

### Question 4

Solve for  $x$  in the equation:

$$2^{3x+1} = 5^{x-2}$$

Give your answer in exact form using logarithms, and approximate the result to three decimal places.

**Question 4 - Solution**

Taking natural logarithms (both sides are positive) gives

$$(3x + 1) \ln 2 = (x - 2) \ln 5.$$

Collect the terms in  $x$  and divide by their nonzero coefficient:

$$x = \frac{-\ln 2 - 2 \ln 5}{3 \ln 2 - \ln 5} \approx -8.323.$$

The logarithm is one-to-one, so solving this equivalent linear equation introduces no extraneous solutions. The exact expression verifies the original equation.