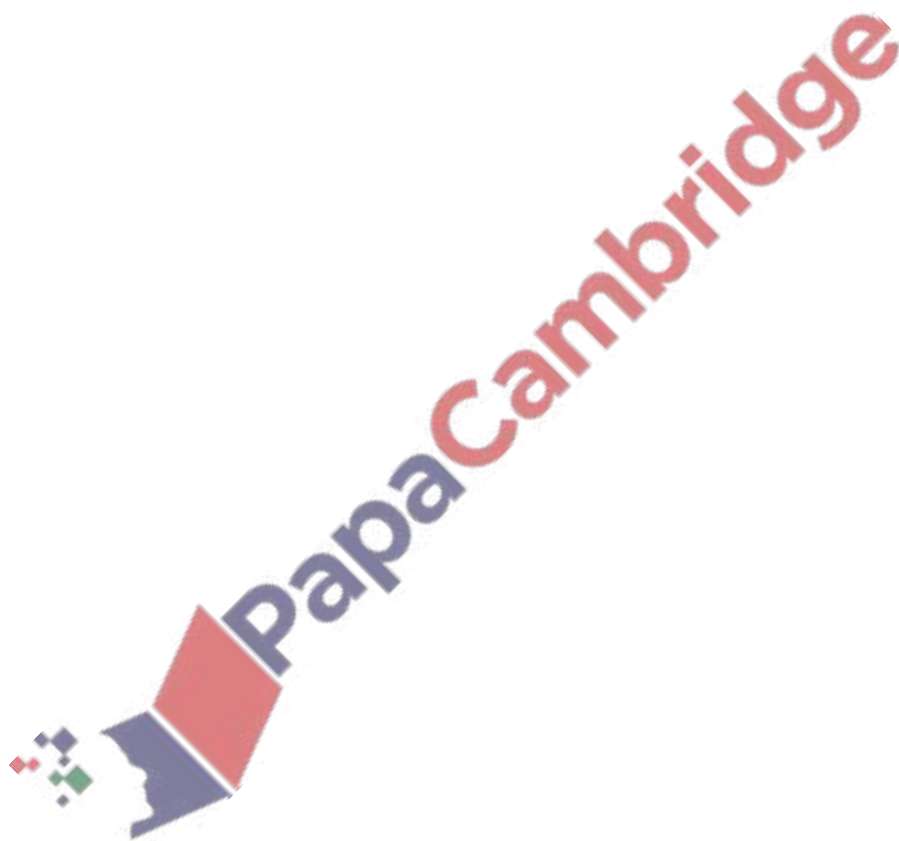1. Nov/2020/Paper_9709/31/No.4

   Solve the equation

$$\log_{10}(2x + 1) = 2 \log_{10}(x + 1) - 1.$$

   Give your answers correct to 3 decimal places. [6]
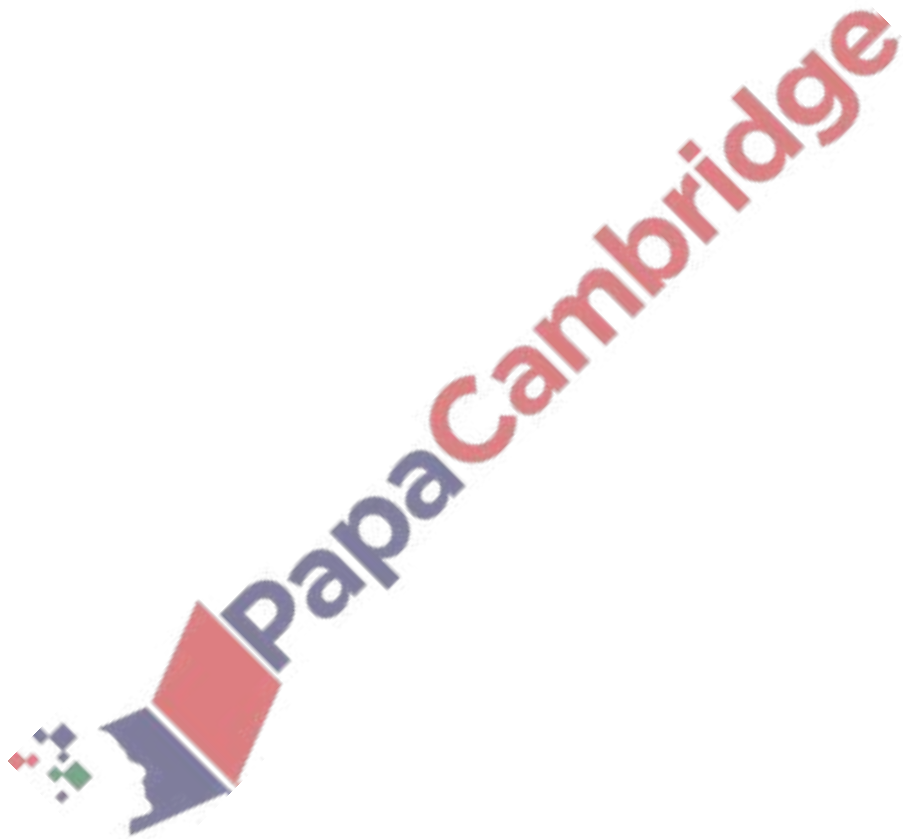
2.

