**Differential and Integral Formulae**

Formulae in **bold** are for Further Maths only, and those given in the formula booklet are in red.

Differentials

Note that .

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First principles:

Chain rule:

Product rule:

Quotient rule:

Parametric differentiation:

Variable acceleration (mechanics):

Further kinematics (mechanics):

Integrals

Note that .

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Area under a curve:

The area under a curve with equation bounded by the -axis, and the lines , and , is given by

Reverse chain rule:

any constant.

any constant.

Integration by parts:

Area bounded by two curves:

Where the area is bounded by two curves with equations and , and the lines , and , and the curves do not intersect between the lines,

Area under parametrically defined curves:

Where the area is bounded by a curve where both and are functions of a parameter , and the lines , and ,

The trapezium rule:

Where is the number of equal strips, and the area is bounded by a curve which cannot be algebraically integrated, and the lines , and ,

Separable first order differential equations:

Integration as the limit of a sum:

Where the area bounded by a curve with equation , and the lines , and can be thought of as a series of thin strips of height , and width ,

Variable acceleration (mechanics):

Further kinematics (mechanics):

**Volumes of revolution:**

**rotated through radians about the -axis,**

**rotated through radians about the -axis,**

**Where the region bounded by a curve where both and are functions of a parameter , and the lines , and , is rotated through radians about the -axis.**

**Where the region bounded by a curve where both and are functions of a parameter , and the lines , and , is rotated through radians about the -axis.**

**Area enclosed by a polar curve:**

**Where the area of a sector is bounded by a polar curve with equation , and the   
half-lines , and ,**

**Mean value of a function:**

**The mean value of a function over the interval is given as,**

**Non-separable first order differential equations:**

**Second order homogeneous differential equations:**

**on the natures of the roots of the auxiliary equation , and .**

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|  | **and are distinct.**  **The general solution will be of the form**  **are arbitrary constants.** |
|  | **There is one root , which is a repeated root.**  **The general solution will be of the form**  **are arbitrary constants.** |
|  | **and are complex conjugates.**  **The general solution will be of the form**  **are arbitrary constants.** |

**Second order non-homogeneous differential equations:**

**and the form of .**

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| **Form of** | **Form of Particular Integral** |
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