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Exponential Equation 2

Pre-Uni Maths for Sciences E3.2

A Level



Solve the following for x : $3^x = \frac{1}{9^{x-\frac{9}{4}}}$.

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Physics. *You work it out.*

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Log Laws 2ii

A Level



Part A Express $\log_a 2 + \log_a 3$

Express $\log_a 2 + \log_a 3$ as a single logarithm.

Note that $\log_a b$ can be typed as `log(b,a)`.

The following symbols may be useful: a , $\log()$

Part B Express $2 \log_{10} x - 3 \log_{10} y$

Express $2 \log_{10} x - 3 \log_{10} y$ as a single logarithm.

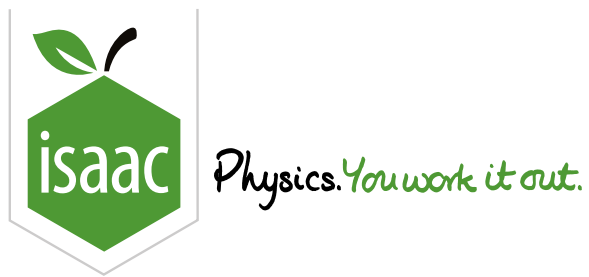
The following symbols may be useful: $\log()$, x , y

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Logarithmic Equations 3

Pre-Uni Maths for Sciences E3.6



Solve the following logarithmic equations.

Part A $\log_3 \sqrt{b} = 2.$

Find b if $\log_3 \sqrt{b} = 2.$

Part B $\log_2(x^2) - \log_2 3 = \log_2 48.$

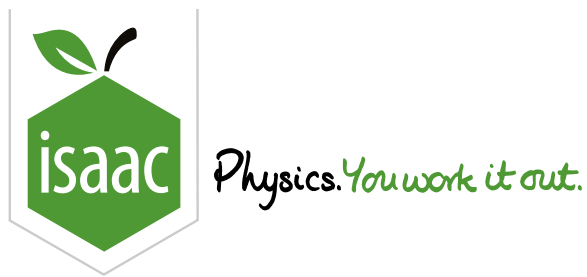
Solve the following for x : $\log_2(x^2) - \log_2 3 = \log_2 48.$

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Apparent Magnitudes

A Level



Pre-Uni Maths for Sciences E3.9

The apparent magnitude m of an astronomical object describes on a logarithmic scale how bright an object appears to an observer. It is related to its actual brightness or energy flux F (i.e. the energy arriving at the Earth per unit area per second) in the following way. Consider two objects with magnitudes m_1 and m_2 and brightnesses F_1 and F_2 ; the relationship between these quantities is

$$\frac{F_1}{F_2} = 100^{\frac{m_2 - m_1}{5}}.$$

Part A Sun and Moon

The magnitude of the Sun is -26.8 and it is a factor of 4.80×10^5 brighter than the full Moon. Find the magnitude of the full Moon.

Part B Supernova 1987A

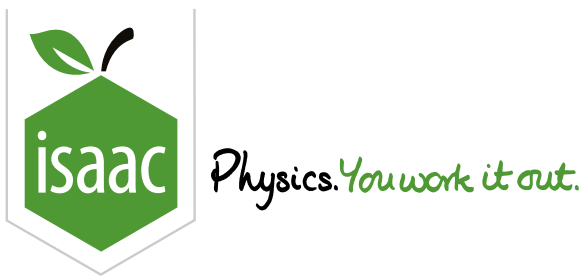
Supernova 1987A was discovered in the nearby dwarf galaxy the Large Magellanic Cloud and, with a magnitude of $+2.9$, it was visible with the naked eye. It was subsequently discovered that its progenitor was a blue supergiant with a magnitude of $+12.2$. Find the ratio of the brightness of Supernova 1987A to that of its progenitor (give your answer to 2 sig figs).

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Log Laws 1i

A Level



It is given that $\ln x = p + 2$ and $\ln y = 3p$

Part A Log laws

Express $\ln(xy)$ in terms of p .

The following symbols may be useful: p

Part B Simplify 1

Express $\ln(x^3)$ in terms of p .

The following symbols may be useful: p

Part C Simplify 2

Express $\ln\left(\frac{y}{e}\right)$ in terms of p .

