Straight lines: gradients and normals 1i

A Level

P P P

Part A Gradient of line

Find the gradient of the line l_1 which has equation $4x - 3y + 5 = 0$.

Part B Perpendicular line

Find the equation of the line l_2, which passes through the point $(1, 2)$ and is perpendicular to the line l_1, 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`

Part C Midpoint

The line l_1 crosses the x-axis at P and the line l_2 crosses the y-axis at Q. Find the coordinates of the midpoint of PQ.

Enter the x-coordinate:

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

Enter the y-coordinate:

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

Part D Length of PQ

Find the length of PQ.

Used with permission from UCLES, A level, June 2005, Paper 4721, Question 9

Logarithmic Plots 4

A Level

A student used a graph of $\ln y$ against x to discover that $y = e^{2x+5}$.

What were the gradient and intercept of the graph?

Part A Find the gradient

What was the gradient of the graph?

Part B Find the intercept

What was the intercept of the graph?

Adapted for Isaac Physics from NST IA Biology preparation work

Gameboard:

STEM SMART Single Maths 15 - Linear Plots, Quadratics & Logarithms Revision

Simultaneous Equations 2i

A Level

Solve the simultaneous equations

$$2x^2 + y^2 = 57$$

$$x + 2y - 6 = 0.$$

Enter the pair of x and y values that satisfy these equations that has the greatest value of x.

Part A Value of x

Enter the value of x.

The following symbols may be useful: x

Part B Value of y

Enter the value of y

The following symbols may be useful: y

Gameboard:

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Quadratics: Graphs and Discriminants 1i

A Level

P P P

Part A Graph

Sketch the curve $y = 2x^2 - x - 3$, giving the coordinates of all points of intersection with the axes.

Enter the value of y at which the curve crosses the y-axis.

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

Part B Solve inequality

Hence or otherwise solve the inequality $2x^2 - x - 3 < 0$.

What form does your answer take? Choose from the list below, where a and b are constants and $a < b$, and then find a and/or b.

- $x < a$
- $x \leq a$
- $x > a$
- $x \geq a$
- $a < x < b$
- $a \leq x \leq b$
- $x < a$ or $x > b$
- $x \leq a$ or $x \geq b$

Write down the value of a.

Write down the value of b (or if your chosen form has no b, write "n").

The following symbols may be useful: n

Part C Possible values

Given that the equation $2x^2 - x - 3 = k$ has no real roots, find the set of possible values of the constant k.

Write down an inequality for k.

The following symbols may be useful: <, >, k

Used with permission from UCLES, A level, June 2016, Paper 4721, Question 9.

Gameboard:

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Completing the Square 1ii

A Level

Part A Complete square

Express $2x^2 + 12x + 13$ in the form $a(x + b)^2 + c$.

The following symbols may be useful: x

Part B Solve equation

Solve the equation $2x^2 + 12x + 13 = 0$, giving your answers in the form $a \pm b$ where a and b are in simplified surd form.

The following symbols may be useful: ±

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Quadratics: Functions of the Unknown 1i

A Level

P P P

Find the roots of the equation $x - 8\sqrt{x} + 13 = 0$, giving your answers in the form $p \pm q\sqrt{r}$ where p, q, and r are integers.

The following symbols may be useful: ±

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Exponentials and Logs

A Level

C C C

Part A Sketching

Consider the curve $y = 6 \times 5^x$, sketch it and find the value of the y intercept of the curve.

What is the value of the y intercept of the curve?

The following symbols may be useful: y

Part B Find x-coordinate

The point P on the curve $y = 9^x$ has y-coordinate equal to 150. Use logarithms to find the x-coordinate of P.

Give the x-coordinate of P to 3 significant figures.

Part C New x-coordinate

The curves $y = 6 \times 5^x$ and $y = 9^x$ intersect at the point Q. Find the exact value of the x-coordinate at point Q, giving any logarithms in base three.

Give the exact value of the x-coordinate at point Q, giving any logarithms in base three $(\log_3)$.

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`

Used with permission from UCLES, A Level, January 2010, Paper 4722, Question 9.

Gameboard:

STEM SMART Single Maths 15 - Linear Plots, Quadratics & Logarithms Revision

Solving Equations & Logs 2i

A Level

Part A Solve equation

Use logarithms to solve the equation $2^{n-3} = 18000$, giving your answer to 3 significant figures.

Part B Simultaneous equations

Solve the simultaneous equations $\log_2 x + \log_2 y = 8$ and $\log_2(\frac{x^2}{y}) = 7$

State the value of x.

The following symbols may be useful: x

State the value of y.

The following symbols may be useful: y

Used with permission from UCLES, A Level Maths, June 2015, OCR C2, Question 8