

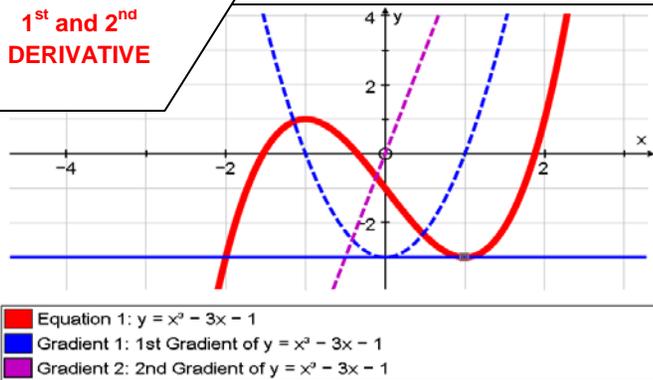
# Autograph

version 3

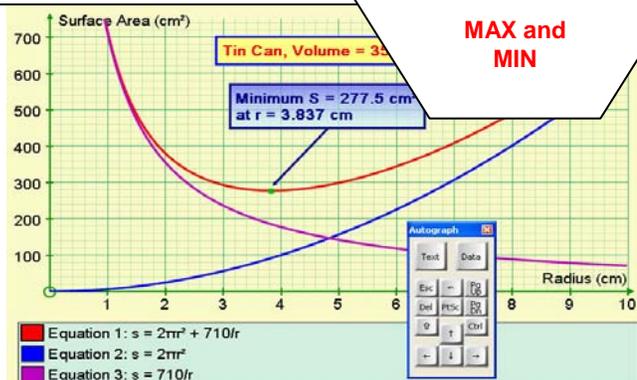
and High School CALCULUS courses

Autograph is spectacular dynamic software from the UK that allows teachers to visualise many of the mathematical topics that occur in Pre-CALCULUS and CALCULUS courses. [AP Calculus: see separate document]

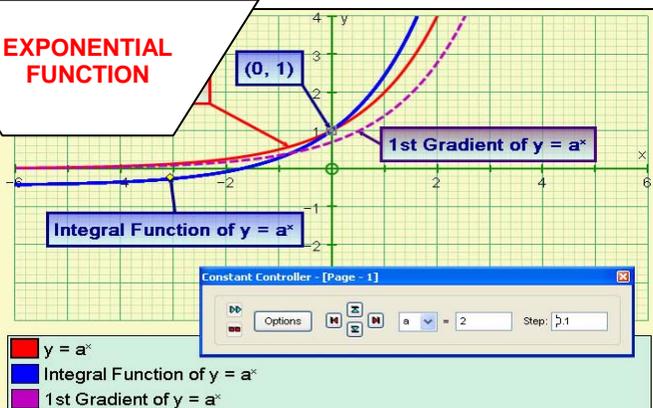
## 1<sup>st</sup> and 2<sup>nd</sup> DERIVATIVE



