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Question

Straight Lines: Coordinates and Lengths 1ii

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

Part A
Find coordinate

The line segment joining the points $(-2, 7)$ and $(-4, p)$ has gradient 4. Find the value of p.

The following symbols may be useful: p

Part B
Find coordinates and midpoint

The line segment joining the points $(-2, 7)$ and $(6, q)$ has midpoint $(m, 5)$. Find m and q.

Enter the values of m and q. If a value is not a whole number, enter the value as a decimal.

$m =$ ____

$q =$ ____

Part C

Find coordinate from length

The line segment joining the points $(-2, 7)$ and $(d, 3)$ has length $2\sqrt{13}$. Find the two possible values of d. Enter the greatest possible value of d.

The following symbols may be useful: d

Used with permission from UCLES, A Level, January 2013, Paper 4721, Question 6.

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Question

Straight Lines: Coordinates and Lengths 2i

Subject & topics: Maths **Stage & difficulty:** A Level P1

The points A, B, and C have coordinates $(5, 1)$, $(p, 7)$, and $(8, 2)$ respectively.

Part A

Possible values of p

Given that the distance between the points A and B is twice the distance between points A and C, calculate the possible values of p.

Hence, state the possible coordinates of B.

(,)

Part B

Midpoint of AB

Given also that the line passing through A and B has equation $y = 3x - 14$, find the coordinates of the midpoint of AB.

Enter the x and y coordinates below. If a value is not a whole number, enter the value as a decimal.

(,)

Used with permission from UCLES, A Level, January 2006, Paper 4721, Question 9.

Question deck:

STEM SMART Single Maths 9 - Linear Plots

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Question

Straight Lines: Gradients and Normals 4ii

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

The points A and B have coordinates $(6, 1)$ and $(-2, 7)$ respectively.

Part A
Length of AB

Find the length of AB.

Part B
Gradient of AB

Find the gradient of the line AB.

Part C

Compare gradients

Determine whether the line $4x - 3y - 10 = 0$ is perpendicular to AB.

- The lines are perpendicular
- The lines are not perpendicular

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Question

Straight Lines: Gradients and Normals 2i

Subject & topics: Maths **Stage & difficulty:** A Level P1

A is the point $(2, 7)$ and B is the point $(-1, -2)$.

Part A
Equation of line

Find the equation of the line through A parallel to the line $y = 4x - 5$, giving your answer in the form $y = mx + c$.

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

Part B
Length of AB

Calculate the length of AB, giving your answer in simplified surd form.

Part C

Find equation of line

Find the equation of the line which passes through the midpoint of AB, and which is perpendicular to AB. Give your answer in the form $ax + by + c = 0$, where a, b, and c are integers.

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

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Question

Straight Lines: Gradients and Normals 1ii

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

A is the point $(-2, 6)$ and B is the point $(3, -8)$. The line l is perpendicular to the line $x - 3y + 15 = 0$, and passes through the midpoint of AB. Find the equation of l, giving your answer in the form $ax + by + c = 0$ where a, b, and c are integers.

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

Question deck:

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Question

Straight Lines: Gradients and Normals 3ii

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

The points A$(1, 3)$, B$(7, 1)$, and C$(-3, -9)$ are joined to form a triangle.

Part A
Show right angle

Show that this triangle is right angled, and determine whether the right angle is located at A, B, or C.

- A
- B
- C

Part B
Triangle in circle

The points A, B and C lie on the circumference of a circle. Find the x and y coordinates of the centre of the circle.

Enter the x and y coordinates below. If a value is not a whole number, enter the value as a decimal.

(,)

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STEM SMART Single Maths 9 - Linear Plots

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Question

Log Plots

A-level Maths Topic Summaries - Logarithms

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

Fill in the blanks to complete the notes on log plots.

Part A

Log plots for power laws, $y = kx^{\alpha}$

If $y = kx^{\alpha}$ a plot of y against x is a [ ]. However, we can use logarithms to create a graph that is a [ ].

$$
\begin{aligned}
y &= kx^{\alpha} \\
\log_b y &= \log_b (kx^{\alpha}) \\
\log_b y &= \log_b k + \log_b (x^{\alpha}) \\
\log_b y &= \log_b k + \alpha \log_b x \\
\log_b y &= \alpha \log_b x + \log_b k
\end{aligned}
$$

The equation $\log_b y = \alpha \log_b x + \log_b k$ has the form $Y = mX + c$. This tells us is that if we plot a graph with [ ] **on the vertical axis** and [ ] **on the horizontal axis**, it will be a straight line. This line will have a **gradient of** [ ], and will **meet the vertical axis at** [ ].