Solve the equation

$$\ln(1 + e^{-3x}) = 2.$$
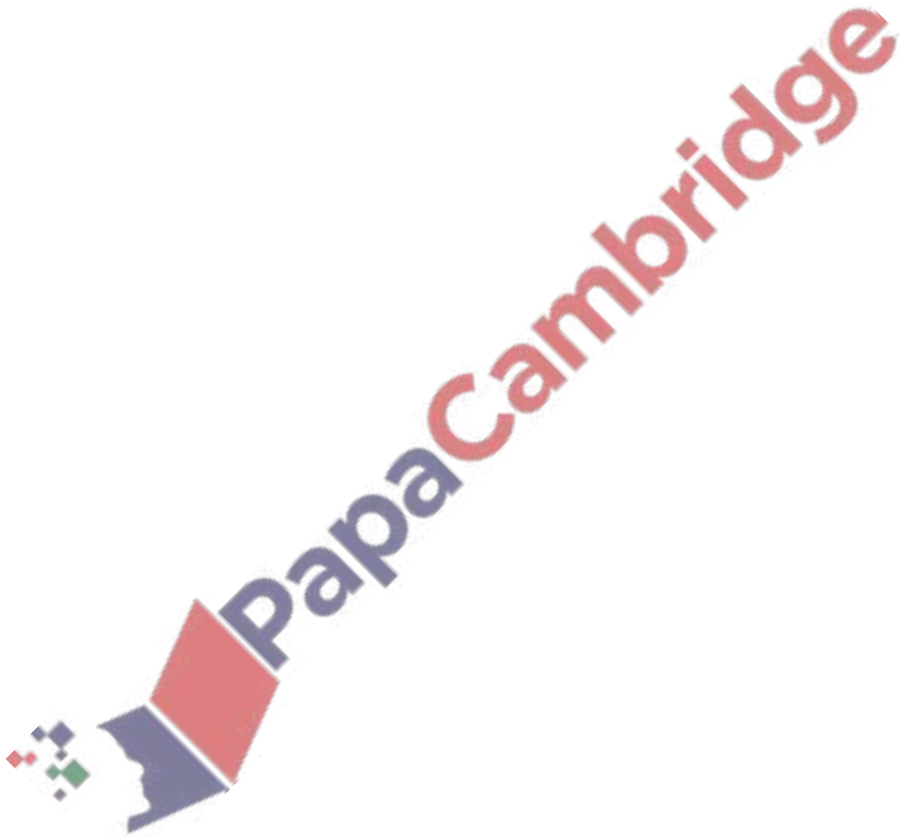
Give the answer correct to 3 decimal places. [3]

3.

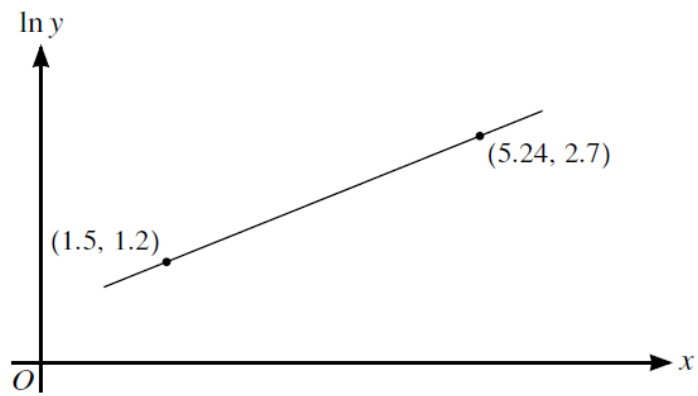The variables x and y satisfy the relation $2^y = 3^{1-2x}$.

