[2] $r\cos 2\theta = \csc\theta$

$r(\cos^2\theta - \sin^2\theta) = \csc\theta$

$r\left(\frac{x^2}{r^2} - \frac{y^2}{r^2}\right) = \frac{r}{y}$

$\frac{x^2-y^2}{r^2} = \frac{1}{y}$

$y(x^2-y^2) = r^2$

$y(x^2-y^2) = x^2+y^2$

[3] $r = \sqrt{(-35)^2 + (-21)^2}$

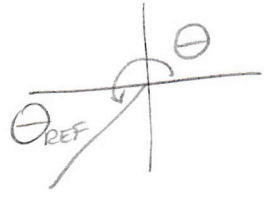
$= 7\sqrt{(-5)^2 + (-3)^2}$

$= 7\sqrt{25+9}$

$= 7\sqrt{34}$

$\tan\theta = \frac{-21}{-35} = \frac{3}{5}$ POINT, θ IN Q_3

$\theta_{REF} = \tan^{-1}\frac{3}{5}$



$\theta = \pi + \tan^{-1}\frac{3}{5}$

$\left(7\sqrt{34}, \pi + \tan^{-1}\frac{3}{5}\right)$

[4] $\vec{u} = \overrightarrow{QR} = \langle -1--1, 2-1, -3--2 \rangle = \langle 0, 1, -1 \rangle$

$\vec{v} = \langle -1-3, 1--5, -2--3 \rangle = \langle -4, 6, 1 \rangle$

[a] $\vec{u} \times \vec{v} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 0 & 1 & -1 \\ -4 & 6 & 1 \end{vmatrix} \begin{matrix} \vec{i} & \vec{j} \\ 0 & 1 \\ -4 & 6 \end{matrix} = \vec{i} + 4\vec{j} - (-6\vec{k} - 4\vec{k}) = \langle 7, 4, 4 \rangle$

SANITY CHECK:
$\langle 7,4,4 \rangle \cdot \langle 0,1,-1 \rangle = 0+4-4 = 0$
$\langle 7,4,4 \rangle \cdot \langle -4,6,1 \rangle = -28+24+4 = 0$

$\|\vec{u} \times \vec{v}\| = \sqrt{7^2+4^2+4^2} = \sqrt{49+16+16} = \sqrt{81} = 9$

[b] $\vec{u} \cdot \vec{v} = 0(-4)+1(6)+(-1)(1) = 5 > 0 \longrightarrow$ ACUTE

[c] $\pm 12\left(\frac{\vec{u} \times \vec{v}}{\|\vec{u} \times \vec{v}\|}\right) = \pm \frac{\overset{4}{\cancel{12}}\langle 7,4,4 \rangle}{\cancel{9}_3} = \left\langle \frac{28}{3}, \frac{16}{3}, \frac{16}{3} \right\rangle$ or $\left\langle -\frac{28}{3}, -\frac{16}{3}, -\frac{16}{3} \right\rangle$

[d] $\text{PROJ}_{\vec{u}}\vec{v} = \frac{\vec{u}\cdot\vec{v}}{\vec{u}\cdot\vec{u}}\vec{u} = \frac{5}{0(0)+1(1)+(-1)(-1)}\langle 0,1,-1\rangle = \frac{5}{2}\langle 0,1,-1\rangle$

