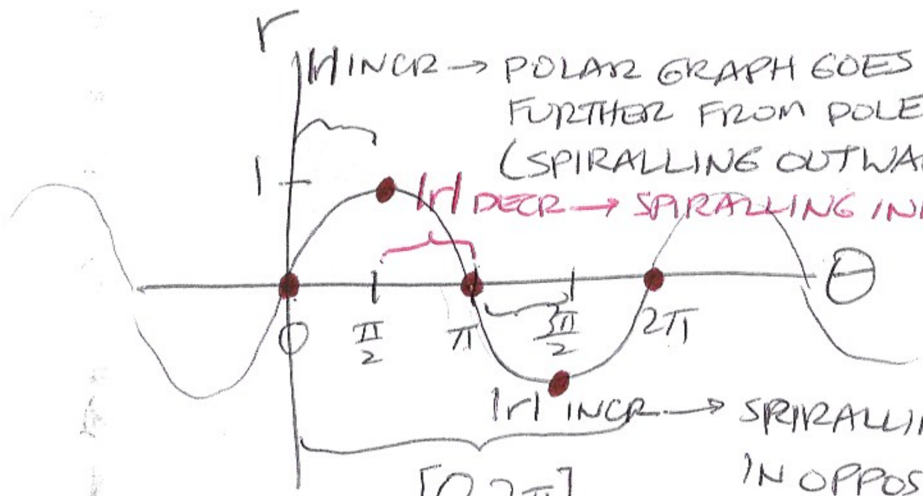
θ	r	(r, θ)
$-\frac{\pi}{6}$	$\sin(-\frac{\pi}{6}) = -\frac{1}{2}$	$(-\frac{1}{2}, -\frac{\pi}{6})$
$-\frac{\pi}{4}$	$-\frac{\sqrt{2}}{2}$	$(-\frac{\sqrt{2}}{2}, -\frac{\pi}{4})$

SINCE $r < 0$

$\theta \in Q_4$

POINTS IN Q_2

GRAPH $r = \sin\theta$



|r| INCR → POLAR GRAPH GOES FURTHER FROM POLE (SPIRALLING OUTWARD)

|r| DECR → SPIRALLING INWARD

|r| INCR → SPIRALLING OUTWARD IN OPPOSITE QUADRANT ($r<0$)

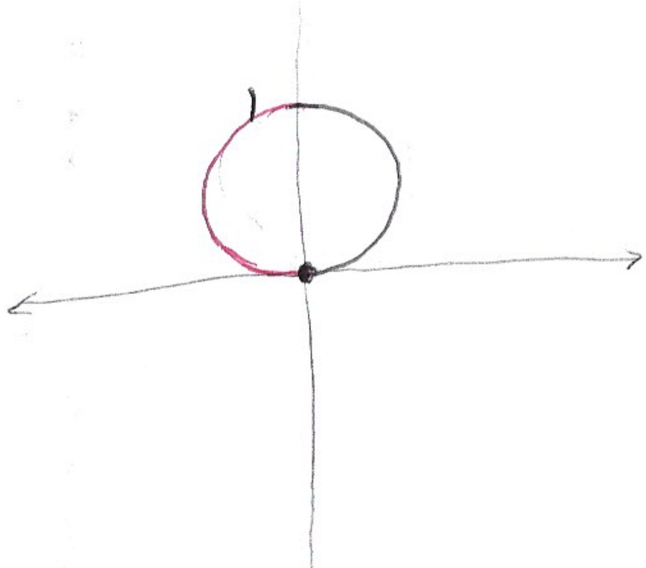
$[0, 2\pi]$

IDENTIFY θ

FOR $r=0$, LOCAL MAX/MIN OF r

↓

θ GIVES RISE TO A T.L.



$\theta = 0, \pi, 2\pi$

T.L. TO POLAR GRAPH