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Curve  $C$  has equation  $y = x^2$

$C$  is translated by vector  $\begin{bmatrix} 3 \\ 0 \end{bmatrix}$  to give curve  $C_1$

Line  $L$  has equation  $y = x$

$L$  is stretched by scale factor 2 parallel to the  $x$ -axis to give line  $L_1$

Find the exact distance between the two intersection points of  $C_1$  and  $L_1$

**[6 marks]**