

MODULE N. 1 Title: DERIVATIVES	
Lesson n. 1 Basic idea and definition (2 hours)	
CONTENT	<p>To introduce the students to the idea of derivative and its meaning.</p> <ul style="list-style-type: none"> - Define the slope of a secant line to a curve; introduce the incremental ratio. - Define derivative as the limit of the increment(al) ratio (also known as Newton difference quotient) as the step (that is h or Δx) approaches zero. - Start from the definition to obtain the derivative of some elementary functions.
LANGUAGE	To acquire the basic language to describe functions, limits and the derivative
STUDY SKILLS AND STRATEGIES	To complete activities, to report back, describe and explain. Lesson is developed in the usual way.
<p>Activity 1: The students have to determine the slope of the secant line cutting the parabola of equation: $y = -(x^2)/4 + x$ across the points A and B, where $x_A = 1$ and $x_B = 5/2$. The parabola is our function.</p>	
<p>Activity 2: The students have to write the incremental ratio of the previous function. Here $h = (x_B - x_A)$.</p>	
<p>Activity 3: The students have to solve the limit of the incremental ratio (as h approaches zero, i.e. x_B approaches x_A), and compare the value obtained with the technique they know since the third year course.</p>	
HOMEWORK	<p>To watch the following videos:</p> <p>https://www.youtube.com/watch?v=rAof9Ld5sOg https://www.youtube.com/watch?v=ZvCWt4BjbyI</p> <p>and/or</p> <p>https://www.khanacademy.org/math/ap-calculus-ab/derivative-introduction-ab/derivative-as-tangent-slope-ab/v/derivative-as-slope-of-tangent-line</p> <p>To examine the following web site:</p> <p>http://tutorial.math.lamar.edu/Classes/CalcI/DefnOfDerivative.aspx</p> <p>To find the derivative of the following functions:</p> <p>a) $f(x) = \sin(2x)$; b) $f(x) = e^{2x}$ c) $f(x) = 2x^2 - 3x + 1$</p> <p>starting from the definition of derivative.</p>

MODULE N. 1 Title: Derivatives	
Lesson n. 2: Derivatives (1 hour)	
CONTENT	Determine the derivative of a function in order to find its tangent line to a given point.
LANGUAGE	To employ the acquired basic language to describe derivative.
STUDY SKILLS AND STRATEGIES	To complete activities, to report back, describe and explain. Lesson performed in the usual way; moreover, students have to speak using the correct terminology.
<p>Activity 1: Let $y = - (1/x)$:</p> <ul style="list-style-type: none"> • The incremental ratio is: • Write and solve the limit of the incremental ratio. The derivative is:..... • Plot the function on a xy cartesian frame of reference 	
<p>Activity 2: Write the equation of the tangent line to the previous function with respect to the point $A(1;-1)$. Draw the tangent line.</p>	
<p>Students at the blackboard with the teacher have to show and explain the solution obtained, using the proper terminology.</p>	

MODULE N. 1 Title: Derivatives	
Lesson n. 3: The chain rule (2 hours)	
CONTENT	The very important chain rule for derivatives calculation.
LANGUAGE	To employ the terminology previously learned.
STUDY SKILLS AND STRATEGIES	The students have to watch a video explaining this important rule. Moreover, they have to apply this technique to solve simple exercises.
<p>Activity 1: Let examine the following video lesson: https://www.khanacademy.org/math/ap-calculus-ab/product-quotient-chain-rules-ab/chain-rule-ab/v/chain-rule-introduction</p> <p>Discuss this lesson with the teacher.</p>	
<p>Activity 2: Find the derivative of the following functions:</p> <p>a) $f(x) = \arctg(\log(x))$; b) $f(x) = \log(1/\sin(x))$; c) $f(x) = \cos(3x^5 + 2x)$ d) $f(x) = e^{\sin(x)+\cos(x)}$; e) $f(x) = x^{\ln(\sin(x))}$; f) $f(x) = \arcsen(\tg(x))$</p>	
Students at the blackboard with the teacher have to show and explain the solution obtained, using the proper terminology.	

While derivative is (quite) easily understood by students, and so are normally the rule to compute derivatives of elementary functions, the chain rule is not. The chain rule, that is the rule to obtain derivative of composite functions, needs more training and example, initially under teacher's guide, and then as individual work.