X	Y	Θ_1	Θ_2	dX/dt	dY/dt	$d\Theta_1/dt$	$d\Theta_2/dt$	T (sec)
5	5	0	Pi/2	0	t	0.2t	-0.20t	0-1
5	5.5	0.1	1.465	0	t	0.2t	-0.22t	1-2
5	7.0	0.41	1.07	0	t			2-3

$a_1=5$ $a_2=5$

$X=5$, $Y=5+0.5t^2$

$$\begin{bmatrix}\dot{p}_x\\ \dot{p}_y\end{bmatrix} = \begin{bmatrix}-a_1\sin\theta_1 - a_2\sin(\theta_1+\theta_2) & -a_2\sin(\theta_1+\theta_2)\\ a_1\cos\theta_1 + a_2\cos(\theta_1+\theta_2) & a_2\cos(\theta_1+\theta_2)\end{bmatrix}\begin{bmatrix}\dot{\theta}_1\\ \dot{\theta}_2\end{bmatrix}$$

JACOBIAN MATRIX

$$\cos\theta_2 = \frac{p_x^2 + p_y^2 - a_1^2 - a_2^2}{2a_1a_2} \qquad (1)$$

and

$$\sin\theta_2 = \pm\sqrt{1 - cos^2\theta_2} \qquad (2)$$

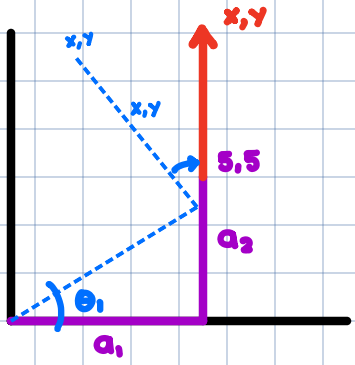
Now we can write the solution for θ_2:

$$\theta_2 = atan2(\sin\theta_2, \cos\theta_2) \qquad (3)$$

The solution for θ_1 is

$$\theta_1 = atan2(p_y, p_x) - atan2(a_2\sin\theta_2, a_1 + a_2\cos\theta_2) \qquad (4)$$

$$\begin{bmatrix}a & b\\ c & d\end{bmatrix}^{-1} = \frac{1}{ad-bc}\begin{bmatrix}d & -b\\ -c & a\end{bmatrix}$$



$a_1 = 5 \quad a_2 = 5$

$x = 5 \quad y = 5 + t^2(0.8)$

$$J\begin{pmatrix}\dot{\theta}_1\\ \dot{\theta}_2\end{pmatrix} = \begin{matrix} v_x = \partial x/\partial t \\ v_y = \partial y/\partial t \end{matrix}$$

$$J = \begin{bmatrix} -5\sin(0) - 5\sin(0+\pi/2) & -\sin(0+\pi/2) \\ 5(1) + 5(0) & 5(0) \end{bmatrix}$$

$$= \begin{bmatrix} -5 & -5 \\ 5 & 0 \end{bmatrix}$$

$$J^{-1} = \frac{1}{\underbrace{(-5)(0)-(-5)(5)}_{25}} \begin{bmatrix} 0 & 5 \\ -5 & -5 \end{bmatrix}$$

$$\begin{pmatrix}\dot{\theta}_1\\ \dot{\theta}_2\end{pmatrix} = J^{-1}\begin{pmatrix} v_x \\ v_y \end{pmatrix} = \frac{1}{25}\begin{bmatrix} 0 & 5 \\ -5 & -5 \end{bmatrix}\begin{bmatrix} 0 \\ t \end{bmatrix} = \begin{pmatrix} t/5 \\ -t/5 \end{pmatrix}$$

$$\cos\theta_2 = \frac{P_x^2 + P_y^2 - a_1^2 - a_2^2}{2a_1a_2}$$

$\theta_2 = 0$

$\theta_1 = \tan^{-1}(a_2\sin\theta_1 / a_1 + a_2\cos\theta_2)$

$= \pi/2$

$$\cos\theta_2 = \frac{5^2 + (5.5)^2 - 5^2 - 5^2}{2(5)(5)}$$

$= 0.105$

$\theta_2 = 1.465$

$\theta_1 = 0.1$

$$J = \begin{bmatrix} -5\sin(0.1) - 5\sin(1.565) & -5\sin(1.565) \\ 5\cos(0.1) + 5\cos(1.565) & 5\cos(1.565) \end{bmatrix}$$

$$= \begin{bmatrix} -5.5 & -5 \\ 5 & 0.029 \end{bmatrix}$$

$$J^{-1} = \frac{1}{24.84}\begin{bmatrix} 0.029 & 5 \\ -5 & -5.5 \end{bmatrix}$$

$$\begin{pmatrix}\dot{\theta}_1\\ \dot{\theta}_2\end{pmatrix} = \frac{1}{24.84}\begin{bmatrix} 0.029 & 5 \\ -5 & -5.5 \end{bmatrix}\begin{bmatrix} 0 \\ t \end{bmatrix} = \begin{pmatrix} 0.201t \\ -0.221t \end{pmatrix}$$

$$\cos\theta_2 = \frac{5^2 + 7^2 - 5^2 - 5^2}{2(5)(5)}$$

$= 0.48 \qquad \cos\theta_2 < 1$

$\theta_2 = 1.07$

$\theta_1 = 0.41$

$A - 25 < 50$

$A < 75$

$$J = \begin{bmatrix} -6.973 & -4.98 \\ 5.039 & 0.454 \end{bmatrix}$$

$$J^{-1} = \frac{1}{21.93}\begin{bmatrix} 0.454 & 4.98 \\ -5.039 & -6.973 \end{bmatrix}$$

$$\begin{pmatrix}\dot{\theta}_1\\ \dot{\theta}_2\end{pmatrix} = \begin{pmatrix} 0.23t \\ -0.32t \end{pmatrix}$$