AP Calculus: Pre-Calculus Standards to Master

Student responsibility: Reflect on your proficiency level for each standard and identify your rank.

	Novice	Average	Master	Pre-Calculus Standard (I can...)
1				Hand graph a Linear function
2				Hand graph a Quadratic function
3				Hand graph a Cubic function
4				Hand graph a General Polynomial function
5				Hand graph an Absolute Value function
6				Hand graph an Exponential function (base e)
7				Hand graph a Natural Log function (base e)
8				Hand graph a Sine function [0,2π]
9				Hand graph a Cosine function [0,2π]
10				Hand graph a Tangent function [0,2π]
11				Hand graph a Cosecant function [0,2π]
12				Hand graph a Secant function [0,2π]
13				Hand graph a Cotangent function [0,2π]
14				Hand graph a Square root function
15				Hand graph the Greatest Integer function
16				Hand graph a Piecewise function
17				Hand graph a Rational function
18				Solve any linear equation by hand
19				Solve any quadratic equation by hand and using calculator
20				Solving a system of equations by hand and by using calculator
21				Expand polynomials such as $(a+b)^2$ and $(a+b)^3$
22				Recognize factored form $(a^2-b^2) = (a+b)(a-b)$
23				Find x and y Intercepts of any function
24				Identify Symmetry (vertical, horizontal, origin) of any function
25				Find points of intersection of any two functions
26				Identify slope of a line
27				Identify rate of change
28				Understand function notation
29				Identify properties parallel and perpendicular lines
30				Explain the difference between a function and a relation
31				Recognize Implicit and explicit forms for equations
32				Identify the independent and dependent variables
33				Identify the domain and range of any functions
34				Find the inverse of any function
35				Perform transformations on any function
36				Perform operations on composite functions
37				Identify even and odd attribute of any function
38				Identify all unit circle radian special values
39				Identify all sine,cosine,tangent,secant,cosecant,cotangent values on unit circle
40				Model data with a linear function
41				Model data with a quadratic function
42				Model data with a trigonometric function

AP Calculus: Limits

	Novice	Average	Master	Limits (I can...)
1				Explain the general concept of a limit
2				Find the limit of a function graphically
3				Find the limit of a function analytically
4				Find the limit of a function numerically
5				Find one-sided limits
6				Explain oscillating behavior
7				State and explain the formal definition of a limit of a function at a point
8				Apply the properties of limits: Scalar multiple, sum or difference, product, quotient, and power
9				Find the limit of polynomial, rational, radical, composite, and trigonometric functions
10				Invoke the strategies for finding limits
11				Apply direct substitution to a limit
12				Apply the cancellation technique
13				Apply the rationalization technique
14				Identify when a limit results in indeterminate form
15				Explain the squeeze theorem
16				Identify and apply the special trig limit regarding the sine function
17				Identify and apply the special trig limit regarding the cosine function
18				Find limits on both open an closed intevals
19				Explain why a function contains a hole vs. an asymptote
20				Explain the three conditions for a function to be continuous at a point
21				Identify and apply the properties of continuity including scalar multiple, sum and difference, product, quotient and composite functions
22				Explain and apply the Intermediate Value Theorem
23				Find limits that result in an answer of infinity or negative infinity
24				Explain the relationship between vertical asymptotes and a limit of infinity or negative infinity
25				Find limits of a function as x approaches infinity or negative infinity
26				Explain the relationship between horizontal and slant asymptotes and limits of functions as x approaches infinity or negative infinity

AP Calculus: The Derivative

Novice	Average	Master	The Derivative (I can...)
			Explain the meaning of a derivative
			Recognize the tangent line problem in developing the definition of the derivative
			Use the multiple notations for the derivative
			Explain the difference between slope and rate of change
			Recognize and compute the derivative of a function using the 'Definition of the Derivative'
			Find the slope of the line tangent to a function at a point
			Find the equation of the tangent line to a function at a point
			Explain the relationship between differentiability and continuity
			Find a derivative using the constant rule
			Find a derivative using the power rule
			Find a derivative using the constant multiple rule
			Find a derivative using the sum and difference rules
			Find a derivative using any of the 6 basic trigonometric derivatives
			Find a derivative using the product rule
			Find a derivative using the quotient rule
			Find higher-order derivatives
			Find a derivative using the chain rule
			Find a derivative using Implicit differentiation
			Find the derivative of e to the x and e to the u
			Find the derivative on the natural log of x and the natural log of u.
			Find the derivative of any function or any combination of functions

AP Calculus: Applications of the Derivative

Student responsibility: Reflect on your proficiency level for each objective and identify your rank.

Novice	Average	Master	Applications of the Derivative (I can...)
			Curve Sketching
			Find the critical numbers for a function
			Identify all relative and absolute extrema of a function on either an open or closed interval
			Determine (visually) where a function is increasing or decreasing
			Use the First Derivative Test to determine intervals where a function is increasing or decreasing
			Determine (visually) where a function is concave up or concave down
			Use the Second derivative to locate possible points of inflection
			Use the Second derivative to determine intervals where a function is concave up or concave down
			Use the Second Derivative Test to locate minimums or maximums of a function
			Explain and apply Rolle's Theorem
			Explain and apply the Mean Value Theorem
			Apply the first and second derivatives to sketch any function
			Properly justify intervals where f is increasing/decreasing or concave up/ concave down
			Optimization
			Identify when a problem is a maximize or minimize problem
			Write an equation that will be used to solve an optimization problem
			Use the curve sketching techniques to solve an optimization problem
			Position - Velocity - Acceleration
			Explain the relationship between the first and second derivatives and the position, velocity, and acceleration functions
			Find the velocity and acceleration functions given the position function
			Find the instantaneous position of a moving object
			Find instantaneous velocity of a moving object
			Find instantaneous acceleration of a moving object
			Explain the difference between speed and velocity
			Find the time when an object has a velocity of zero
			Solve problems using position/velocity/acceleration functions

