

# Matrix Theory(EE5609) Assignment 5

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**Abstract—**This Assignment finds the radius and centre of a given circle.

Download latex-tikz codes from

<https://github.com/anshum0302/EE5609/blob/master/assignment5/assign5.tex>

## 1 PROBLEM STATEMENT

Find the radius and the coordinates of the centre of the circle

$$2\mathbf{x}^T \mathbf{x} + \begin{pmatrix} 16 & -4 \end{pmatrix} \mathbf{x} + 88 = 0 \quad (1.0.1)$$

## 2 SOLUTION

The general equation of a circle is given by

$$\mathbf{x}^T \mathbf{x} - 2\mathbf{c}^T \mathbf{x} + f = 0 \quad (2.0.1)$$

where  $\mathbf{c}$  is the centre of the circle and  $r = \sqrt{\|\mathbf{c}\|^2 - f}$  is the radius of the circle

Equation of circle given in (1.0.1) can be rewritten as

$$\mathbf{x}^T \mathbf{x} - 2 \begin{pmatrix} -4 \\ 1 \end{pmatrix}^T \mathbf{x} + 44 = 0 \quad (2.0.2)$$

Comparing (2.0.1) and (2.0.2) we get

$$\mathbf{c} = \begin{pmatrix} -4 \\ 1 \end{pmatrix} \quad (2.0.3)$$

$$f = 44 \quad (2.0.4)$$

Then centre of the circle (1.0.1) is  $\mathbf{c} = \begin{pmatrix} -4 \\ 1 \end{pmatrix}$  and radius

$$r = \sqrt{\|\mathbf{c}\|^2 - f} \quad (2.0.5)$$

$$= \sqrt{(-4)^2 + 1^2 - 44} \quad (2.0.6)$$

$$= \sqrt{-27} \quad (2.0.7)$$

But radius of the circle cannot be imaginary number so the given equation (1.0.1) doesn't represent a circle.