

**Project / Draft # 4**

[2 periods of 45' / 1h30' / week]

Note : requirement : improve your understanding and knowledge of both Maths and English.

|                             |   |
|-----------------------------|---|
| <p>Tuesday<br/>Sept. 15</p> | <p>1) <b>Elementary functions : [函数]</b><br/>                 Examples - Equations - graphs (.ppt) - properties</p> <p>a) Polynomial functions :<br/> <math display="block">P : x \mapsto y = a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0 = \sum_{k=0}^{k=n} a_k x^k</math></p> <p>(i) Quick review on 1<sup>st</sup> and 2<sup>nd</sup> degree<br/> <math>l : x \mapsto y = ax + b</math> and <math>T : x \mapsto y = ax^2 + bx + c</math></p> <p>(ii) Examples of 3<sup>rd</sup> and 4<sup>th</sup> degree functions<br/> <math>f : x \mapsto y = ax^3 + bx + c</math> and <math>f : x \mapsto y = ax^4 + bx^2 + c</math></p> <p>b) Inverse and Homographic functions :<br/>                 (i) Quick review on <math>f : x \mapsto y = \frac{A}{x}</math><br/>                 (ii) Extension to <math>f : x \mapsto y = \frac{A}{x-L} + H</math><br/>                 (iii) Homographic form : <math>f : x \mapsto y = \frac{ax+b}{cx+d}</math></p> <p>c) Rational functions : <math>R : x \mapsto y = \frac{ax^2 + bx + c}{a'x^2 + b'x + c'}</math></p> <p>d) Irrational functions : <math>r : x \mapsto y = \sqrt{\frac{ax^2 + bx + c}{a'x^2 + b'x + c'}}</math></p> <p>e) Exponential &amp; Logarithm: <math>f : x \mapsto y = a^x</math> and <math>g : x \mapsto y = \log_a(x)</math></p> <p>f) Trigonometric functions : <math>f : x \mapsto y = A \sin(ax + b) + B \cos(cx + d)</math></p> |
| <p>Tuesday<br/>Sept. 22</p> | <p>2) <b>Introduction to limits</b><br/>                 Examples / graphs / Exercises</p> <p>a) Polynomial functions : <math>\lim_{x \rightarrow \infty} P(x)</math></p> <p>b) Rational functions <math>\lim_{x \rightarrow \infty} R(x)</math> ; <math>\lim_{x \rightarrow \alpha} R(x)</math> ; <math>\lim_{x \rightarrow 0} R(x)</math></p> <p>c) Irrational functions <math>\lim_{x \rightarrow \infty} r(x)</math> ; <math>\lim_{x \rightarrow \alpha} r(x)</math> ; <math>\lim_{x \rightarrow 0} r(x)</math></p>   |
| <p>Tuesday<br/>Sept. 29</p> | <p>3) <b>Formal Definitions of limits</b><br/>                 Examples / graphs / Exercises</p> <p>a) Infinite limits <math>\lim_{x \rightarrow \pm\infty} f(x) = \pm\infty</math> ; <math>\lim_{x \rightarrow \pm\infty} f(x) = a</math> ; <math>\lim_{x \rightarrow a} f(x) = \pm\infty</math></p> <p>b) Graphic interpretations : asymptotes [渐进线]</p>  |
| <p><b>Oct. 1 - 8</b></p>    | <p><b>National Holyday of the 60<sup>th</sup> anniversary<br/>of the people's Republic of China</b></p>   |