The following symbols may be useful: p

Part D Solve equation

Express y in terms of x and e , simplifying your answer.

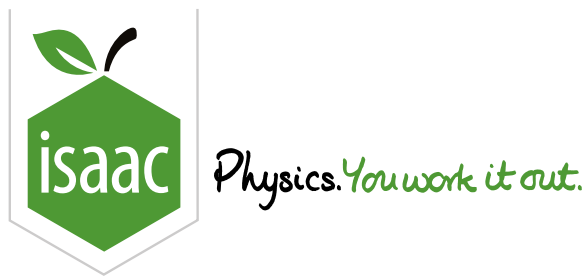
The following symbols may be useful: e , x , y

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Energy Decay

A Level



Pre-Uni Maths for Sciences E3.10

A steel bar is tapped on one end and the resulting pulse of energy travels backwards and forwards along the bar. A very small fraction α of its energy is lost on each reflection so that after n reflections the fraction of its initial energy left is $(1 - \alpha)^n$. It takes a time τ to travel from one end of the bar to the other.

Part A Time for energy to halve

Find an expression for the time it takes for the energy in the pulse to halve.

Use either \log_{10} , or the natural log, \ln . When you are entering your answer, note that $\log_{10} a$ can be written using `log(a,10)`.

The following symbols may be useful: `alpha`, `ln()`, `log()`, `tau`

Part B Time for energy to fall by factor of 100

Find an expression for the time it takes for the energy in the pulse to fall by a factor of 100.

Use either \log_{10} , or the natural log, \ln . When you are entering your answer, note that $\log_{10} a$ can be written using `log(a,10)`.

The following symbols may be useful: `alpha`, `ln()`, `log()`, `tau`

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Solving Equations & Logs 2ii

A Level
P P P

Part A Solve equation

Use logarithms to solve the equation $5^{3w-1} = 4^{250}$, giving the value of w correct to 3 significant figures.

Part B Find expression

Given that $\log_x(5y + 1) - \log_x 3 = 4$, express y in terms of x .

The following symbols may be useful: x , y

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Solving Equations & Logs 3i

A Level
P P P

Part A Solve equation

Solve the equation $2^{4x-1} = 3^{5-2x}$, giving your answer in the form $\frac{\log_{10} a}{\log_{10} b}$.

When you are entering your answer, note that $\log_a b$ can be written using .

The following symbols may be useful: $\log()$, \times

Part B Find integer

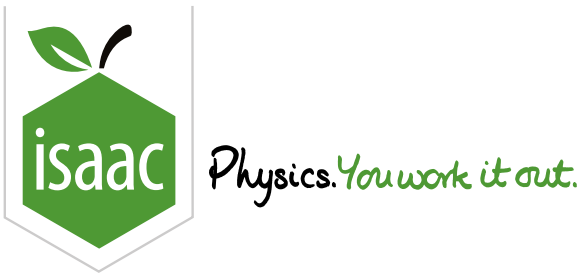
Find the smallest integer n which satisfies the inequality $7^{2n} > e^{600}$.

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Logarithmic Plots 1

A Level
P P P

The logarithms to base 10 of two variables, x and y , are plotted against each other below.