(a) By taking logarithms, show that the graph of y against x is a straight line. State the exact value of the gradient of this line. [3]

(b) Find the exact x-coordinate of the point of intersection of this line with the line $y = 3x$. Give your answer in the form $\dfrac{\ln a}{\ln b}$, where a and b are integers. [2]

3

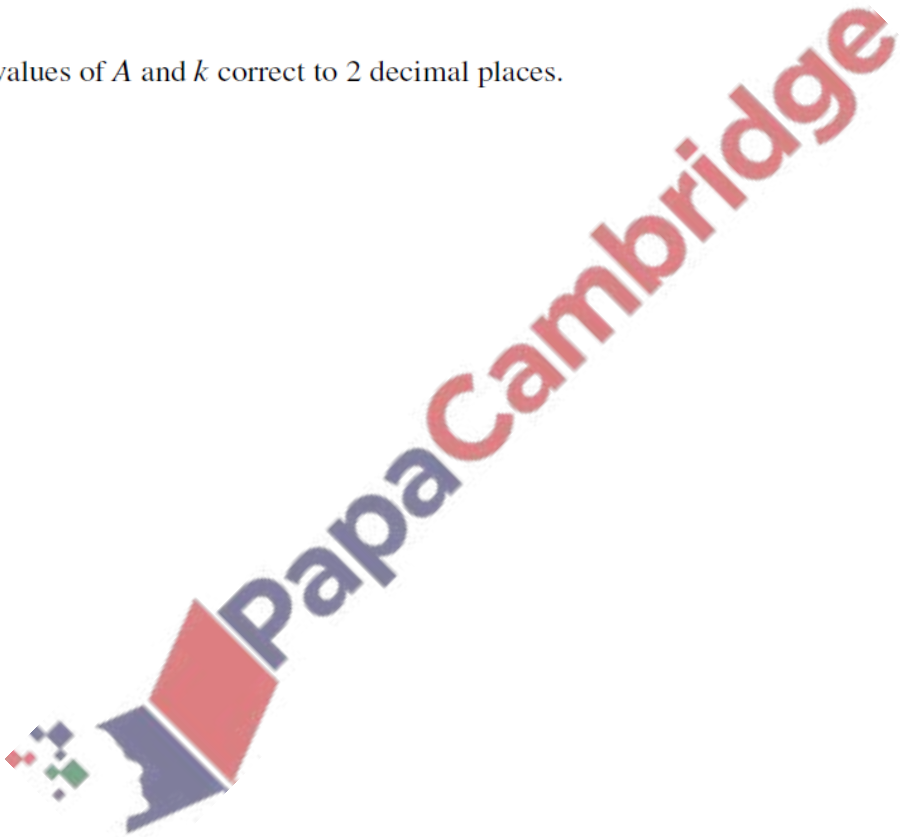Find the set of values of x for which $2(3^{1-2x}) < 5^x$. Give your answer in a simplified exact form. [4]
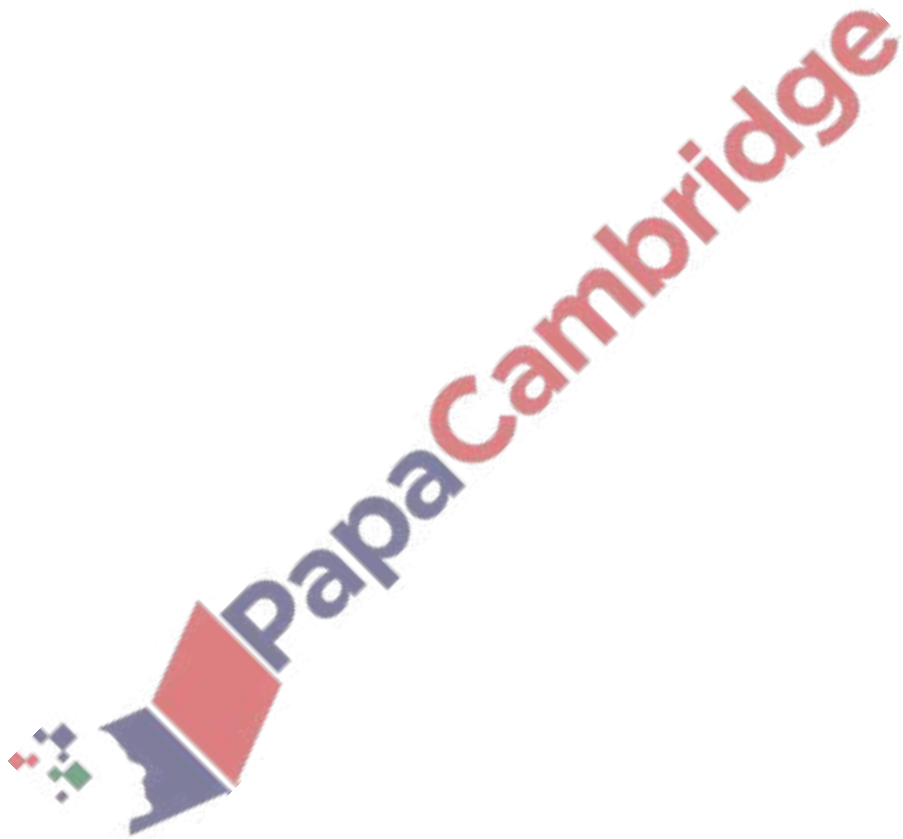
The variables x and y satisfy the equation $y^2 = Ae^{kx}$, where A and k are constants. The graph of $\ln y$ against x is a straight line passing through the points $(1.5, 1.2)$ and $(5.24, 2.7)$ as shown in the diagram.