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| Tuesday<br>Oct. 13 | <p>4) <b>General Theorems on limits</b><br/>Examples / graphs / Exercises</p> <ul style="list-style-type: none"><li>a) Sum, products, quotients, square root. [Chart of combinations]</li><li>b) Application to Rational and Irrational functions</li><li>c) Undetermined cases types : <math>\infty - \infty</math>; <math>\frac{\infty}{\infty}</math>; <math>\frac{0}{0}</math>; <math>0 \times \infty</math></li></ul> |
| Tuesday<br>Oct. 20 | <p>5) <b>Applications of limits to determine aspects of the graph of a function</b><br/>Examples / graphs / Exercises</p> <ul style="list-style-type: none"><li>a) Infinite branches</li><li>b) Asymptotes parallel to one axis</li><li>c) Asymptote non parallel to one axis</li></ul>  |
| Tuesday<br>Oct. 27 | <p>6) <b>Introduction to the Derivative [导函数] in one point :</b><br/>Examples / graphs / Exercises</p> <ul style="list-style-type: none"><li>a) Formal definition [Vol. A 2-2 p.1-13 - 2005]</li><li>b) Illustration / graph : Tangent in one point.</li><li>c) Linear approximation of a function in one pt.</li><li>d) Application to approximation in calculus</li></ul>  |
| Tuesday<br>Nov. 3  | <p>7) <b>General Formulas of the Derivatives :</b><br/>Examples / graphs / Exercises<br/>Some examples of proofs [Vol. A 2-2 p.14-19 - 2005]</p> <ul style="list-style-type: none"><li>a) Sum and product</li><li>b) Power and quotient</li><li>c) Square root</li><li>d) Composite functions.</li><li>e) Trig functions</li><li>f) Exponential and Log</li></ul>  |

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| Tuesday<br>Nov. 10 | <b>8) Applications of the Derivatives to the variations of a function on a given interval :</b><br>[Polynomial and rational functions] <ul style="list-style-type: none"><li>a) Theorem of the sign of the derivative</li><li>b) Theorem of Minima and Maxima</li><li>c) Chart of the variations of a function</li><li>d) Construction of the curve</li></ul>   |
| Tuesday<br>Nov. 17 | <b>9) Review : 20 exercises plus applications of Calculus in Physics</b> [Max. power in an electrical circuit, and Fermat Optics] <ul style="list-style-type: none"><li>a) Calculation of the derivative</li><li>b) Chart of the variations of the function</li><li>c) Construction of the curve</li><li>d) Special points : interception with axes</li><li>e) Asymptotes</li><li>f) Coordinates of Max and Min</li></ul> |
| Tuesday<br>Nov. 27 | <b>10) Use of computers to check calculations :</b><br>Exercises and practice in the computer Lab. <ul style="list-style-type: none"><li>a) Introduction to Mapple.</li><li>b) Use of software to build curves of functions with asymptotes and tangents.</li><li>c) Compare the graphs of a function and its derivative.</li></ul>   |
| Tuesday<br>Dec. 1  | <b>11) Introduction to Euler's Method</b> <ul style="list-style-type: none"><li>a) Use of Excel to build the graph of a function point to point.</li><li>b) Construction of the Exponential function</li><li>c) Examples and practice in Computer Lab</li></ul>   |

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| Tuesday<br>Dec. 8  | 12) <b>Introduction to Primitive functions</b> [原函数]<br>Examples and practice<br>a) Use of inverse formulas from the derivatives.<br>b) Use of formula of the composite functions.  |
| Tuesday<br>Dec. 15 | 13) <b>Introduction of the finite integral</b> : $I = \int_a^b f(x)dx$<br>Examples and practice<br>a) General properties of the integral<br>b) The fundamental Theorem of Calculus<br>c) Applications to the Area calculations.                   |
| Tuesday<br>Dec. 22 | 14) <b>Integration by parts.</b><br>Examples and practice [.ppt]<br>a) General formula and Examples $\int_a^b u'v = [uv]_a^b - \int_a^b uv'$<br>b) Applications to the calculations of an area<br>c) Applications to the calculations of a volume |
| Tuesday<br>Dec. 29 | 15) <b>Application of Calculus to Physics</b> :<br>a) Curve of a rocket<br>b) Periodical movements of a spring  |
|                    | 16) <b>General review on functions on computers.</b><br>Examples and practice with Mapple or SketchPad<br>a) Derivatives / Graphs / Integrals<br>b) Sequences of functions depending on a parameter : $y = f_n(x)$                                |