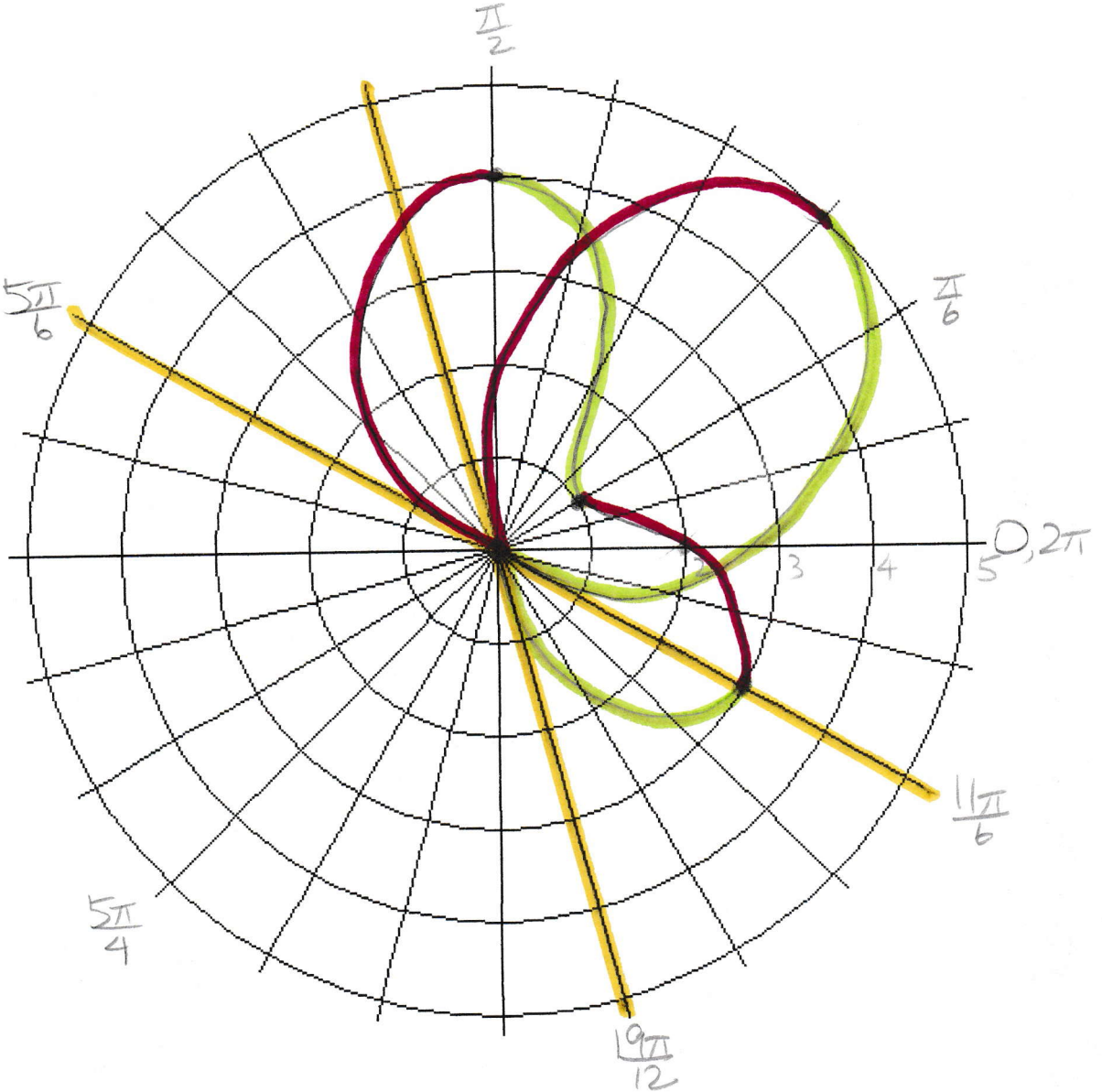
$= \langle 0, \frac{5}{2}, -\frac{5}{2}\rangle$

$\langle -4,6,1\rangle - \langle 0, \frac{5}{2}, -\frac{5}{2}\rangle = \langle -4, \frac{7}{2}, \frac{7}{2}\rangle$

$\langle -4,6,1\rangle = \langle 0, \frac{5}{2}, -\frac{5}{2}\rangle + \langle -4, \frac{7}{2}, \frac{7}{2}\rangle$

[5] $\theta = 0$ TO $\theta = \frac{\pi}{6}$: $|r|$ DECR $\longrightarrow$ SPIRAL IN FROM $(2,0)$ TO $(1, \frac{\pi}{6})$

