

PLANNED COURSE

SUBJECT AREA: Elementary Analysis

GRADE/COURSE 11

Standard And Strand 2.1 Numbers, Number Systems and Number Relationships

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
Graphically represent the Complex Number System and Identify operations implied by the existence of specific sets.	Pictorially display sets and subset relationships regarding the following sets: a. Natural Numbers b. Whole Numbers c. Integers d. Rational Numbers e. Irrational Numbers f. Imaginary Numbers	Class presentation, quizzes, tests.
Determine solution sets and explain salient aspects of the intervals that contain such sets.	Find solution sets mechanically and graphically. Verify solution sets by an alternate method.	Class presentation, homework, quizzes, tests.
Express an intuitive notion of successor mappings and continuity.	Discuss concepts of levels of infinity, betweenness of points and sets containing no greatest element or no least element.	Class discussion, observation.
Use proper notation when writing intervals that are open, closed, or neither.	Select notation specifics from among the following arrangements to convey solution sets: $()$, $[\]$, $(\]$, $[\)$, $\{ \}$.	Homework, class work, quizzes, tests.

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
Identify domain and range.	Use set notation and ordered pairs to identify and to list domain and range.	Homework, class work, quizzes, tests.
Determine when relations are functions.	Determine functions using any method suitable to the relation description.	Homework, class work, quizzes, tests.
Display mappings and classify functions.	Illustrate mappings of relations, and mappings of functions which are one-to-one, onto, and one-to-one and onto.	Homework, class work, quizzes, tests.
Graph relations and functions and delineate characteristics germane to such representations.	Determine domain, range, maximum, minimum, relative maximum, relative minimum, intervals where the graph increases or decreases and the notion of concavity. Explain graph characteristics as they may relate to life issues.	Homework, quizzes, class work, tests.

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Standard And Strand 2.2 Computation and Estimation

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
Develop algorithms for problem solving.	Formulate procedures using the four elementary operations in successive steps.	Group work, homework, quizzes, tests.
Inspect solutions for reasonability	Display an intuitive idea of the neighborhood of desired answers.	Class discussion, teacher observation.
Produce estimated answers.	Employ rounding prior to computational procedures. Approximate answers from graphs.	Class work, homework, quizzes, tests.
Estimate error	Approximate answers within a \pm interval of certainty.	Class discussion, teacher observation.
Use graphic methods in problem solving.	Determine and explain the meaning of zeros of a function.	Class work, homework, quizzes, tests.

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Standard And Strand 2.3 Measurement and Estimation

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
<p>Solve trigonometric equations using both radians and degrees, but emphasizing radians, culminating with real world applications.</p> <p>Apply linear, square and cubic relations in real-world problems.</p> <p>Use appropriate units when problem solving.</p>	<p>Use proper units of measurement such as meters, cm, cm^2, revolutions per minute, etc. when answering real world application problems.</p> <p>Estimate answers and calculate acceptable error using linear approximations and differentials.*</p> <p>Estimate the decimal equivalence of e using $e = \lim_{n \rightarrow \infty} \left(1 + \frac{1}{n} \right)^n$.</p>	<p>Class presentation, quizzes, tests.</p>

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Standard And Strand 2.4 Mathematical Reasoning and Connections

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
<p>Apply the concepts of direct proofs, indirect proofs or proof by contradiction to prove mathematical theorems, where applicable.</p> <p>Demonstrate mathematical solutions to real world problems.</p>	<p>Prove the distance formula to find the distance between two points.</p> <p>Prove the distance formula to find the distance from a point to a line.*</p> <p>Prove the midpoint formula.*</p> <p>Use algebraic relationships to prove geometric formulas.*</p> <p>Prove the Laws of Logarithms for multiplication, division, and raising to a power.*</p> <p>Prove the trigonometric Pythagorean identities.</p>	<p>Class presentation, quizzes, tests.</p>

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Standard And Strand 2.4 Mathematical Reasoning and Connections

