

Mathematics Curriculum

Subject Area: Advanced Placement Calculus AB 11-12					
Advanced Placement Topic: Limits					
Show-Me Standards					
	Advanced Placement Standard	Show Me Standards	DOK	Instructional Strategies Student Activities/Resources	Assessment
	<i>The students will:</i>				
Graphically	1. relate the informal definition of a limit to various functions and determine values.	MA 5 3.4	Strategic Thinking	1. Evaluate limits by the informal definition and graphically.	1. Evaluate the limit as x approaches 0 of x^{-2} (SMP 4,5)
Numerically	1. evaluate limits using direct substitution.	MA 5 3.4	Skill/Concept	1. Determine when direct substitution is appropriate.	1. Given a polynomial function, evaluate the limit. (SMP 4)

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	<i>The students will:</i>				
Analytically	1. develop skills in factor and reduce, rationalizing numerators , special limits of sine and cosine and division with greatest power in the denominator to evaluate limits.	MA 5 3.4, 3.6	Strategic Thinking	1. Determine the correct process to solve limits of rational expressions.	1. Find the $\lim_{x \rightarrow 2} (x-2) \div (x^2-4)$ (SMP 4,y)
One-Sided	1. Evaluate limits of various functions from either the right or the left.	MA 5 3.4	Skill/Concept	1. Apply various methods of solving limits to determine the limit from the left or the right.	1. $\lim_{x \rightarrow 3^-} (x-3)^{-1}$ (SMP 4,5)

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	<i>The students will:</i>				
Infinite	1. Determine how limits fail to exist by showing that they approach either positive or negative infinite.	MA 5 3.5	Skill/Concept	1. Apply various methods of determining limits including graphs to find infinity.	1. $\lim_{x \rightarrow 1} (x-1)^{-2}$ (SMP 4,5)
L' Hopital's Rule	1. After learning rules of differentiation students will determine the application of L'Hopitals Rule.	MA 5 3.4	Strategic Thinking	1. Following the defined application of L'Hopital's Rule, students will apply, often repeatedly, the rule defined limits.	1. $\lim_{x \rightarrow 0} (\sin 3x) \div (3x)$ (SMP 1,2,4,5)
Limits at Infinity	1. Evaluate limits at positive or negative infinity to find horizontal asymptotes of rational functions and later apply to solve limits in general.	MA 5 3.5	Strategic Thinking	1. Evaluate various limits as x approaches positive or negative infinity.	1. $\lim_{x \rightarrow \infty} (\sin x) \div x$ (SMP 2,4,5,7)

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	<i>The students will:</i>				
Power, Product, Quotient, Chain Rules	1. find 1st and 2nd derivatives applying power, product, quotient and chain rules.	MA 5 3.1, 3.6	Strategic Thinking	1. Determine which is appropriate; power, product, quotient or chain rule, then apply.	1. $y=(3x^2+4x)^5$ (SMP 1,6)
Implicit	1. distinguish between explicit and implicit equations. Then, find 1st and 2nd derivatives using rules for implicit differentiation.	MA 5 3.1, 3.4	Strategic Thinking	1. Determine if solving implicitly or leaving and using rules of explicit derivatives.	1. $xy+3x^2y=7$, find y' (SMP 1,6)

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	<i>The students will:</i>				
Rates of change, average and instantaneous	1. distinguish between average rate of change and instantaneous rates of change.	MA 5 3.1	Skill/Concept	1. Given a function and a defined interval, contrast average and instantaneous rates of change.	1. Find the average rate of change of $x(t)=t^2+2t+5$ over the interval $[1,6]$ (SMP 1,4)
Equation of tangent and normal lines	1. apply 1st derivatives to find equations of normal and tangent lines.	MA 5 3.4	Strategic Thinking	1. Apply various 1st derivatives and a point of tangency that is given or must be found. Various equations of tangent and normal lines will be written.	1. Write the equation of the tangent and normal line of $y=\sin x$ at $\pi/2, 1$ (SMP 1,5,6)

