Logarithms

Using the laws of logarithms, solve the equation

$$2\log_{19}(4x-5)-\log_{19}x = 2$$

(5 marks)

Using the power law of logarithms:

$$2\log_{19}(4x-5) = \log_{19}(4x-5)^2$$

1 mark

Using the division law of logarithms:

$$\log_{19}(4x-5)^2 - \log_{19}x = \log_{19}\left(\frac{(4x-5)^2}{x}\right)$$

1 mark

So,

$$\log_{19}\left(\frac{(4x-5)^2}{x}\right) = 2 \Rightarrow \frac{(4x-5)^2}{x} = 19^2 \ (= 361)$$

1 mark

$$\frac{(4x-5)^2}{x} = 361 \Rightarrow 16x^2 - 40x + 25 = 361x$$

$$16x^2 - 401x + 25 = 0$$

$$(16x-1)(x-25) = 0$$

1 mark

$x = \frac{1}{16}$ would lead to $\log_{19}\left(-\frac{19}{4}\right)$ which does not exist, so ignore this value.

$$x = 25$$

1 mark