Find the values of A and k correct to 2 decimal places. [5]
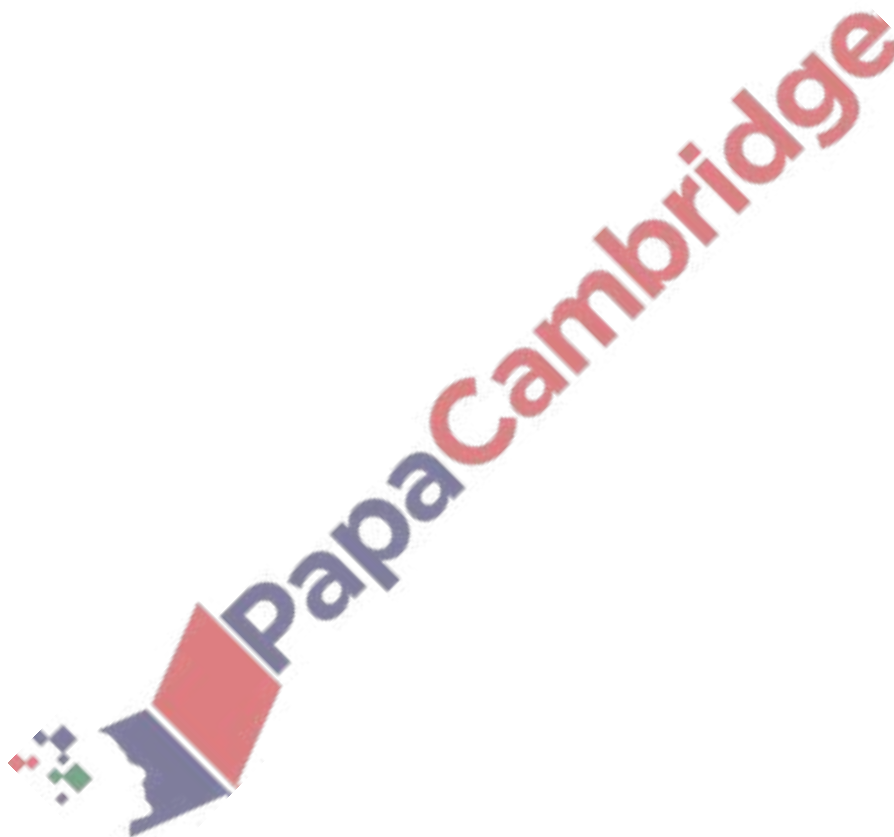
(a) Show that the equation

$$\ln(1 + e^{-x}) + 2x = 0$$

can be expressed as a quadratic equation in e^x. [2]

(b) Hence solve the equation $\ln(1 + e^{-x}) + 2x = 0$, giving your answer correct to 3 decimal places.

[4]

7.

Solve the equation $\ln 3 + \ln(2x + 5) = 2\ln(x + 2)$. Give your answer in a simplified exact form. [4]