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Related Rates	1. apply implicit thoughts to solve related rate problems.	MA 5 3.1, 3.4	Strategic Thinking	1. Given various situations an equation or a system of equations must be written involving given variables and a variable to be determined to solve related rates.	1. A spherical balloon is inflated with gas at the rate of 800 cm ³ /min. How fast is the radius of the balloon increasing when the radius is 30 cm? (SMP 1,2,6)
Natural Logs	1. find derivatives involving natural logs.	MA 5 3.5	Skill/Concept	1. Understand and apply rules of natural logs to find various derivatives.	1. Find y' given $y=(\ln x)^4$ (SMP 4)

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	<i>The students will:</i>				
Trigonometric Functions	1. find the derivatives of all six trig functions.	MA 5 3.1, 3.4	Skill/Concept	1. Apply previous derivatives in combination with the trigonometric derivatives to solve.	1. $y=(3x+2)(\sin 2x)$ find y' (SMP 4,5)
Inverse Trigonometric Functions	1. apply differentiation rules for inverse trig functions.	MA 5 3.5	Skill/Concept	1. Solve differentiation problems involving trigonometric inverses.	1. Find y' of $y=x \arcsin x$ (SMP 4,6)
Exponential Functions	1. find derivatives of exponential functions of base e and other bases.	MA 5 3.5	Strategic Thinking	1. Find 1st derivatives of exponential functions.	1. Find y' of $y=e^{2x}$ (SMP 4,6)

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	<i>The students will:</i>				
Relative and Absolute Extremas	1. find absolute extrema. Find relative extrema by 1st and 2nd derivative test.	MA 5 3.1, 3.4	Strategic Thinking	1. Distinguish between absolute and relative extrema. Understand the process of finding extrema by 2nd derivative test.	1. Given $y = \sin x$ $[0, \pi]$ find a) absolute extrema b) relative extrema (SMP 1,6)
Increasing and Decreasing Concavity	1. given various functions, find intervals of increasing, decreasing, and concavity.	MA 5 3.1,3.4	Strategic Thinking	1. Apply 1st derivative test to find intervals of increasing and decreasing. Apply 2nd derivative test to determine intervals of concavity.	1. Given $y = \cos 2x$ $[0, 2\pi]$ find a) intervals of increasing or decreasing b) intervals of concavity (SMP 1,6)

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	<i>The students will:</i>				
Points of Inflection	1. find 2nd derivatives and determine the existence of points of inflection.	MA 5 3.1, 3.4	Strategic Thinking	1. Using the definition of points of inflection, determine if they exist and find them.	1. $y = \sin 2x$ $[0, 2\pi]$ find all points of inflection. (SMP 1,6)
Find Maximum and Minimums	1. write equations from word problems and find maximum or minimum values.	MA 5 3.1, 3.4	Strategic Thinking	1. Translate given information into an equation to determine a maximum or a minimum value.	1. A rancher has 200 ft of fencing to enclose two adjacent, rectangular pens. What dimensions should be used to create a maximum area? (SMP 1,2,4)

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Rolles and Mean Value Theorem	1. define and apply Rolles and Mean Value Theorem.	MA 5 3.4	Strategic Thinking	1. Determine and if possible, apply Rolles and Mean Value Theorem.	1. Determine whether Rolles Theorem can be applied to $f(x)=(x-1)(x-2)(x-3)$ on $[1,3]$. If it can not be applied, explain why. If it can be applied, find the value of c that is guaranteed. (SMP 1,2,6)
Velocity and Acceleration	1. determine average velocity, velocity and acceleration.	MA 5 3.4, 3.5	Skill/Concept	1. Find average velocity, velocity and acceleration given equations and intervals.	1. $s(t)=-16t^2+64t+20$ a) Find velocity at $t=2$ b) Find acceleration when the velocity is equal to 0. (SMP 1,6)