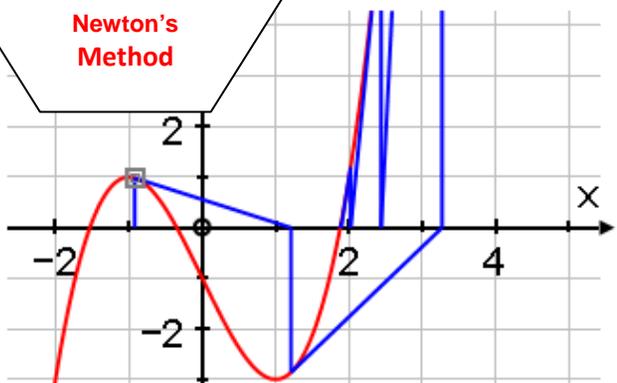
## MAX and MIN



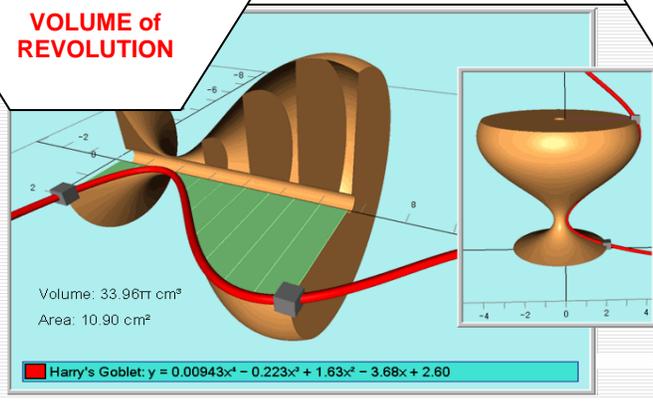
## EXPONENTIAL FUNCTION



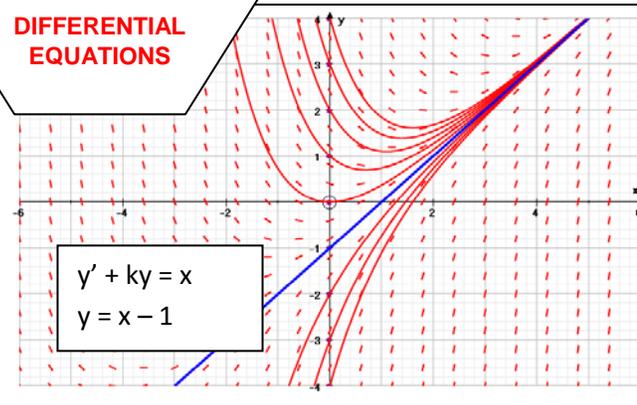
## Newton's Method



## VOLUME of REVOLUTION



## DIFFERENTIAL EQUATIONS



### THE LEARNING TEAM

200 Business Park Drive, Suite 303, Armonk, NY 10504, USA

Tel: +1 914 219 5608  
 Contact: Sebastian Cervantes

[www.learningteam.org/autograph](http://www.learningteam.org/autograph)

Fax: +1 914 273 0936  
[sales@learningteam.org](mailto:sales@learningteam.org)

# USA: Topic Outline for High School CALCULUS courses

with references to Autograph

=====



AUTOGRAPH PAGE

=====

## PRE-CALCULUS

**Functions: function of a function. Constant and identity function.  
The absolute value function. The square root and cubic function.**



2D

Polynomial functions: The degree; the general form of a polynomial.  
The roots of a polynomial. The x- and y-intercepts of a graph.

**The straight line: defined by slope and point; parallel/perp. lines.  
The slope-intercept form:  $y = mx + b$**



2D

**Quadratics: solve by factoring. Quadratic inequalities.  
Completing the square. Sum and product of roots; quadratic formula.  
The vertex of a parabola. Vertical stretches and shrinks.**



2D

The remainder theorem: division by  $x - a$ ; Roots of polynomials  
The factor theorem. The integer root theorem. Conjugate pairs.  
Multiple roots. Point of inflection. Concave upward, concave downward.

**Reflections of a graph: about x-axis, y-axis, through the origin.  
Symmetry of a graph: Symmetry with respect to the y-axis.  
Symmetry with respect to the origin. Odd and even functions.**



2D

**Translations of a graph: The equation of a circle.  
Rational functions; Singularities. The reciprocal function.  
Horizontal and vertical asymptotes.**



2D

**Inverse functions: Constructing; graph of an inverse function  
Logarithms: common and natural logarithms. The laws of logarithms. Change  
of base. Logarithmic and exponential functions**



2D

Factorials; Permutations and Combinations; The binomial theorem;  
Pascal's triangle. Sequences, series, and probability  
Sigma notation; Arithmetic sequences; Geometric sequences

**Vectors: Cartesian and polar coordinates; Parametric equations**



2D

**CALCULUS**

Cartesian plane; functions; distance formula; Lines in the plane; slope;  
Circles; Functions; Continuity; Limits & asymptotes; Curve sketching



Differentiation: the slope of a curve; Differentiability and continuity  
The derivative as a rate of change; Higher order derivatives  
The product and quotient rules



Position , velocity, acceleration; The chain rule and the general power rule;  
Implicit differentiation; Extrema on an interval; The mean value theorem  
Increasing and decreasing functions; Concavity & the second derivative  
Optimization problems (max/min problems)



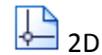
Newton's method



Integration: indefinite integral ; U-substitution; general power rule  
The fundamental theorem of calculus; Area and the definite integral  
Trapezoid rule; Average value of a function; Area between two curves  
Volumes of revolution ("discs" & "shells")  
Volumes of solids with known cross section



Exponential and logarithmic functions  
Differentiation and integration of exponentials; Inverse functions;  
Logarithmic functions; Natural logarithmic differentiation  
Natural logarithmic integration



Differential equations: Growth and decay; L'Hopital's rule  
Derivatives and integrals of trigonometric functions and inverses  
Integration techniques; Integration by parts



AP CALCULUS and AP STATISTICS - see separate documents

DOUGLAS BUTLER  
ICT Training Centre, Oundle, UK

[debutler@argonet.co.uk](mailto:debutler@argonet.co.uk)  
[www.tsm-resources.com](http://www.tsm-resources.com); [www.autograph-maths.com](http://www.autograph-maths.com)

Oundle, May 2009