Logs and Exponential (Powers) Examples

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Q1. Simplify the following:-

$a^4 \cdot a^7$ $\qquad$ $\log_{10}(2) + \log_{10}(32)$

$\dfrac{a^7}{a^4}$ $\qquad$ $\log_{10}(32) - \log_{10}(2)$

$\left(a^4\right)^7 \cdot a^5$ $\qquad$ $\log_{10}(2) + \log_{10}(40) - \log_{10}(8)$

Solution

$a^4 \cdot a^7 = a^{(4+7)} = a^{11}$ $\qquad$ $\log_{10}(2) + \log_{10}(32) = \log_{10}(64)$

$\dfrac{a^7}{a^4} = a^{7-3} = a^4$ $\qquad$ $\log_{10}(32) - \log_{10}(2) = \log_{10}\left(\dfrac{32}{2}\right) = \log_{10}(16)$

$\left(a^4\right)^7 \cdot a^5 = a^{7\cdot 4} \cdot a^5 = a^{28+5} = a^{33}$ $\qquad$ $\log_{10}(2) + \log_{10}(40) - \log_{10}(8) = \log_{10}\left(\left(\dfrac{2\cdot 40}{8}\right)\right) = \log_{10}(10) = 1$

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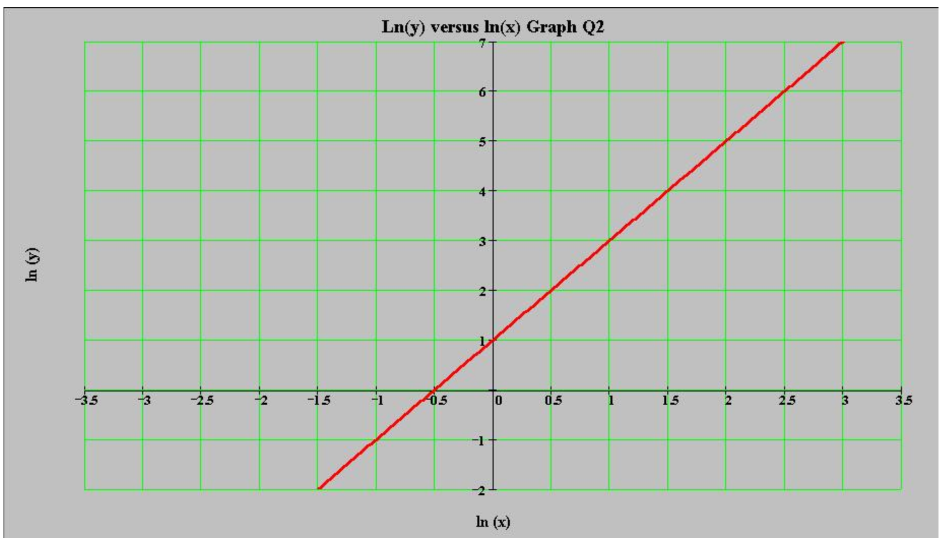
Q2. We suspect the 2 parameters x,y are related by the following relationship.

$$y = a \cdot x^b$$



Using the graph provided determine if this relationship seems reasonable (explain why!) and find values for a and b and write out the full equation.

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Solution

Since the graph is a straight line of the form $\log_e(y) = b*\log_e(x) + \log_e(a)$ then it is reasonable to assume the relationship above.

From the graph the gradient is b=2 and the constant is $\log_e(a) = 1$.

Hence the equation is

We have the form

$$\log_e(y) = \log_e(a) + b \cdot \log_e(x)$$

$b = 2$ and $\log_e(a) = 1$ therefore $a = e$

We have

$$\log_e(y) = \log_e(e) + 2 \cdot \log_e(x)$$

taking antilogs of both sides and using log/power rules we have

$$y = e \cdot x^2$$

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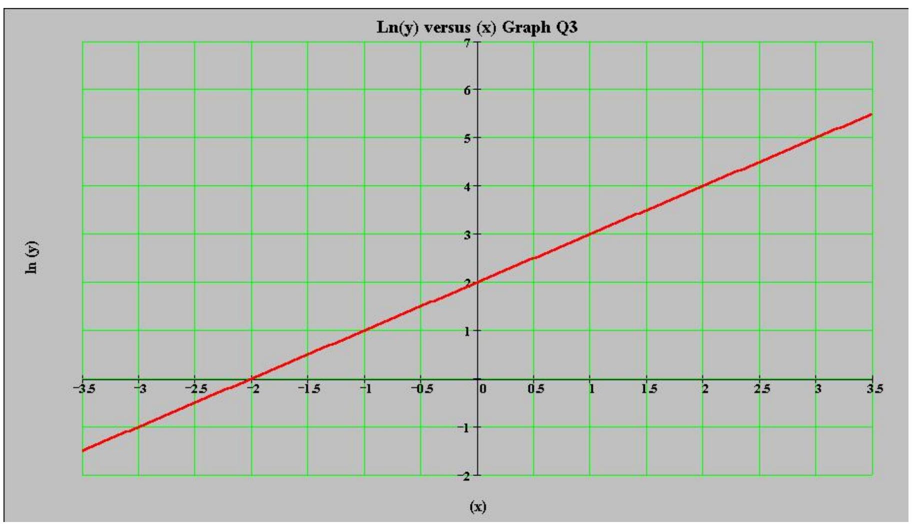
Q3. We suspect the 2 parameters x,y are related by the following relationship.

$$y = a \cdot b^x$$

Using the graph provided determine if this relationship seems reasonable (explain why!) and find values for a and b and write out the full equation.



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Solution

Since the graph is a straight line of the form $\log_e(y) = \log_e(b)*(x) + \log_e(a)$ then it is reasonable to assume the relationship above.

From the graph the gradient is $\log_e(b)=1$ and the constant is $\log_e(a) = 2$.

Hence the equation is

We have the form

$$\log_e(y) = \log_e(a) + \log_e(b)\cdot(x)$$

$\log_e(b) = 1$ and $\log_e(a) = 2$ therefore $b = e$ $a = e^2$

We have

$$\log_e(y) = \log_e\left(e^2\right) + \log_e(e)\cdot x$$

taking antilogs of both sides and using log/power rules we have

$$y = e^2\cdot e^x = e^{2+x}$$