isaac You work it out.

Question

Three Exponential Equations

Subject & topics: Maths | Functions | General Functions **Stage & difficulty:** A Level P2

Solve the following exponential equations.

Part A

Solve for a

Solve the equation below to find a

$$\sqrt{4^3} = 2^{\frac{a}{9}}$$

Part B

Solve for x

Solve the equation below to find x

$$5^{2(x+1)} = \frac{25^{3x+\frac{1}{2}}}{125}$$

Part C

Solve for n

Solve the equation below to find n

$$\frac{1}{49^{n}} = \frac{\sqrt[3]{7}}{343^{\frac{5}{9}\,n}}$$

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Question

Log Laws 2ii

Subject & topics: Maths **Stage & difficulty:** A Level P2

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`

Question deck:

STEM SMART Double Maths 8 - Exponentials and Logarithms

isaac You work it out.

Question

Logarithmic Equations 3

Pre-Uni Maths for Sciences E3.6

Subject & topics: Maths | Functions | General Functions **Stage & difficulty:** A Level P2

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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STEM SMART Double Maths 8 - Exponentials and Logarithms

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Question

Apparent Magnitudes

Pre-Uni Maths for Sciences E3.9

Subject & topics: Maths | Functions | General Functions **Stage & difficulty:** A Level C2

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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Question

Log Laws 1i

Subject & topics: Maths **Stage & difficulty:** A Level P2

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 $\ln\left(\frac{y}{\mathrm{e}}\right)$ 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`

Question deck:

STEM SMART Double Maths 8 - Exponentials and Logarithms

isaac You work it out.

Question

Energy Decay

Pre-Uni Maths for Sciences E3.10

Subject & topics: Maths | Functions | General Functions **Stage & difficulty:** A Level C2

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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Question deck:

STEM SMART Double Maths 8 - Exponentials and Logarithms

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Question

Solving Equations & Logs 2ii

Subject & topics: Maths **Stage & difficulty:** A Level P2

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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STEM SMART Double Maths 8 - Exponentials and Logarithms

isaac You work it out.

Question

Solving Equations & Logs 3i

Subject & topics: Maths **Stage & difficulty:** A Level P2

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 `log(b,a)`.

The following symbols may be useful: `log(), x`

Part B
Find integer

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

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Question

Logarithmic Plots 1

Subject & topics: Maths | Functions | General Functions **Stage & difficulty:** A Level P2

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

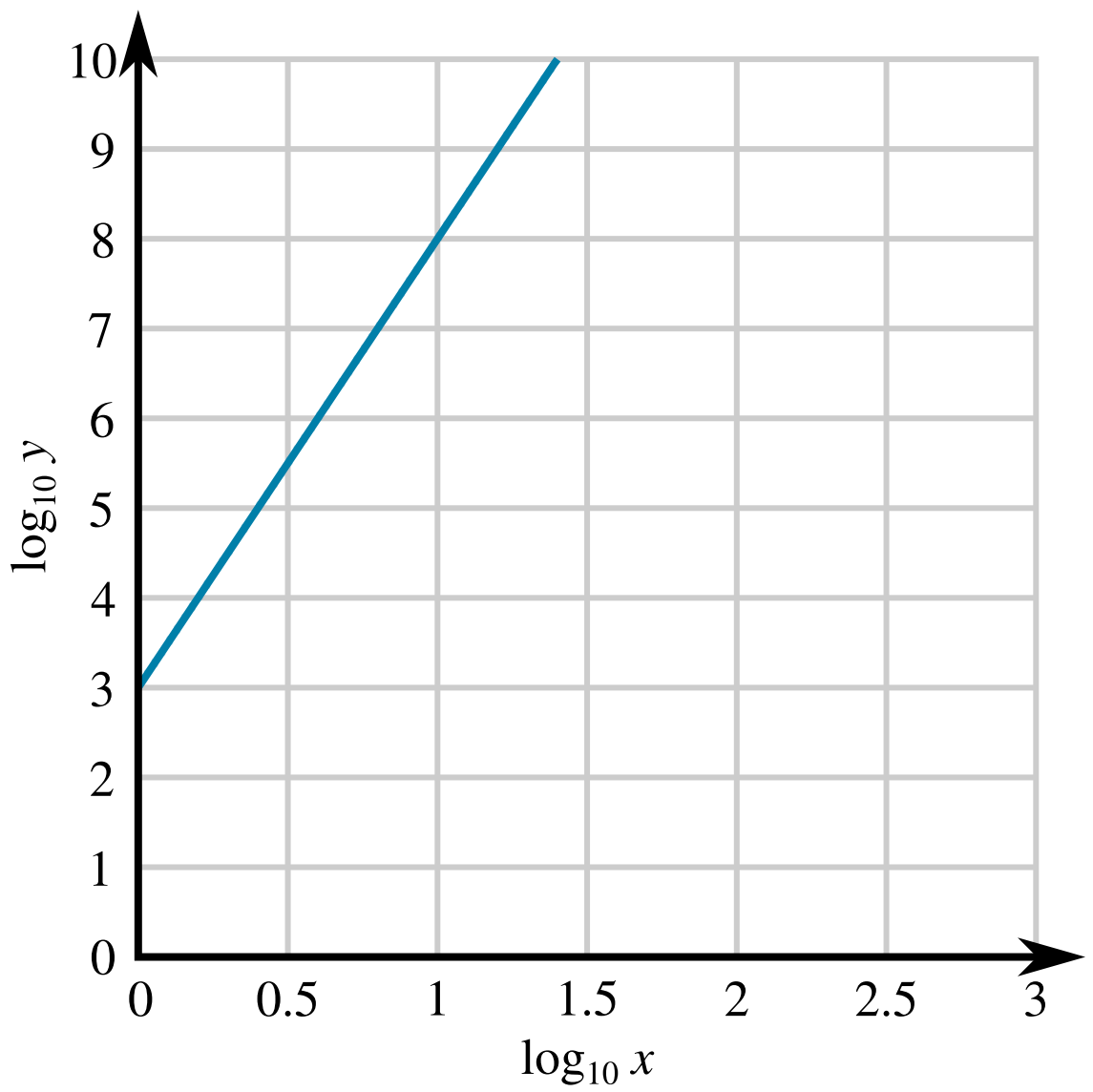

Figure 1: A plot of $\log_{10} y$ against $\log_{10} x$.

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

Question deck:

STEM SMART Double Maths 8 - Exponentials and Logarithms

isaac You work it out.

Question

Logarithmic Plots 3

Subject & topics: Maths | Functions | General Functions **Stage & difficulty:** A Level P2

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.

Adapted for Isaac Physics from NST IA Biology preparation work