

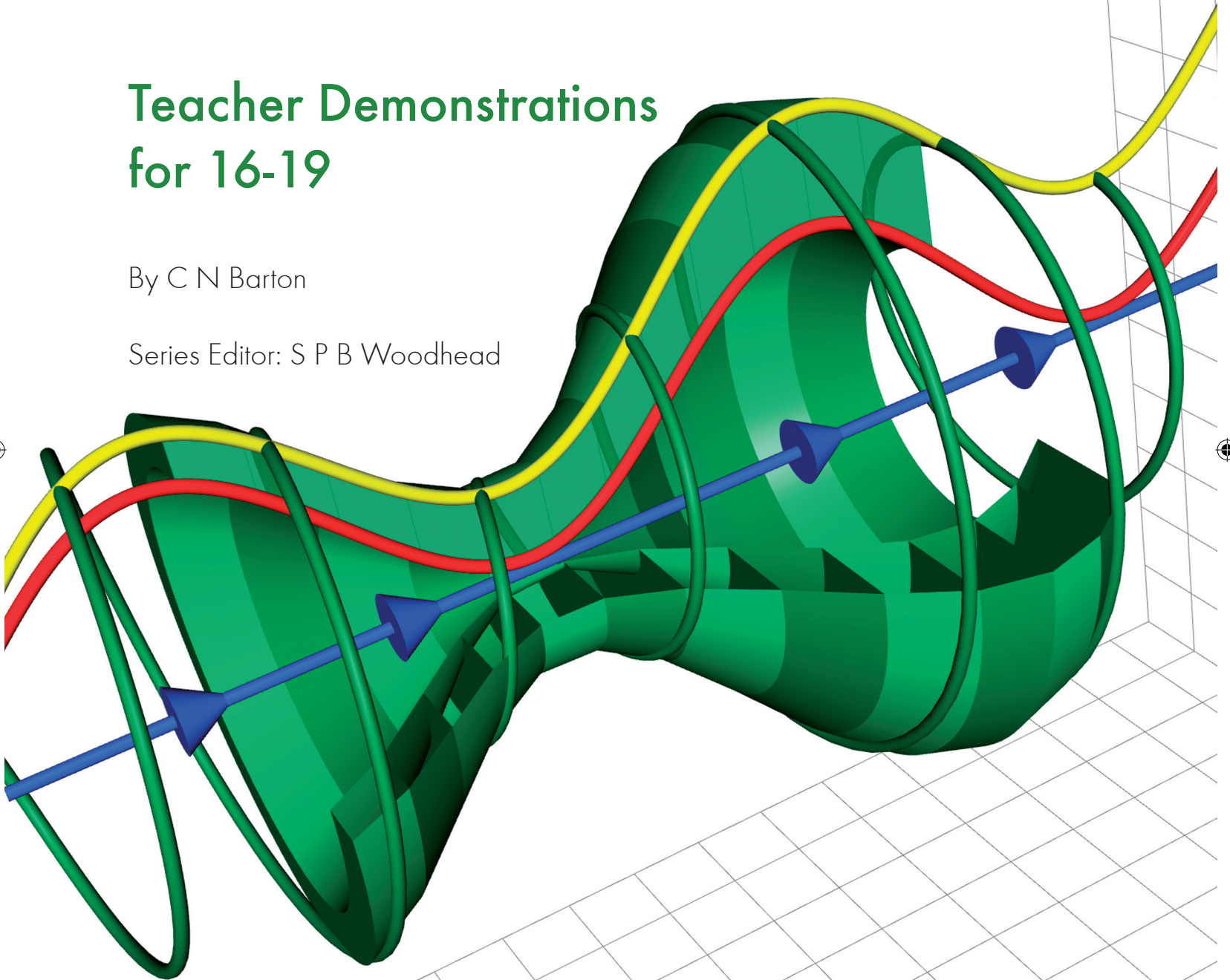
Autograph

Activities

Teacher Demonstrations
for 16-19

By C N Barton

Series Editor: S P B Woodhead



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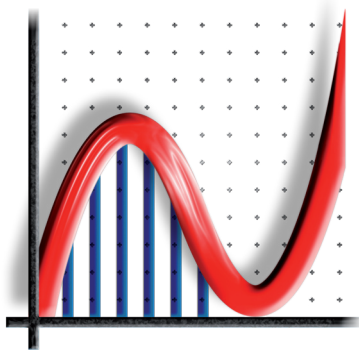
Key

