

Assignment 3

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Download all the python codes from

<https://github.com/cmaspi/EE3900/tree/main/Assignment-3/code>

latex-tikz codes from

<https://github.com/cmaspi/EE3900/blob/main/Assignment-3/main.tex>

1 PROBLEM

(Construction Q 2.14) Draw a circle of radius 3 units. Take two points **P** and **Q** on one of its extended diameter each at a distance of 7 units from its centre. Draw tangents to the circle from these two points **P** and **Q**

2 SOLUTION

Let the centre of the circle be at origin. Let **x** be the locus of the point of tangency from the point **P**

$$\|\mathbf{x}\| = 3 \quad (2.0.1)$$

$$\mathbf{x} = \begin{pmatrix} 3 \cos \theta & 3 \sin \theta \end{pmatrix}^T \quad (2.0.2)$$

Similarly,

$$\|\mathbf{P}\| = 7 \quad (2.0.3)$$

$$\mathbf{P} = \begin{pmatrix} 7 \cos \phi & 7 \sin \phi \end{pmatrix}^T \quad (2.0.4)$$

Since the tangent is perpendicular to the normal we can write

$$\mathbf{x}^T (\mathbf{x} - \mathbf{P}) = 0 \quad (2.0.5)$$

$$\begin{pmatrix} 3 \cos \theta \\ 3 \sin \theta \end{pmatrix}^T \begin{pmatrix} 3 \cos \theta - 7 \cos \phi \\ 3 \sin \theta - 7 \sin \phi \end{pmatrix} = 0 \quad (2.0.6)$$

$$9 \cos^2 \theta + 9 \sin^2 \theta - 21(\cos \theta \cos \phi + \sin \theta \sin \phi) = 0$$

$$\cos(\theta - \phi) = \frac{3}{7} \quad (2.0.7)$$

A plot for the planes is given below