**Y13 A-level Mathematics**

**32 Parametric Equations 1 week**

## Teaching objectives

**a Understand and use the parametric equations of curves and conversion between Cartesian and parametric forms**

**b** Use parametric modelling in a variety of contexts

**c Differentiate simple functions and relations defined parametrically for first derivative only.**

**Resources for advance preparation:**

**MEI Parametric cards for sorting (1 between 2) http://mei.org.uk/files/sow/31-parametric-equations-res.pdf**

**UM: https://undergroundmathematics.org/chain-rule/parametric-points/problem**

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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 |
| 1 | Trig identities review e.g. [Trig identity match](https://drive.google.com/file/d/0B9L2lYGRiK2bSFBlQkZEMXJRdHc/edit) | Introduce parametric equations graphically. Use Geogebra: [Geogebra Introduction to parametrics](https://www.geogebra.org/m/UfDqG6Ad)1. Sketching a parametric curve
2. The parametric equation of a circle

Make sure students are confident with plotting parametrics by finding coordinates.[UM: parametric paths](https://undergroundmathematics.org/chain-rule/parametric-paths) | Pre-requisites:DifferentiationConfident in sketching curvesTrigonometric identitiesLook at x = cos t, y = sin t and could ask students to plot these using intervals of pi/4Use UM: parametric paths to look at sketching different curves – consider what stays the same and what is different,  | Proof question; For the curve with parametric equations x = 5cost + cos 5t, y = 5sin t – sin 5t prove that if the point with coordinates (p,q) is on the curve then so is the point with coordinates (q,p). What does this tell about the curve? |
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| 2 | Miniwhiteboard questions to sketch curves by plotting points (review of lesson 1) | Finding the cartesian equation of a curve[UM: parametric preliminaries - now try this](https://undergroundmathematics.org/chain-rule/parametric-preliminaries) | Key Question: What’s the same and what’s different about the curve with cartesian question y = 2x2 – 1 and the curve with parametric equations x = cos t, y = cos 2tStudents need to think carefully when converting to Cartesian form – see comments on here http://mei.org.uk/files/sow/31-parametric-equations.pdf | [Solomon Maths: Parametrics](https://pmt.physicsandmathstutor.com/download/Maths/A-level/C4/Worksheets-Notes/Solomon/C4%20Differentiation%20A%20-%20Questions.pdf) |
| 3 | Miniwhiteboard questions: some examples of practising chain rule | Introducing tangents to parametric curves[Geogebra Introduction task](http://mei.org.uk/files/ict/geogebra-a2-core-tasks.pdf#page=8)Introduce how to find stationary points, ensure students know how to apply the chain rule.MEI Parametric cards <http://mei.org.uk/files/sow/31-parametric-equations-res.pdf>* Finding the gradient of a curve
* Finding the equation of a tangent

Finding the turning points of a curve | Students need to be careful with notation e.g. dy/dt and think about what dx/dt and dy/dt mean. | [MathCentre questions p6](http://www.mathcentre.ac.uk/resources/uploaded/mc-ty-parametric-2009-1.pdf)TES: [Parametric functions lock game](https://www.tes.com/teaching-resource/parametric-functions-lock-game-6395197)Key Question: Describe which features of the parametric equations x = 1-t2, y = t3 make it non-differentiable at the point corresponding to t =0 . |
| 4 | Mini whiteboard questions – find stationary points of functions (including trigonometric functions)  | [UM: parametric points](https://undergroundmathematics.org/chain-rule/parametric-points) and the fluency ‘problem’ to find stationary points and match up the curve | Use this task to consolidate all learning. | Standards unit p10 – where are the errors?[Standards unit: Parametrics](http://www.mrbartonmaths.com/resources/standard%20unit%20pdfs/SU%20Algebra%20Lessons/A14%20-%20Exploring%20Equations%20in%20Parametric%20Form.pdf)[Solomon Maths parametric differentiation](https://pmt.physicsandmathstutor.com/download/Maths/A-level/C4/Worksheets-Notes/Solomon/C4%20Differentiation%20B%20-%20Questions.pdf) |