Items:

curve straight line α $\log_b k$ $\log_b x$ $\log_b y$

Part B

Log plots for exponentials, $y = kb^{\alpha x}$ & $y = k\mathrm{e}^{\alpha x}$

If we take logarithms of both sides of $y = kb^{\alpha x}$ we end up with

$$\log_b y = \alpha x + \log_b k$$

The equation $\log_b y = \alpha x + \log_b k$ has the form $Y = mX + c$. This tells us is that if we plot a graph with [ ] **on the vertical axis** and [ ] **on the horizontal axis**, it will be a straight line. This line will have a **gradient of** [ ], and will **meet the vertical axis at** [ ].

A special case is when $b = \mathrm{e}$. We write $\log_\mathrm{e}$ as $\ln$. Taking logarithms of $y = k\mathrm{e}^{\alpha x}$ gives $\ln y = \alpha x + \ln k$. A graph with [ ] **on the vertical axis** and x **on the horizontal axis** will be a straight line. This line will have a **gradient of** α, and will **meet the vertical axis at** [ ].

Items:

[α] [$\ln k$] [$\ln y$] [$\log_b k$] [$\log_b x$] [$\log_b y$] [x]

Question deck:

STEM SMART Single Maths 9 - Linear Plots

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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

Question deck:
STEM SMART Single Maths 9 - Linear Plots

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Question

Logarithmic Plots 2

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

The equation representing the radioactive decay of the number of atoms in a sample, N, with time, t, is $N = N_0 e^{-\lambda t}$ where λ is the decay constant.

Below is a graph of $\ln N$ against t for a particular radioactive substance.

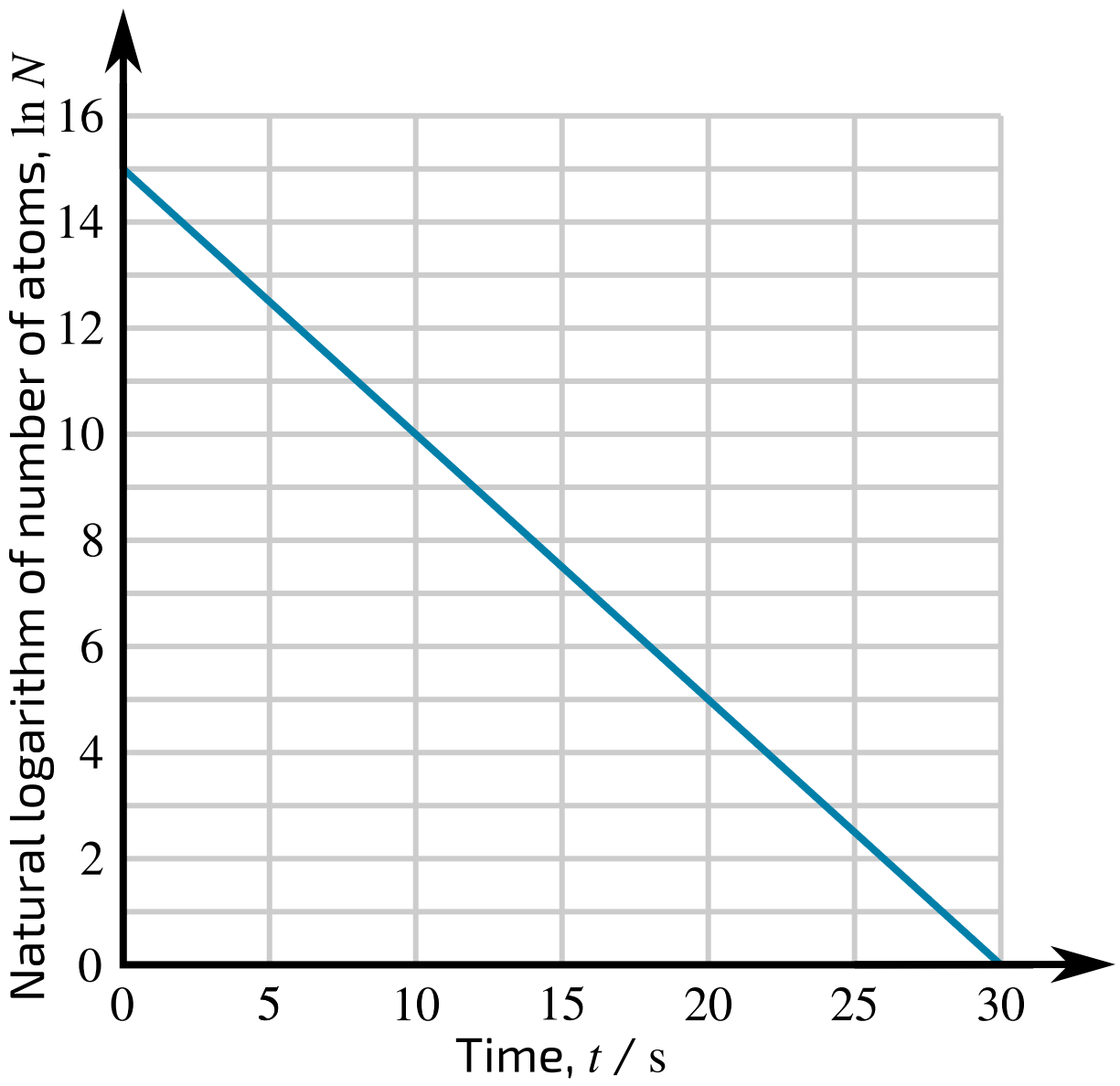

Figure 1: A plot of the natural logarithm of the number of atoms, $\ln N$, against time, t.

