**Y12 AS Mathematics**

**11 Integration 1.5 weeks**

## Teaching objectives

**a** To review knowledge of differentiation

**b** To ensure students make use of the connections between differentiation and integration

**c** To know and use the Fundamental Theorem of Calculus to calculate indefinite integrals

**d** To gain fluency skills in calculating definite integrals to work out the area under a curve

(Include where possible: proof, modelling, problem solving & using calculators)

**Resources for advance preparation:**

[**UM: Gradient Match**](https://undergroundmathematics.org/introducing-calculus/gradient-match) – card sort (students can cut up)

[**TES worksheet**](https://www.tes.com/teaching-resource/introduction-to-integration-6308321)– examples of f(x) & f(x) project or use mini white boards

[**MEI: Calculus card match**](https://integralmaths.org/sow-resources.php) - Using index and surd form in differentiation and integration.

**KM: [True, Never, Sometimes;](http://www.kangaroomaths.com/free_resources/ks5/resources/session3/plenary/integrationtruesometimesnever.ppt)**

[**UM: Integral Chasing**](https://undergroundmathematics.org/calculus-of-powers/integral-chasing) **–** project on the board

[**MEI Integrating technology**](http://mei.org.uk/integrating-technology) - MEI casio worksheet for pupils to work through – could project instead of print

**UM:** [**What else do you know?**](https://undergroundmathematics.org/calculus-meets-functions/what-else-do-you-know) – project on the board

**UM:** [**Problem areas**](https://undergroundmathematics.org/introducing-calculus/problem-areas) – project on the board

[**UM: Additional integrals**](https://undergroundmathematics.org/calculus-meets-functions/additional-integrals) – to project on the board

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|  | **Starter** | **Main teaching**Including key questions, key teaching points, models and resources | **Notes**Including Support and Extension | **Consolidation/Plenary**Including key questions and homework |
| **Lesson 1**Introduction to integration as reverse of differentiation | [**UM: Gradient Match**](https://undergroundmathematics.org/introducing-calculus/gradient-match)or http://engaging-math.blogspot.co.uk/2016/06/derivative-matching-cards.htmlAfter matching pairs students can suggest equations for each function. | Students to explain their solutions.Select some student responses from this card sort or use [**TES worksheet**](https://www.tes.com/teaching-resource/introduction-to-integration-6308321) to discuss with students the degree of the function and its gradient function.Pose questions such as: If f’(x) = $ax^{n}$ then what would f(x) equal? When we differentiate a constant term we get 0. How could we compensate for this when integrating? | Lead students through generalising the method for finding f(x) from f’(x), defining this as integration (Fundamental Theorem of Calculus.) | 10-15 minutes routine practice of calculating indefinite integrals (use any textbook / website / worksheet) |
|  | **Starter** | **Main teaching**Including key questions, key teaching points, models and resources | **Notes**Including Support and Extension | **Consolidation/Plenary**Including key questions and homework |
| **Lesson 2**Practice and consolidation of indefinite integration |  | Questioning for statements in the starterExplain why…Give a reason why…How can we be surethat…Convince me that… | [**MEI: Calculus card match**](https://integralmaths.org/sow-resources.php) card sort using index and surd form in differentiation and integration | Is it ever false that ?Is it ever false that ? |
| **Lesson 3**Introduction to definite integration and area under a curve | Introduce integration as finding area under the curve(see notes) | Practice definite integration – 20-30 minutes routine practice of calculating definite integrals (use any textbook / website / worksheet) | Extension – proof to integration being area under a curve – could use<https://www.youtube.com/watch?v=HXovJIj0caY>(students do not need to know this but could be a good starter/extension) | **KM: [True, Never, Sometimes;](http://www.kangaroomaths.com/free_resources/ks5/resources/session3/plenary/integrationtruesometimesnever.ppt)**Give me an example of a curve for which  |
| **Lesson 4**Practice, consolidation of and problem solving with definite integration | [**UM: Integral Chasing**](https://undergroundmathematics.org/calculus-of-powers/integral-chasing)Project on the board for students to problem solve.…do the ‘Main’ before showing answers… | [**MEI Integrating technology**](http://mei.org.uk/integrating-technology)- After consolidating written method use calculators/technology to ensure pupils can check their answers using their calculators. Check answers to starter using calculators and then students to share solutions/methods with the class. | **UM:** [**What else do you know?**](https://undergroundmathematics.org/calculus-meets-functions/what-else-do-you-know)Project on the board for students to discuss. | **UM:** [**Problem areas**](https://undergroundmathematics.org/introducing-calculus/problem-areas)Project on the board for students to discuss. |
| **Lessons 5 & 6**Exam questions/ problem solving/ proof | [**UM: Additional integrals**](https://undergroundmathematics.org/calculus-meets-functions/additional-integrals) | Students to complete exam questions from all exam boards. Star questions from your selected exam board so students can see layout differences etc. |  | Exam question from selected exam board as an exit ticket. |