Autograph Function Name
Keyboard Shortcut



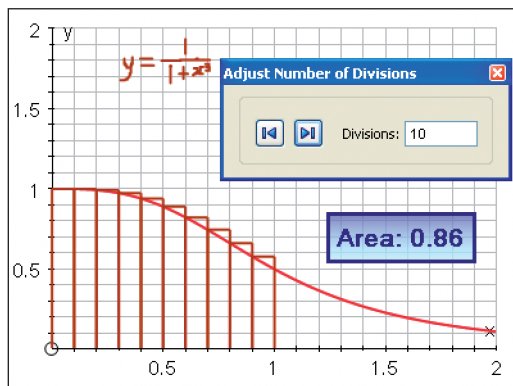
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GETTING GOING



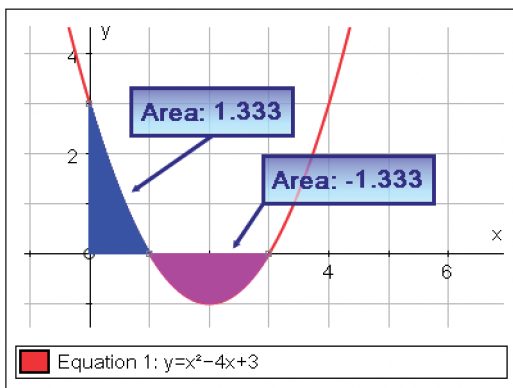
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TEACHER DEMONSTRATIONS



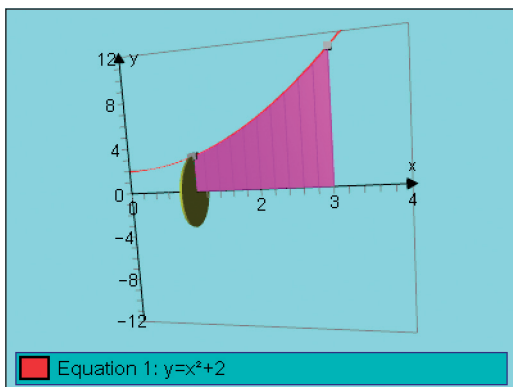
T1 The Trapezium Rule.....	39
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A demonstration which dynamically illustrates and compares two types of numerical integration: Rectangles and the Trapezium Rule. Students are introduced to over and under estimates, as well as issues of the concavity of functions.



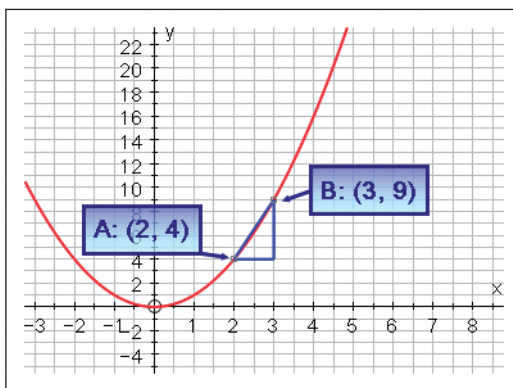
T2 Things to Watch Out for when Integrating47

A demonstration which clearly conveys and explains the notoriously misunderstood issues surrounding integration – negative areas, improper integrals, unbounded functions and unbounded integrals.



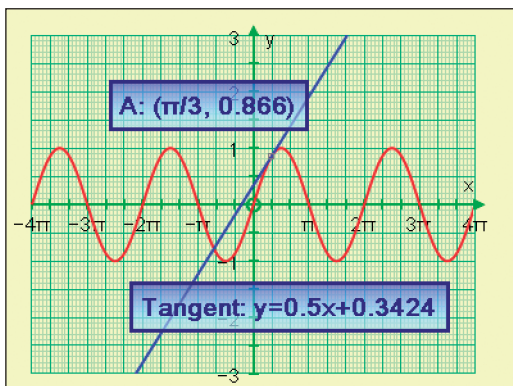
T3 Introducing Volume of Revolution57

This demonstration utilises Autograph's unique 3D interface to dynamically and interactively introduce students to the concept of the volume of revolution. Students can see solid shapes forming and hence are able to derive the formula for calculating their volumes.



