

9-9.2-22

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Question:

Find the area bounded by the curve $x^2 = 4y$ and the line $x + 2 = 4y$.

Solution:

Equation	Description
$x^2 = 4y$	Parabola(conic)
$x + 2 = 4y$	Line

TABLE 0: Information

The given curve can be expressed as a conic of parameters

$$v = \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}, u = \begin{pmatrix} 0 \\ -2 \end{pmatrix}, f = 0 \quad (0.1)$$

The given line parameters are

$$h = \begin{pmatrix} 0 \\ \frac{1}{2} \end{pmatrix}, m = \begin{pmatrix} 1 \\ \frac{1}{4} \end{pmatrix} \quad (0.2)$$

From (??), the points of intersection of line and conic are

$$\mathbf{x}_1 = \begin{pmatrix} 2 \\ 1 \end{pmatrix}, \mathbf{x}_2 = \begin{pmatrix} -1 \\ \frac{1}{4} \end{pmatrix} \quad (0.3)$$

As you can see in the figure, the area bounded by the curve $x^2 = 4y$ and the line $x - 2 = 4y$ is given by

$$\int_{-1}^2 \left(\frac{x+2}{4} - \frac{x^2}{4} \right) dx = \frac{9}{8} \quad (0.4)$$

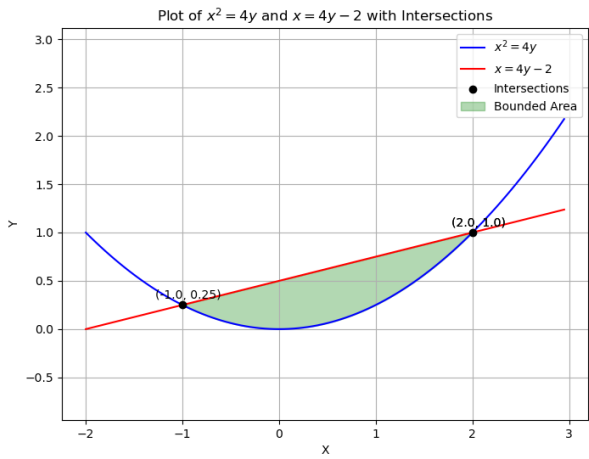


Fig. 0.1: Line and Parabola