

Key Concepts

Course
Intro to Calculus

School Year
2008/2009

Unit 1: Absolute Value

Class Day
2 Translating mathematical symbols into English can make solving problems easier.

Class Day
2 Absolute value can be used to represent the distance between two points.

Class Day
2 Interval notation typically is made up of a left grouping symbol, two values separated by a comma, and a right grouping symbol

Class Day
4 Graphs and equations can be used in conjunction to help solve problems.

Class Day
4 Many concepts are connected to the Pythagorean Theorem.

Unit 2: Functions

Class Day
6 Function notation is a different form of representing relationships between quantities. This is not a new idea, just a new way to represent an idea (equations) which you have been dealing with for a long time.

Class Day
6 Not all relationships are functions. A relationship is a function if and only if for any x -value in the domain of the function there is only one corresponding y -value.

Class Day
6 Three ways to determine if a relationship is a function: graphs, tables of values, equations.

Class Day
6 The domain of a function are the values which do not “break” the function.

Class Day
7 Three ways to determine if a relationship is a function: graphs, tables of values, equations.

Class Day
8 You can create functions by combining (compositing) other functions.

Class Day
8 It is important to be able to move back and forth fluently between the graph of a function and the equation representing the function.

Unit 3: Inverse Functions

Class Day
15 Functions can undo other functions.

Class Day
15 If you graph a function and the function which undoes it, then the graphs will be reflections of each other across the line $y = x$.

Class Day
15 An equation for a function which undoes another function can be created by working to undo each step of the original function starting with the last step and working backwards.

Class Day
15 Functions which undo each other are called “inverses”.

Class Day
15 The notation for inverse functions can be tricky-- f^{-1} would be the inverse of the function f . The “-1” symbol’s location is crucial and looks a lot like other uses.

Unit 4: Transforming Functions

Class Day
18 Graphs of functions can be transformed by shifting, flipping, compressing, or combination of these.

Class Day
18 How the graph of a function changes can be described using both words and algebra.

Unit 5: Optimization

Class Day
25 An optimal solution can be found by creating function, graphing the function, and then finding the maximum or minimum value.

Unit 6: Roots of Polynomials

Class Day
27 The locations where the graph of a function crosses the x -axis can be used to find factors of the function.

Class Day
27 A polynomial can have up to as many roots as its degree.

Key Concepts

Course
Intro to Calculus

School Year
2008/2009

Class Day 27	A polynomial function is smooth and has a domain of all real numbers.
Class Day 27	The graphs of some polynomials functions do not have x-intercepts. The x-intercepts represent the real roots, or zeroes, of the function.
Class Day 28	The graphs of some polynomials functions do not have x-intercepts.
Class Day 30	A polynomial function is created when a series of terms are connected with addition such that each term is comprised of a real number coefficient and a variable raised to a whole number power. (This is not really a definition, but it captures what will be most important to us.)
Class Day 30	The domain of a polynomial is all real numbers. Hence the graph of a polynomial will have to breaks.
Class Day 30	Graphs of polynomials are smooth-- no pointy parts.
Class Day 30	Graphs of polynomials have no horizontal asymptotes.
Class Day 30	A lower bound for the degree of a polynomial can be inferred from the "bumps" on the graph of the polynomial.
Class Day 30	The behavior at the "ends" of a polynomial (way out where x is really small or really big) can be used to determine if the degree of the polynomial is odd or even and whether the coefficient of the highest degree term (the lead coefficient) is positive or negative.
Class Day 30	The behavior of the graph of the polynomial at the locations where it crosses the x-axis can be used to tell you the multiplicity of the real roots of the function-- tells you what degree each factored term has to be raised to.
Class Day 33	A negative exponent represent the reciprocal of the base.
Class Day 33	When multiplying expressions with the same base, the exponents can be added.
Class Day 33	When dividing expressions with the same base, the exponents can be subtracted.

Unit 7: Exponents and Logarithms

Class Day
34 Exponential growth and decay are characterized by a constant multiplier.

Class Day
34 Exponential growth and decay arise from situations where each “individual” creates new “individuals”.

Class Day
34 Exponential growth or decay can be modeled by the function $f(t) = Cb^t$ where C represents the starting value or initial population, b represents the exponential constant, and t represents the # of cycles of growth.

Class Day
35 Exponential growth can be either discrete, happening all at once, or continuous, changing all the time.

Class Day
35 Growth of money in an investment gaining interest can be thought of as continuous growth-- the principal is accumulating interest, and the interest is accumulating interest, and the interest on the interest is accumulating interest on a continuous basis.

Class Day
35 The number e can be thought of as the total amount of money in an account which started with \$1, was growing at a rate of 100% per year, and had an infinite number of compounding periods (compounded continuously) at the end of one year.

Class Day
36 There are two types of questions we can ask concerning exponential: 1) Given the number of growth cycles, determine the quantity; 2) Given the quantity, determine the number of growth cycles. These questions are inverses of each other.

