

# Question - 9-9.4-4

EE24BTECH11038 - Malakala Bala Subrahmanya Aravind

## Question:

Find the area of the region bounded by  $y^2 = 2x$  and  $x^2 + y^2 = 4x$ .

**Solution:** The parameters of the conics are

Variable	Description
$V_1, u_1, f_1$	Parameters of Parabola
$V_2, u_2, f_2$	Parameters of circle
$P_1, P_2$	Points of intersection
$A$	Area between the conics

TABLE 0: Variables Used

$$V_1 = \begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix}, u_1 = \begin{pmatrix} -\frac{1}{2} \\ 0 \end{pmatrix}, f_1 = 0 \quad (0.1)$$

$$V_2 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, u_2 = \begin{pmatrix} 2 \\ 0 \end{pmatrix}, f_2 = -4 \quad (0.2)$$

The intersection of two conics with parameters  $V_i, u_i, f_i, i = 1, 2$  is defined as

$$x^T (V_1 + \mu V_2) x + 2(u_1 + \mu u_2)^T x + (f_1 + \mu f_2) = 0 \quad (0.3)$$

Solving this the points of intersection are

$$\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 2 \\ -2 \end{pmatrix}, \begin{pmatrix} 2 \\ 2 \end{pmatrix} \quad (0.4)$$

Area between the curves is,

$$2 \int_0^2 \left( 2 + \sqrt{4 - y^2} - \frac{y^2}{2} \right) dy \quad (0.5)$$

By solving the integration, we get area is equal to 11.62 sq.units

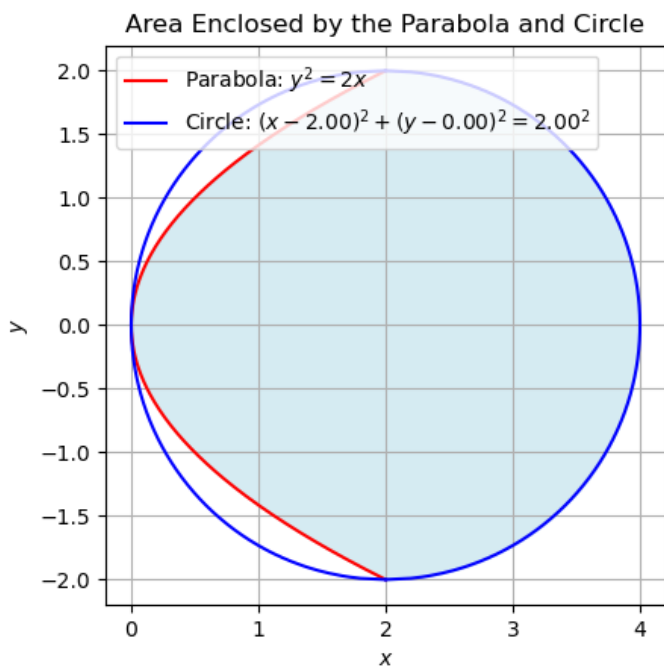


Fig. 0.1