$\frac{\pi}{6}$	$\frac{\pi}{2}$	INCR	OUT	$(1, \frac{\pi}{6})$	$(4, \frac{\pi}{2})$
$\frac{\pi}{2}$	$\frac{5\pi}{6}$	DECR	IN	$(4, \frac{\pi}{2})$	POLE
$\frac{5\pi}{6}$	$\frac{5\pi}{4}$	INCR	OUT	POLE	$(-5, \frac{5\pi}{4})$
$\frac{5\pi}{4}$	$\frac{19\pi}{12}$	DECR	IN	$(-5, \frac{5\pi}{4})$	POLE
$\frac{19\pi}{12}$	$\frac{11\pi}{6}$	INCR	OUT	POLE	$(3, \frac{11\pi}{6})$
$\frac{11\pi}{6}$	2π	DECR	IN	$(3, \frac{11\pi}{6})$	$(2, 2\pi)$


π/2
5π/6
π/6
0, 2π
11π/6
5π/4
19π/12
3
4
5

[6] $(-r, -\theta)$: $-r = 2\cos(-\theta) - \cos 2(-\theta)$

$-r = 2\cos\theta - \cos 2\theta$

$r = -2\cos\theta + \cos 2\theta$ NO CONCLUSION

$(r, \pi - \theta)$: $r = 2\cos(\pi - \theta) - \cos 2(\pi - \theta)$

$r = 2[\cancel{\cos}^{-1}\pi\cos\theta + \cancel{\sin}^{0}\pi\sin\theta] - \cos(2\pi - 2\theta)$

$r = -2\cos\theta - \cos(-2\theta)$

$r = -2\cos\theta - \cos 2\theta$ NO CONCLUSION

NO CONCLUSION

[7][a] $2\vec{u}\cdot\vec{v} - 8\vec{u}\cdot\vec{u} - 3\vec{v}\cdot\vec{v} + 12\vec{v}\cdot\vec{u}$

$= 2(0) - 8\|\vec{u}\|^2 - 3\|\vec{v}\|^2 + 12(0)$

$= -8(25) - 3(49)$

$= -200 - 147$

$= -347$

[b] $-\vec{u}\times(\vec{v}\times\vec{u})$

$= (-\vec{u}\cdot\vec{u})\vec{v} - (-\vec{u}\cdot\vec{v})\vec{u}$

$= -\|\vec{u}\|^2\vec{v} - 0\vec{u}$

$= -25\vec{v}$

[c] $|-25|\|\vec{v}\| = 25(7) = 175$

[8] $x = (2\cos\theta)\cos\theta = 2\cos^2\theta = 1+\cos 2\theta$
$y = (2\cos\theta)\sin\theta = 2\sin\theta\cos\theta = \sin 2\theta$
} PARAMETRIC IN θ

$$\frac{dy}{dx} = \frac{(\sin 2\theta)'}{(1+\cos 2\theta)'} = \frac{2\cos 2\theta}{-2\sin 2\theta} = -\cot 2\theta$$

$$\frac{d^2y}{dx^2} = \frac{\frac{d}{d\theta}(-\cot 2\theta)}{\frac{dx}{d\theta}} = \frac{2\csc^2 2\theta}{-2\sin 2\theta} = -\csc^3 2\theta$$

[9] [a] $\left(8, \frac{19\pi}{13} - \pi\right) = \left(8, \frac{6\pi}{13}\right)$

[b] $\left(-8, \frac{19\pi}{13} - 4\pi\right) = \left(-8, -\frac{33\pi}{13}\right)$

[c] $\left(8, \frac{6\pi}{13} - 4\pi\right) = \left(8, -\frac{46\pi}{13}\right)$

[d] $\left(8, \frac{6\pi}{13} + 2\pi\right) = \left(8, \frac{32\pi}{13}\right)$