Class Day
36 A logarithm is an exponential equation in disguise.

Class Day
36 Problems involving logarithms can be solved by first translating the problem into one involving exponents and then solving this exponent problem.

Class Day
42 There are three fundamental properties of logarithms: the multiplication property, the division property, and the power property.

Class Day
43 There are three fundamental properties of logarithms: the multiplication property, the division property, and the power property.

Key Concepts

Course
Intro to Calculus

School Year
2008/2009

Class Day
44 There are three fundamental properties of logarithms: the multiplication property, the division property, and the power property.

Unit 8: Circular Functions

Class Day
46 “Radian” is an acronym for “RADius ANgle”.

Class Day
46 One radian is equal to the amount a point on the circumference of a circle needs to be rotated so that the arc length between the original point and the rotated point is exactly equal to the radius of the circle.

Class Day
46 Rotations in a counterclockwise direction are said to be positive while rotations in a clockwise direction are said to be negative.

Class Day
46 A full rotation is equal to 2π radians.

Class Day
46 Given two points on the circumference of a circle, one of the points can be rotated around the center to match up with the other point in an infinite number of ways.

Class Day
50 The location of the point of intersection of the terminal side of a central angle and a circle are related to each other. This relationship is what is meant by the term “circular function”.

Class Day
53 The sine of a central angle in the unit circle is defined as the y-coordinate of the point of intersection of the terminal side of the angle and the unit circle.

Class Day
53 The cosine of a central angle in the unit circle is defined as the x-coordinate of the point of intersection of the terminal side of the angle and the unit circle.

Class Day
54 Given two points on the circumference of a circle, one of the points can be rotated around the center to match up with the other point in an infinite number of ways.

Class Day
54 The sine of a central angle in the unit circle is defined as the y-coordinate of the point of intersection of the terminal side of the angle and the unit circle.

Class Day
54 The cosine of a central angle in the unit circle is defined as the x-coordinate of the point of intersection of the terminal side of the angle and the unit circle.

Key Concepts

Course
Intro to Calculus

School Year
2008/2009

Class Day
55 An identity is an equation which is true for all values of the variable.

Class Day
61 Arguments of angles have to agree.

Class Day
61 The arguments of trigonometric functions can be changed.

Class Day
61 The rules for changing the arguments of trigonometric expressions are derived from the rules you already know and cleverness.

Class Day
66 A point rotating on the circumference of a circle can be used to generate a sine or cosine graph by plotting the height of the sine (or cosine) as a function of the measure of the central angle.

Class Day
66 Graphs of sinusoidal functions can be stretched, compressed, shifted, and reflected in the same way that graphs of any function can.

Class Day
66 A point rotating on the circumference of a circle can be used to generate a sine or cosine graph by plotting the height of the sine (or cosine) as a function of time when the point of on the circumference of the circle is rotating at some speed.

Class Day
66 Increasing the speed at which the point on the circumference of a circle is rotating makes the graph of the sine or cosine have more “bump” in a given time. In other words, increasing the rotation speed shortens the period of the function. Decreasing the speed, increases the period.

Unit 9: Calculus Overview

Class Day
70 The rate of change for a function at a given point can be approximated by finding averages over very small intervals.

Class Day
71 The instantaneous rate of change of a function at a point can be approximated by using an average of average rates of change. This is especially helpful when working with experimental data.

Class Day
72 The definite integral can be thought of as the area under the graph of a function and above the x-axis.

Key Concepts

Course
Intro to Calculus

School Year
2008/2009

Class Day
72 A definite integral can be approximated by cutting up the area under the curve and above the x-axis into smaller shapes-- rectangles and trapezoids in particular.

Unit 10: Polar Coordinates

Class Day
75 Polar graphs are a different coordinate system.

Class Day
75 The coordinates of a polar graph are the radius and the angle of rotation. The angle of rotation is considered the independent variable and the radius is considered the dependent variable.

Class Day
77 Polar coordinates and equations can be converted to rectangular ones.

Class Day
78 Our work with trigonometry and circular functions gives us the necessary tools for converting between the polar coordinate system and the rectangular (Cartesian) coordinate system.

Unit 11: Limits

Class Day
80 A limit can be thought of as the value a function approaches.

Class Day
80 Limits can be determined graphically, numerically, or algebraically.

Class Day
80 When evaluating limits algebraically, first substitute the value and see what happens. If you get an indeterminate form, then you re-write it using algebra so that it is not an indeterminate form.

Class Day
83 Limits involving the x-value going to infinity can often be evaluated by determining which part of the function dominates.

Class Day
86 A function is continuous if it's graph can be drawn without lifting the pencil.

Class Day
86 In order to analytically determine if a function is continuous at a point, the left-hand and right-hand limit must be equal and the value of the function at the point in question must be equal to this limit.

Key Concepts

Course
Intro to Calculus

School Year
2008/2009

Class Day
86

If a function is continuous on some closed interval, $[a,b]$, then the function takes on every value between $f(a)$ and $f(b)$.
