

**4** A curve has equation  $y = 2 \ln(k - 3x) + x^2 - 3x$ , where  $k$  is a positive constant.

**(a)** Given that the curve has a point of inflection where  $x = 1$ , show that  $k = 6$ . **[5]**

It is also given that the curve intersects the  $x$ -axis at exactly one point.

**(b)** Show by calculation that the  $x$ -coordinate of this point lies between 0.5 and 1.5. **[2]**

**(c)** Use the Newton-Raphson method, with initial value  $x_0 = 1$ , to find the  $x$ -coordinate of the point where the curve intersects the  $x$ -axis, giving your answer correct to 5 decimal places. Show the result of each iteration to 6 decimal places. **[3]**

**(d)** By choosing suitable bounds, verify that your answer to part **(c)** is correct to 5 decimal places. **[1]**