Part A

Find λ

Use this plot to determine λ for this sample.

Part B

Find N_0

Use this plot to determine N_0 for this sample. Give your value for N_0 to 2 significant figures.

Adapted for Isaac Physics from NST IA Biology preparation work

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Question deck:

STEM SMART Single Maths 9 - Linear Plots

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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.

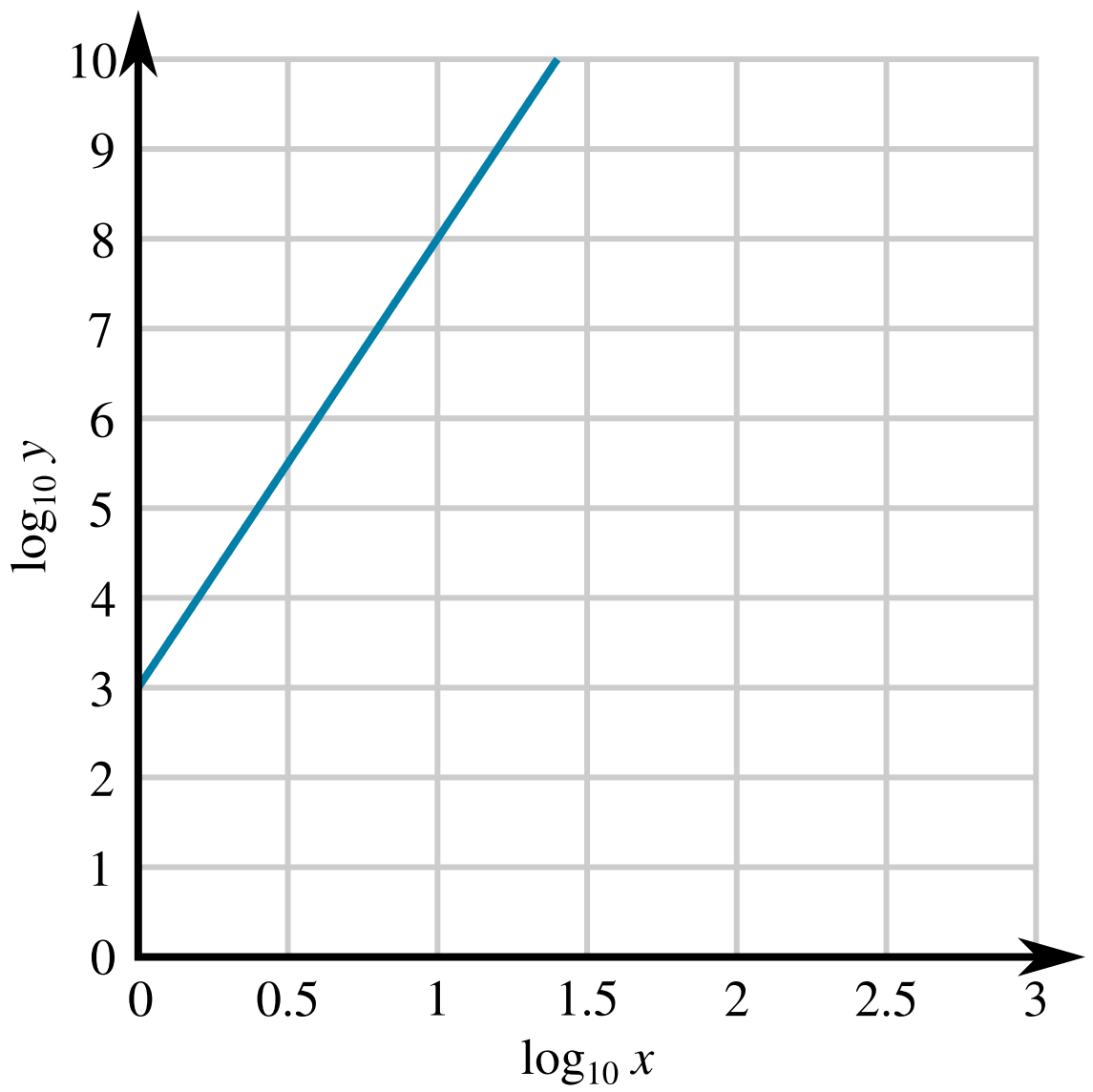

Figure 1: A plot of $\log_{10} y$ against $\log_{10} x$.

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