Guidance for tutors

Outcome	AG13	Student can consistently:	Basic calculus, differentiation and integration.

How the topic is examined

- This topic is not currently examined on GCSE but certain aspects are on Level 2 Further Maths, AS/A2 mathematics and additional maths qualifications.
- It is likely that students would have a calculator to solve problems involving calculus – however questions can easily be asked so that they don't have to.
- Questions may ask students to:
  - Differentiate a function or find $\frac{dy}{dx}$
  - Find the gradient of a function at a particular point.
  - Integrate a function
  - Find the area underneath a curve between two points.

Prior knowledge

- Students should be confident with:
  - Substituting into expressions (AEx5)
  - Simplifying expressions (AEx2)
- In addition questions involving this topic can have links to:
  - Estimate the gradient of a curve and the area underneath it.

Suggested tuition approaches

- Calculus is a whole branch of mathematics that is split into two key areas, differentiation and integration.
- Differentiation should be covered before integration. Ideally differentiation needs introducing from first principles so that students can see where the general rule comes from.
- Integration can be introduced after as the opposite of differentiation.
- Students should probably focus on power functions only and not worry about differentiating and integrating more complicated functions.

Differentiation	Integration
Differentiation is a branch of maths that allows you to find the gradient of a function at a particular point.	Integration is the opposite of differentiation. One of the main uses of integration is to find the area under a curve between two points.

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	Students should be introduced from first principles to the gradient function — The general rule is = then — = −1 To find the gradient at a particular point you then substitute the value into the gradient function.	The general rule for integration is $\int = \frac{+1}{+1}$ To find the area under the curve ( ) between two points and you would integrate between these two values.
Common errors and misconceptions	☐ Students confuse the two rules and mix them up (i.e. they differentiate instead of integrate etc..) ☐ They should take care when substituting numbers into — or into the integrated function to find the area under the graph.	
Suggested resources	☐ Questions and notes ○ http://www.cimt.org.uk/projects/mepres/alevel/pure_ch8.pdf (differentiation) ○ http://www.cimt.org.uk/projects/mepres/alevel/pure_ch12.pdf (integration) ☐ Past Questions ☐ https://www.examsolutions.net/tutorials/exam-questions-differentiation-introduction/ (differentiation) ☐ https://www.examsolutions.net/tutorials/exam-questions-integration-introduction/ (integration) ☐ Video and online tutorials ○ http://www.mathsisfun.com/calculus/derivatives-introduction.html - Introduction to differentiation ○ https://www.mathsisfun.com/calculus/integration-introduction.html - Introduction to integration ○ https://www.khanacademy.org/math/differential-calculus/taking-derivatives/derivative_intro/v/calculus-derivatives-1-new-hd-version (Khan Academy introduction to differentiation) ○ https://www.khanacademy.org/math/integral-calculus/indefinite-definite-integrals (Khan Academy introduction to integration)	

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