Sine stretching

Teacher notes

Why use this resource?

This task gives students an opportunity to find the gradient of a composite function without needing any knowledge of the chain rule. Using sketches and the GeoGebra applet provided, students can think about the transformation from $\sin x$ to $\sin ax$ and how this impacts on the gradient function. Having this example to refer to may help students gain a better understanding when they come to learn the chain rule.

Preparation

Students should already know how to differentiate $\sin x$ and $\cos x$.

The GeoGebra applet needs to be displayed to the class, or students need access to a laptop or tablet to manipulate the applet themselves.

Possible approach

The GeoGebra applet can be used as a starting point, to help students to think generally about what happens as the function $\sin ax$ transforms. Anything they notice may then help them to think about the gradient of $\sin 3x$. Discussing and sharing what they notice from the applet should allow all students to make progress on the gradient function question.

Students should be asked to focus on why their answer is correct and aim to give clear reasoning to support their answers.

Key questions

When thinking about the applet:

- What happens to the gradient as $\sin x$ transforms to $\sin 2x$?
- What happens to a point on the graph of $\sin x$ as it transforms to $\sin 2x$?

Once students have decided which is the correct gradient function:

- Can you explain why that is the correct gradient?
- For any value of a, what is the gradient function of $\sin ax$? (The applet on the solution page may help students to answer this.)

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Possible extension

Students could be asked to extend their thinking to other functions that they know, such as $\cos ax, e^{ax}$ and $ln(ax)$. Can they make a more general prediction about the gradient function of $f(ax)$? Does this fit with examples they already know involving polynomials?

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