9-9.2-20

EE24BTECH11066 - YERRA AKHILESH

Question:
Find the area of the region bounded by the curves $y = x2 + 2$, $y = x$, $x = 0$ and $x = 3$.
solution: The parameters of the conic are

Equations
$y = x^2 + 2$
$y = x$
$x = 0$
$x = 3$

TABLE 0: Given Equations

Conic	**Parameters**
V	$\begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix}$
u	$\frac{-1}{2}\begin{pmatrix} 1 \\ 0 \end{pmatrix}$
f	0

$$L : x_i = h + \kappa_i m \tag{0.1}$$

Where,

$$\kappa_i = \frac{1}{m^\top V m}(-m^\top (Vh + u) \pm \sqrt{[m^\top (Vh + u)]^2 - g(h)(m^\top V m)}) \tag{0.2}$$

For the curves $y = x^2 + 2$ and $y = x$, we find the points of intersection by solving

$$x^2 + 2 = x \tag{0.3}$$

Rearranging the equation:

$$x^2 - x + 2 = 0 \tag{0.4}$$

Since this quadratic has no real roots, we calculate the area between the curves over the interval $x = 0$ to $x = 3$.

The area between the curves is given by:

$$A = \int_0^3 (x - (x^2 + 2))\, dx \tag{0.5}$$

Simplifying the integrand:

$$A = \int_0^3 (x - x^2 - 2)\, dx \tag{0.6}$$

Solving the integral:

$$A = \left[\frac{x^2}{2} - \frac{x^3}{3} - 2x \right]_0^3 \tag{0.7}$$

Evaluating at the bounds:

$$A = \left[\frac{9}{2} - \frac{27}{3} - 6 \right] - [0] \tag{0.8}$$

Simplifying:

$$A = \frac{9}{2} - 9 - 6 = \frac{9}{2} - 15 = \frac{-21}{2} \tag{0.9}$$

Taking the absolute value, the area of the region is:

$$A = \frac{21}{2} \tag{0.10}$$