T4 Introducing the Concept of Differentiation69

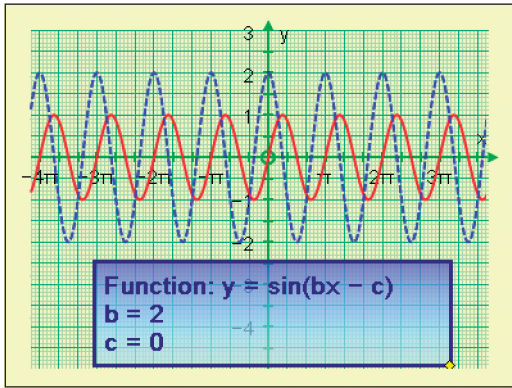
An interactive and dynamic demonstration that allows students to visualise exactly where the concept of differentiation is derived from. This demonstration lays the foundations for differentiation from first principles.



T5 Discovering the Gradient Functions of Trigonometric Functions79

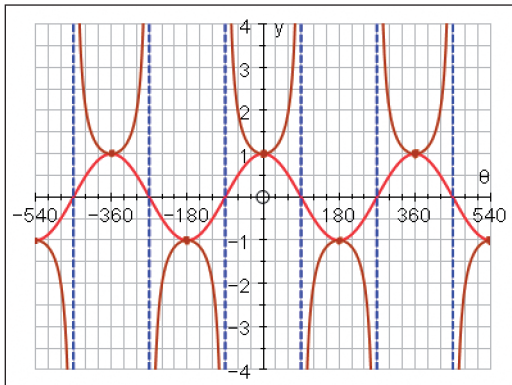
This demonstration allows a class to interactively discover the gradient functions of $y = \sin(x)$, $y = \cos(x)$ and $y = \tan(x)$. There is plenty of opportunity for class participation!





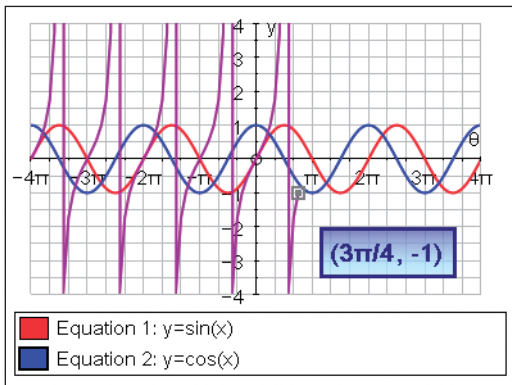
T6 Discovering the Chain Rule91

This demonstration dynamically and intuitively allows students to discover the Chain Rule making use of Autograph's Constant Controller and building upon the prior work on trigonometric functions.



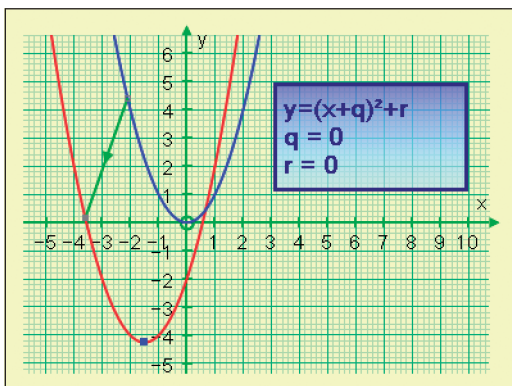
T7 Reciprocal Trigonometric Functions 103

This demonstration allows students to interactively and dynamically build up a picture of the shapes of the graphs $y = \sec(\theta)$, $y = \operatorname{cosec}(\theta)$ and $y = \cot(\theta)$ from the shapes of the graphs $y = \cos(\theta)$, $y = \sin(\theta)$ and $y = \tan(\theta)$.



