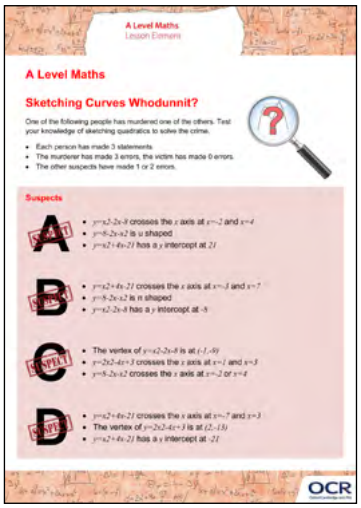
A Level Maths

Sketching Curves Whodunnit?

Instructions and answers for teachers

These instructions should accompany the OCR resource 'Sketching Curves Whodunnit?' activity *which supports OCR A Level Mathematics.*



Associated Files:
Curve Sketching Whodunnit? Activity

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Teacher Guidance

Assumed knowledge

Students will need to have been taught how to find the information required to sketch quadratic curves:

- What shape is a quadratic graph with either a positive or a negative coefficient of x^2.
- How to find x and y intercepts.
- How to find the coordinates of the vertex.
- Where to find the line of symmetry of a quadratic graph.
- How to solve equations by factorisation, completing the square and using the quadratic formula.

Possible Misconceptions

- Assuming all quadratics are u shaped.
- Ignoring negative signs, e.g. thinking the y intercept of $y=x^2-4x-8$ is at 8 rather than -8.
- Forgetting to remove brackets for solutions after factorisation, e.g. $(x-4)(x-7)$ should be $x=4$ and $x=7$.
- Some students may make mistakes when completing the square when the coefficient of x^2 is not 1.
- Co-ordinates of the vertex are (a,b) from $(x-a)^2+b$; some students may forget to change the sign of a.

Teaching Notes

Students must use their knowledge of sketching quadratics to solve the crime. Each suspect has made three statements about various quadratic graphs. Students must decide whether each statement is true or false. One way for them to do this is to work out the various bits of information required for each quadratic and sketch it. The killer has made three errors, the victim has made no errors, and everyone else has made one or two errors.

The location of the crime is at the co-ordinates where two graphs intersect, students could be encouraged to sketch both graphs, however there are many possible approaches and this could form a discussion topic. The date and time requires students to find minimum and maximum values of the curves.

The clues for the first two suspects are easier than the rest. Teachers could decide to direct different groups of students to solve the clues for different suspects, or allow all students to work out the clues for all suspects.

Task

One of the following people has murdered one of the others.
Test your knowledge of sketching quadratics to solve the crime.

- Each person has made 3 statements.
- The murderer has made 3 errors and the victim has made 0 errors.
- The other suspects have made 1 or 2 errors.

Suspects

- $y=x^2-2x-8$ crosses the x axis at $x=-2$ and $x=4$
- $y=8-2x-x^2$ is u shaped
- $y=x^2+4x-21$ has a y intercept at 21

- $y=x^2+4x-21$ crosses the x axis at $x=-3$ and $x=7$
- $y=8-2x-x^2$ is n shaped
- $y=x^2-2x-8$ has a y intercept at -8

- The vertex of $y=x^2-2x-8$ is at $(-1,-9)$
- $y=2x^2-4x+3$ crosses the x axis at $x=1$ and $x=3$
- $y=8-2x-x^2$ crosses the x axis at $x=-2$ or $x=4$

- $y=x^2+4x-21$ crosses the x axis at $x=-7$ and $x=3$
- The vertex of $y=2x^2-4x+3$ is at $(2,-13)$
- $y=x^2+4x-21$ has a y intercept at -21

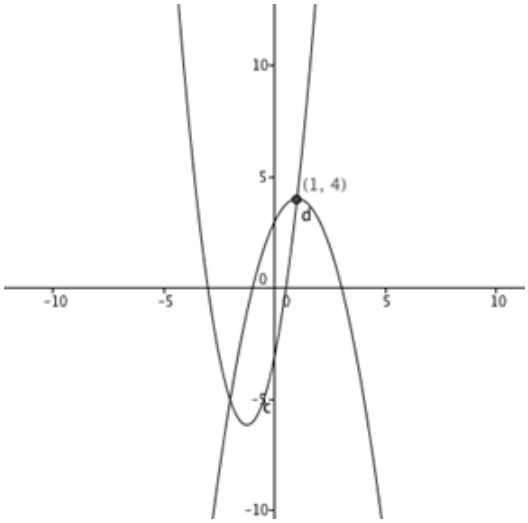
- The vertex of $y=2x^2-4x+3$ is at $(-2,-13)$
- $y=2x^2-4x+3$ does not cross the x axis
- $y=x^2-2x-8$ has a line of symmetry at $x=-1$

- The vertex of $y=x^2-2x-8$ is at $(1,-9)$
- $y=2x^2-4x+3$ has a line of symmetry at $x=1$
- The vertex of $y=x^2+4x-21$ is at $(-2,-25)$

Where?

The murder took place at the point in the first quadrant where $y=2x^2+5x-3$ and $y=3+2x-x^2$ intersect.

Answer = $(1,4)$



When?

The following clues give the time and date that the murder took place.
E.g. Hours answer = 17, minutes answer = 28, would give a time of 17:28.

The hours part of the time is the minimum value of $y=x^2+4x+7$. Answer = 3

The minutes part of the time is the maximum value of $y=21-4x-x^2$. Answer = 25

The day part of the date is the maximum value of $y=10+6x-x^2$. Answer = 19

The month part of the date is the x intercept of $y=3x^2-18x+27$. Answer = 3

Correct Accusation

I think that **Suspect C** murdered **Suspect F** at the co-ordinates **(1, 4)**.
The murder took place at **03:25** on the **19th** of **March**.