Rectilinear Motion

			Find the position of an object at any time using the position function
			Find the velocity of an object at any time using the velocity function
			Find the accerleration of an object at any time using the acceleration function
			Use the velocity function to determine when an object is at rest
			Use the velocity function to determine when an object is moving to the right or left
			Solve problems using position/velocity/acceleration functions

Related Rates

			Identify when a problem is a related rate problem
			Identify what is known and unknown in a related rate problem
			Write an equation that can be used to solve a related rate problem
			Solve related rate problems using implicit differentiation
			Determine the correct units for the solution to a related rate problem

Linear Approximation

			Find the line tangent to a function and use it to approximate the value of a function

Differentials

			Identify a differential equation
			Separate the differentials in a differential equation
			Use the differentials to approximate the change in some value

Draw conclusions from the *graphs* of f'(x) and f''(x)

			Use the *graph* of f to find the graph of f' and f''
			Use the *graph* of f' to find where f is increasing or decreasing
			Use the *graph* of f' to find minimums and maximums on f
			Use the *graph* of f' to sketch a possible graph of f
			Use the *graph* of f'' to find where f is concave up or concave down
			Use the *graph* of f'' to find points of inflection on f
			Use the *graph* of f'' to sketch a possible graph of f'

AP Calculus: Antidifferentiation and the Integral

Novice	Average	Master	Antidifferentiation and the Integral (I can...)
			Explain the meaning of antiderivative
			Explain the meaning of integral
			Explain the meaning of an indefinite integral
			User proper notation for the antiderivative and integration
			Find the integral of a constant function
			Find an integral using the Power Rule
			Find the integral of a polynomial function
			Find the integral of simple trig functions
			Use initial conditions to find a particular solution of a differential equation
			Solve position-velocity-acceleration problems using initial conditions and integration
			Estimate the area under a curve using a left-hand Riemann Sum
			Estimate the area under a curve using a right-hand Riemann Sum
			Estimate the area under a curve using a midpoint Riemann Sum
			Explain that continuity implies integrability
			Explain the meaning of a definite integral
			Explain the relationship between a definite integral and the area under a curve
			Explain how F(b) - F(a) relates to the integral of f(x)
			Apply properties of Definite Integrals
			Explain and apply the Fundamental Theorem of Calculus
			Evaluate definite integrals
			Evaluate definite integrals of piecewise functions
			Explain and apply the Average Value of Function on an Interval Definition
			Explain and apply the Second Fundamental Theorem of Calculus
			Explain why the integral is referred to as the "Great Accumulator"
			Apply the accumulation effect of the integral to a variety of applications

			Explain when U-Substitution is required when integrating
			Apply U-Substitution when finding an integral
			Apply the Change in Variables technique
			Find the integral of an exponential function $y = e^x$
			Find the integral of the reciprocal function $y = 1/x$
			Apply U-Substitution when finding an integral of an exponential function or a reciprocal function
			Find the integral of functions that result in an inverse trigonometric function

AP Calculus: Area and Volume Applications

Student responsibility: Reflect on your proficiency level for each objective and identify your rank.

Novice	Average	Master	Area and Volume Applications (I can…)
			Find the area between two curves using the Fundamental Theorem of Calculus
			Find the area between two curves that intersect at two points
			Find the area between two curves that intersect at more than two points
			Find the area between two curves when integrating with respect to x
			Find the area between two curves when integrating with respect to y
			Find the volume of a solid of revolution using the **disk method** where the axis of revolution is the x or y axis
			Find the volume of a solid of revolution using the disk method where the axis of revolution is some other horizontal line
			Find the volume of a solid of revolution using the disk method where the axis of revolution is some other vertical line
			Find the volume of a solid of revolution using the **washer method** where the axis of revolution is the x or y axis
			Find the volume of a solid of revolution using the washer method where the axis of revolution is some other horizontal line
			Find the volume of a solid of revolution using the washer method where the axis of revolution is some other vertical line
			Find the volume of a solid using **perpendicular cross sections** that are squares
			Find the volume of a solid using perpendicular cross sections that are equilateral triangles
			Find the volume of a solid using perpendicular cross sections that are semi-circles
			Find the volume of a solid using perpendicular cross sections that are any *plausible* shape

AP Calculus: Misc topics

Student responsibility: Reflect on your proficiency level for each objective and identify your rank.

Novice	Average	Master	I can...
			Explain and apply the **Trapezoid Rule**
			Find the area under a curve by using trapezoid of **unequal** widths
			Approximate the area under a curve using data points
			Sketch a slope field given a differential equation
			Draw a particular solution to a **slope field** given an initial condition
			Solve differential equations of the form: **dy/dx = ky**
			State the relationship between Exponential Growth and Decay to $y = Ce^{kt}$ and its derivative (y' = ky)
			Solve exponential growth and decay problems
			Recognize and apply Newton's Law of Cooling
			Solve differential equations using separation of variables