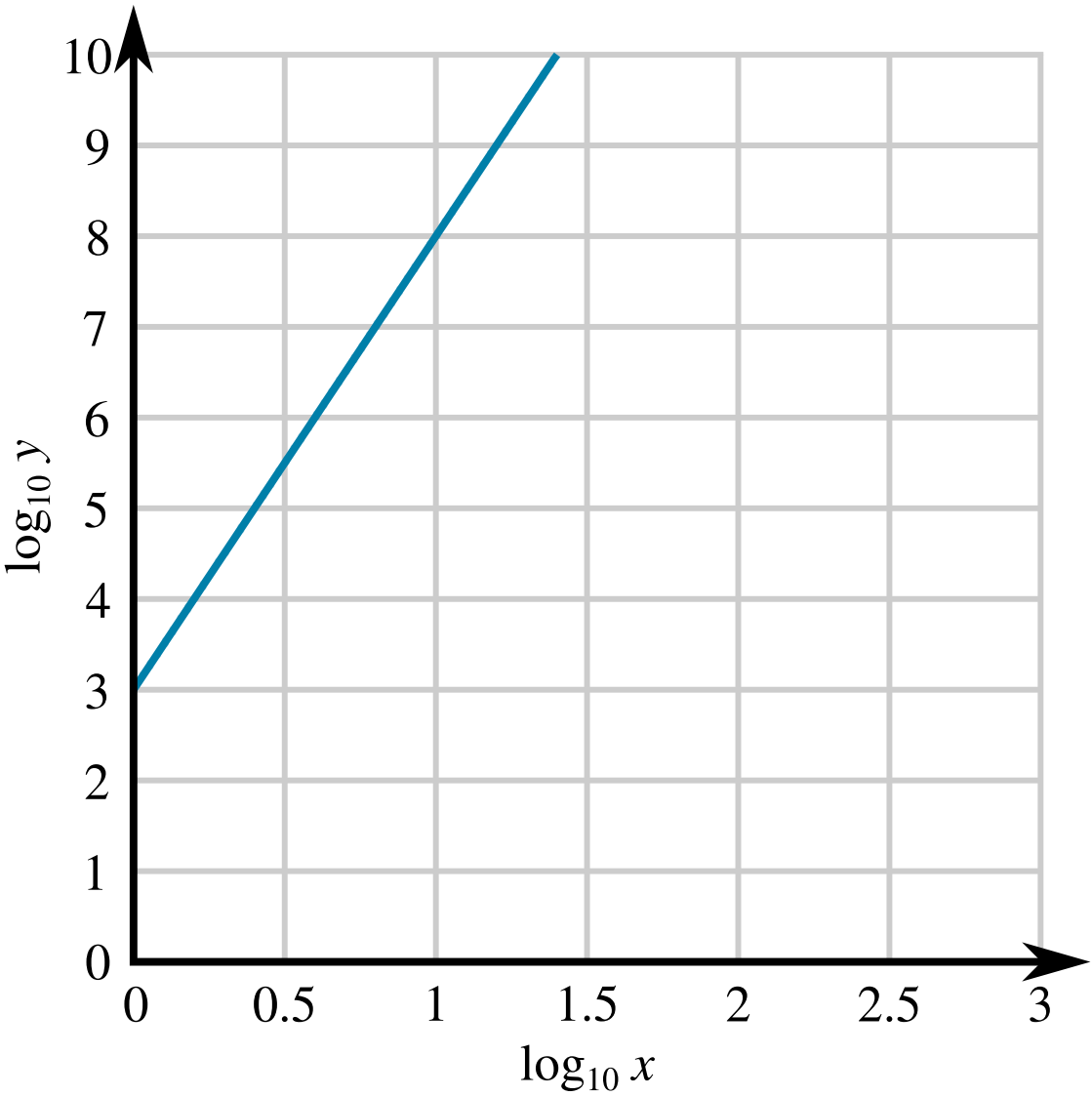


Figure 1: A plot of $\log_{10} y$ against $\log_{10} x$.

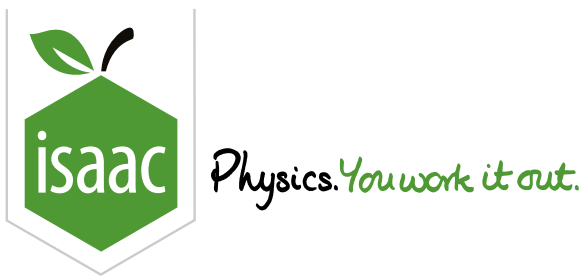
Use this plot to determine the relationship between x and y . Give your answer in the form $y = ax^b$, where a and b are constants.

The following symbols may be useful: x , y

Adapted for Isaac Physics from NST IA Biology preparation work

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Logarithmic Plots 3

A Level



By plotting a graph of $\ln F$ against $\ln r$, a student finds that the relationship between the gravitational force, F , on a pair of objects with fixed masses is given by

$$F = \frac{10^8}{r^2}$$

where r is the separation between them.

Part A Find the gradient

What was the gradient of the graph?

Part B Find the intercept

What was the intercept of the graph? Give your answer to 2 significant figures.

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