

# Assignment 3

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**Abstract—** This document calculate the circle equation such that circle is passing through given two points and the centre of the circle is placed on given straight line.

Download all python codes from  
<https://github.com/cs19resch11004/hari>  
 Download all Latex-tikz codes from  
<https://github.com/cs19resch11004/hari>

## I. PROBLEM

Find the equation to the circle which passes through the points  $\begin{pmatrix} 1 \\ -2 \end{pmatrix}$  and  $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$  and which has its centre on the straight line  $3x + 4y = 7$ .

## II. SOLUTION

Given points  $P = \begin{pmatrix} 1 \\ -2 \end{pmatrix}$  and  $Q = \begin{pmatrix} 4 \\ -3 \end{pmatrix}$  and the straight line, which has centre of the circle is,

$$3x + 4y = 7 \quad (1)$$

Let  $r$  be the radius of the circle. Let  $C = (h, k)$  is the centre of the circle, then the circle equation is,

$$(x - h)^2 + (y - k)^2 = r^2 \quad (2)$$

Substituting the point  $P$  in equation 2,

$$(1 - h)^2 + (-2 - k)^2 = r^2 \quad (3)$$

$$h^2 + k^2 - 2h + 4k + 5 = r^2 \quad (4)$$

Substituting the point  $Q$  in equation 2,

$$(4 - h)^2 + (-3 - k)^2 = r^2 \quad (5)$$

$$h^2 + k^2 - 8h + 6k + 25 = r^2 \quad (6)$$

Equation 4 - equation 6 gives,

$$3h - k = 10 \quad (7)$$

Substituting Centre  $C$  in equation 1,

$$3h + 4k = 7 \quad (8)$$

By solving equation 7 and equation 8, we will get the centre of the circle. as

$$C = \begin{pmatrix} \frac{47}{15} \\ \frac{-3}{5} \end{pmatrix} \quad (9)$$

Radius  $r$  of the circle is the distance between points  $C$  and  $P$ .

$$r = \sqrt{\left(\frac{47}{15} - 1\right)^2 + \left(\frac{-3}{5} + 2\right)^2} \quad (10)$$

$$r = \frac{\sqrt{1465}}{15} \quad (11)$$

Required Resultant circle equation is,

$$X^T X - 2 \begin{pmatrix} \frac{47}{15} \\ \frac{-3}{5} \end{pmatrix} X + \frac{825}{225} = 0$$