T8 Investigating Trigonometric Identities 115

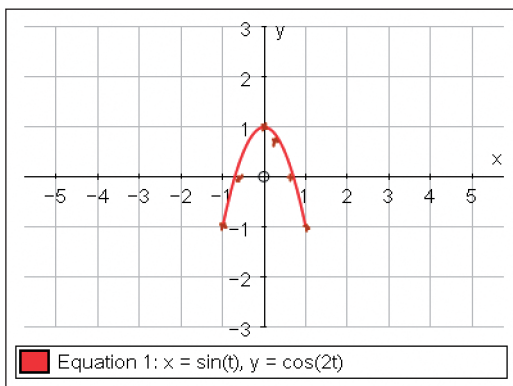
This demonstration allows students to visualise common trigonometric identities, such as $\tan(\theta) = \sin(\theta)/\cos(\theta)$ and $\sin^2(\theta) + \cos^2(\theta) = 1$, and understand exactly why they work.



T9 Completing the Square: A Graphical Approach 127

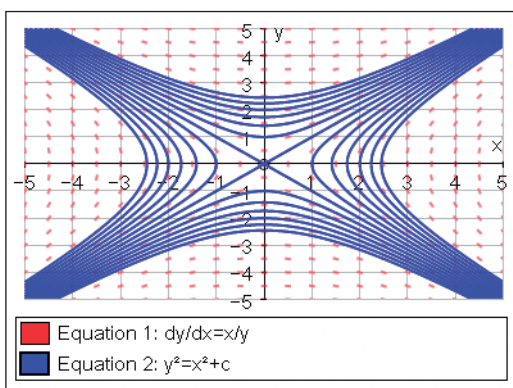
This demonstration is designed to illustrate to the students the importance and usefulness of the completed square form of an equation in terms of co-ordinate geometry. There are four challenging questions included to put students to the test and provoke interesting discussion.





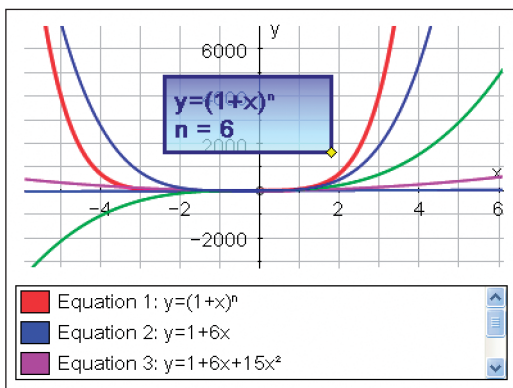
T10 Trigonometric Parametric Equations 141

In this demonstration, students are introduced to the concept of parametric equations in a visual and dynamic way. They are encouraged to experiment and suggest variations which will help consolidate and deepen understanding of what can be a rather difficult topic.



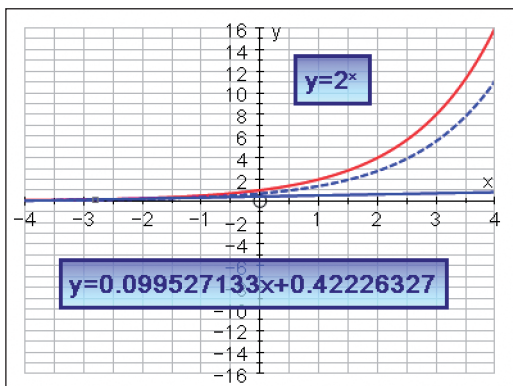
T11 Discovering First Order Differential Equations 153

In this demonstration, students are dynamically introduced to the concept of first-order differential equations using one of Autograph's most powerful functions.



T12 Understanding the Binomial Approximation 163

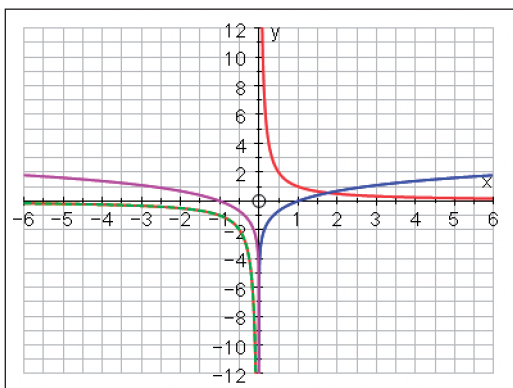
Students are presented with a graphical representation of the binomial approximation to really get a feel for what binomial approximations are actually doing and what values of x they are appropriate for. Negative and fractional powers are also covered.