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	<i>The students will:</i>				
Indefinite Integration and Area by Limits	1. apply rules of summation to find area using limits. 2. learn and apply basic rules of integration for indefinite integrals.	MA 5 3.4	Skill/Concept	1. Sketch and solve area by using summation rules and limits. 2. Apply power rule, trig integrals and basic properties of integration to solve integration problems.	1. Use the limit process to find the area of the region between the graph of $y=-2x+3$ and the x-axis over $[0,1]$. 2. $\int(3x+4)(2x+1)dx$ solve. (SMP 1,6)
Reimann Sums	1. find area using Reimann Sums.	MA 5 3.2	Strategic Thinking	1. By the use of applying the limit of a sum, solve various questions by Reimann Sums.	1. Using Reimann's Sum, find the area formed by $f(x)=4-2x$, the x-axis, over $[0,2]$ with six equal sub intervals. (SMP 1,4,5)

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	<i>The students will:</i>				
Definite Integrals	<ol style="list-style-type: none"> 1. apply the Fundamental Theorem of Calculus and other theorems to solve integrals. 2. apply the 2nd Fundamental Theorem of Calculus to solve integrals. 	MA 5 3.2	Skill/Concept	<ol style="list-style-type: none"> 1. Apply integration rules and evaluate using the Fundamental Theorem of Calculus. 2. Determine if a function is continuous on a given interval. Apply the 2nd Fundamental Theorem of Calculus. 	<ol style="list-style-type: none"> 1. Find the area of the region bounded by $y=x^3+x$, $x=2$, $y=0$. 2. Find the derivative of $F(x)=\int_0^x \cos t \, dt$ from $[0,x]$ (SMP 1,5,6)
Rules of Integration	<ol style="list-style-type: none"> 1. Power 2. Trigonometric 3. Natural Log 4. Inverse Trig 5. Substitution 6. Exponential Function 	MA 5 3.2, 3.5	Skill/Concept	<ol style="list-style-type: none"> 1. Apply integration rules for the Power Rule. 2. Apply integration rules for the Trigonometric Functions. 3. Apply integration rules to Natural Logarithms. 4. Apply integration rules to Inverse Trig Functions. 5. Apply the technique of substitution for integration. 6. Apply integration rules to Exponential Functions. 	<ol style="list-style-type: none"> 1. $\int 4x \, dx$ 2. $\int 4\sec x \tan x \, dx$ 3. $\int (x+1)^{-1} \, dx$ 4. $\int (1+4x^2)^{-1} \, dx$ 5. $\int x^2(x^3-1)^4 \, dx$ 6. $\int e^{2x} \, dx$ (SMP 1,2,6)

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Area and Volume	1. Area 2. Volume a) Disk b) Washer c) Shell d) Cross Section	MA 5 1.5	Strategic Thinking	1. Graph various regions, determine bounds, and find the enclosed area. 2a. Graph the region and find the volume using the disk method. 2b. Graph the region and find the volume using the washer method. 2c. Graph the region and find the volume using the shell method. 2d. Graph the region and find the volume using cross sections.	1. Find the area formed by $y=\sin x$ and $y=x$ in the first quadrant. 2a. Find the volume of the solid generated by $y=2x^2$, $y=0$, $x=2$ taken about the x-axis. 2b. Find the volume of the solid generated by $y=2x^2$, $y=0$, $x=2$ taken about the y-axis. 2c. Find the volume of the solid formed by revolving the region formed by the graphs of $y=x^2+1$, $y=0$, $x=0$, and $x=1$ about the y-axis. 2d. Find the volume of the region bounded by $y=1-.5x$, $y=-1+.5x$ and $x=0$ by cross sections perpendicular to the x-axis that are squares. (SMP 1,2,4,6)

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Basic Differential Equations	1. solve general and particular solutions of basic differential equations.	MA 5 3.4	Skill/Concept	1. Apply integration rules to solve general and particular equations.	1. $y'=4x$ the equation contains $[0,5]$. Find y . (SMP 1,6)