Slippery slopes

Teacher notes

Why use this resource?

Students are presented with graphs of related functions and asked to determine the gradients of these graphs at certain points. Rather than differentiating, students will have to combine their understanding of transformations with their understanding of gradients. The second set of functions includes translations parallel to the x-axis and these ideas will be built on as students learn more about differentiating functions.

Possible approaches

The problem is split into two related parts. Start with the first set of graphs and ask students to comment on relationships between the equations, between the graphs, and between the graphs and the equations. Then ask the questions below the graphs.

An alternative way to introduce the problem is to zoom in on the image of the first set of graphs and ask students to "Say what you see".

Before moving on to the second set of graphs, ask students which types of transformations were involved in this problem and how they affected the functions and their gradients. This may raise the question of what happens if graphs as translated parallel to the x-axis and provide a natural way to move on to the second set of graphs.

Key questions

- What do you notice about the graphs? Where do the graphs cross the x-axis?
- What is the relationship between points A, B, C and D? What is the relationship between E, F, G and H?
- How do different types of transformations affect the gradient function?

Possible support

Students may need time to realise that there is enough information for them to answer the questions. If students are struggling, you could ask everyone to share a question that they have, so that strategies for tackling these can be discussed.

A process for solving both problems has been split into stages in the solution. On the site this uses concealed text, so the headings could be used to suggest a strategy.

The question in the second part has been deliberately expressed as "What can you deduce about these points?" to give students the opportunity to break it down into "What are

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the coordinates of the points?" and "What is the relationship between them?" If students struggle to understand this question they could be prompted with these, or referred to their approach for the first problem.

Possible extension

Ask students to apply these ideas to some functions that they know about. Exploring some examples of transformations of polynomials could be of interest and provide foundations for the chain rule.

A similar problem, but this time looking at integration, is What else do you know?

A related problem is Slippery slopes … another derivative at the Chain Rule & Integration by Substitution station.

A version of this resource has been featured on the NRICH website. You might like to look at some students' solutions that have been submitted there.

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