T13 Discovering e 179

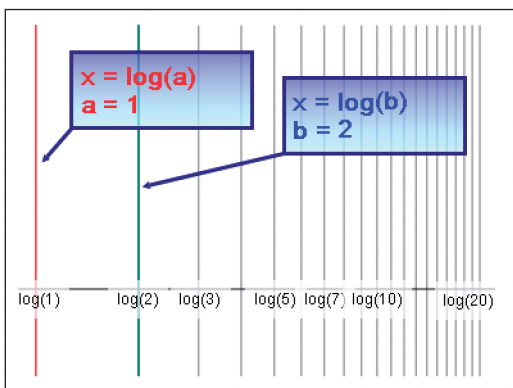
This demonstration dynamically and intuitively allows students to discover the value of e , whilst at the same time consolidating understanding about the relationship between functions and their gradient functions.





T14 Discovering the Natural Log Function 191

This demonstration allows students to interactively build up a picture of the shape of the $y = \ln(x)$ from the graph of $y = 1/x$, calling upon knowledge of integration, gradient functions and the role of constants. This demonstration establishes the important link between the two functions and further illustrates the wonder of e .



T15 Laws of Logs: A Graphical Approach 205

A dynamic and interactive way of discovering the laws of logarithms. Students have the opportunity to make predictions and hence discover the laws of logs for themselves.





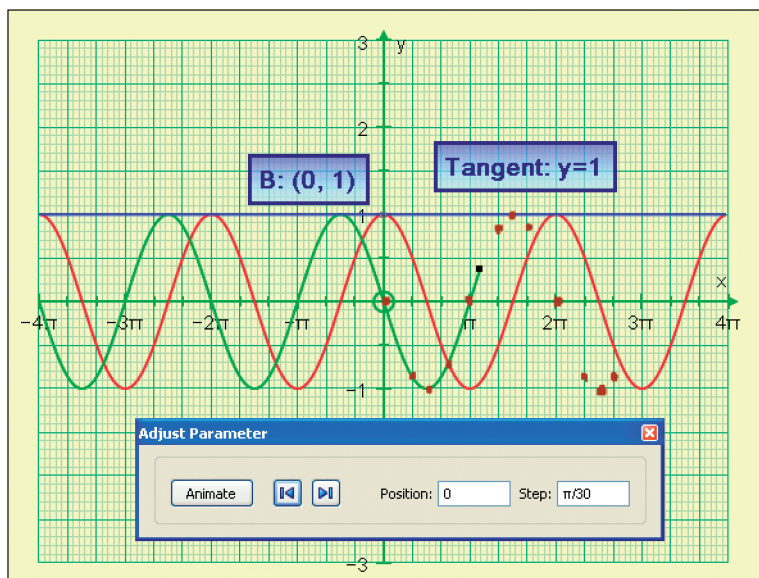
Enter the equation: $y = -\sin(x)$

The curve should begin to be drawn on the screen, hopefully going through the students' points.



Press **Pause Plotting** (or the **Spacebar** on the keyboard) both to stop the process, and to resume it to focus on the key features of the graph.

Your screen should look something like this:



Teacher: So, the gradient function of $y = \cos(x)$ is $y = -\sin(x)$. This leaves one question: what on earth is the gradient function of $y = \tan(x)$?

ACTIVITY 3: $y = \tan(x)$



Open Page - 3 by clicking the **Tab**.

Teacher: Now, the graph of $y = \tan(x)$ is incredibly tricky to draw. Is anybody feeling brave enough to come to the board and give it a go?

Prompt: At what points does the graph cross the x-axis? At what points is the graph undefined / have asymptotes?



Encourage students to come to the front to sketch their curves.



Use the **Erase** tool to rub out any mistakes.

If you want to get rid of all scribbles, click on **Edit** > **Select All Scribbles**, and press **Delete** on the keyboard (or **right-click** on the graph area and select **Delete Objects** from the menu).

When you are ready:



Ensure **Slow Plot** is turned on.

