



# Exponential Equation 2

A Level   Further A

P

P

P

P

P

P

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

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# Exponential Equation 3

A Level

Further A

P

P

P

P

P

P

Solve the following for  $m$ :  $\frac{1}{9^m} = 27^{1-m}$ .

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# Log Laws 1ii

A Level



## Part A Express in terms of $\log_2(x)$ (i)

Express  $\log_2(x^2)$  in terms of  $\log_2(x)$ .

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

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

## Part B Express in terms of $\log_2(x)$ (ii)

Express  $\log_2(8x^2)$  in terms of  $\log_2(x)$ .

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

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

## Part C Find $\log_3 y$

Given that  $y^2 = 27$ , find the value of  $\log_3 y$ .

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

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# Log Laws 2ii

A Level



## Part A   Express as a single log (i)

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

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

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## Part B   Express as a single log (ii)

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

**A Level**   **Further A**  
     

Solve the following logarithmic equations.

**Part A**    $\log_3 \sqrt{b} = 2.$

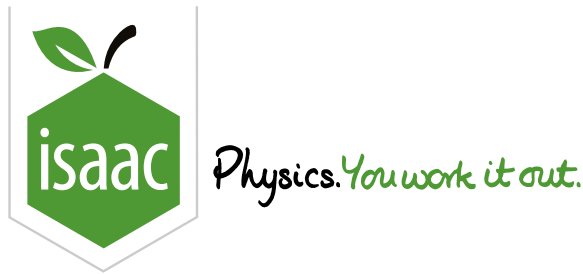
Find  $b$  if  $\log_3 \sqrt{b} = 2.$

**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   Further A

c

c

c

c

c

c

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  $4.80 \times 10^5$  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:  $p$

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## Part B Simplify 1

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

The following symbols may be useful:  $p$

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## Part C Simplify 2

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

The following symbols may be useful:  $p$

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## 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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Gameboard:

**STEM SMART Double Maths 8 - Exponents and Logarithms**

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# Energy Decay

A Level Further A



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  $\alpha$  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  $\tau$  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.

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

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.

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

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

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[Home](#)   [Maths](#)   Solving Equations & Logs 2ii

# Solving Equations & Logs 2ii



## 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



## Part A   Solve equation

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

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

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

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## Part B   Find integer

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

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