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
	<p>Prove formulas for the* $\cos(\mathbf{a} \pm \mathbf{b})$, $\sin(\mathbf{a} \pm \mathbf{b})$, $\tan(\mathbf{a} \pm \mathbf{b})$, $\tan 2\mathbf{a}$, $\cos 2\mathbf{a}$, $\sin 2\mathbf{a}$, $\sin \frac{\mathbf{a}}{2}$, $\cos \frac{\mathbf{a}}{2}$, $\tan \frac{\mathbf{a}}{2}$.</p> <p>Derive the standard form of a circle by using the definition of a circle.</p> <p>Derive the standard form of an ellipse by using the definition of an ellipse.</p> <p>Derive the quadratic formula.</p> <p>Develop the formula: $\sum_1^n i = \frac{n(n+1)}{2}$.*</p> <p>Prove statements using mathematical induction.* (Optional)</p>	<p>Class presentation, quizzes, tests.</p> <p>The mode for assessing each performance indicator will be as noted:</p> <p>Class presentation, quizzes, tests.</p>

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Standard And Strand 2.6 Statistics and Data Analysis

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
Use descriptive methods on data gathered from a population, which holds personal interest to the student.	Using the gathered data, compute the mean, variance and standard deviation. Determine the mode. Note minimum, maximum, quartiles and outliers	Class work, homework, quizzes and tests
Determine the “line of best fit” relative to a specific set of data.	Make use of the graphing calculator to enter data and display a scatter plot. Determine which of a variety of regression equations is the best descriptor of performance. Insert on the scatter plot, the “line” associated with the selected regression equation.	Class demonstrations, homework, quizzes and tests.
Use methods of regression as performance predictors for interests absent from the sample from which the equation was derived.	Use values of interest for the independent variable in regression equations as a vehicle to predict performance.	Class work, homework, quizzes and tests
Use a variety of plots to display raw data and grouped data.	Using raw data and grouped data, construct scatter plots, box and whisker plots (noting outliers) and stem and leaf plots.	Class work, homework, quizzes and tests

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
<p>Use the correlation coefficient of a “line of best fit” to determine dependence.</p> <p>Understand the necessity of using control groups in experimental design.</p>	<p>Select the most appropriate regression function based on comparison of the correlation coefficient. Interpret $r = 0$, $r = 1$, and $r = -1$.</p> <p>Explain the strengths of blind studies. Explain interpreting results of a study and the problems therein.</p> <p>Display an understanding of the importance of sample size and samples that represent a cross section of the population from which they were drawn.</p>	<p>Class work, homework, quizzes and tests.</p> <p>Class work, written report, teacher observation.</p>

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Standard And Strand 2.7 Statistics and Probability

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
Compute the probability of a single event.	Apply the basic definition of probability to determine the likelihood of an event occurring.	Class work, homework, quizzes, tests.
Compute odds associated with success or failure of a single event.	Find the probability of success of an event and utilize the probability of the complement of a set to determine odds.	Class work, homework, quizzes, tests.
Apply descriptive methods to a student collected sample and utilize the proper test and draw conclusions, regarding the mean of the population from which the sample was drawn.	Calculate mean, variance and standard deviation for a population and test the hypothesis that the mean of the sample is equal to the mean of the population.	Class work, homework, quizzes, tests.
Use a-priori probability distributions and probability distributions derived from experimental avenues for decision making.	Apply the cumulative Standard Normal Distribution to assess the probability of an experimental outcome lies in a given interval.	Class work, class discussion, homework, teacher observation, quizzes, tests.

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Standard And Strand 2.7 Probability and Predictions

Focus Questions(s)

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
Find the probability of events that are independent, and events structured into repeated independent trials.	Define independent events, find the product of probabilities, determine conditional probability.	Class work, homework, quizzes, tests.

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Standard And Strand	2.8: Algebra and Functions		

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
<p>Solve real world problems using patterns, series, and sequences.</p> <p>Solve problems using the understanding of algebraic equations, inequalities, and systems of equations culminating with solutions of real life problems.</p> <p>Use systems of equations and inequalities to solve problems analytically and graphically.</p> <p>Model real life data using applicable functions. Students will solve these problems using proper mathematical techniques.</p> <p>Solve problems using proper mathematical techniques culminating with the solution of real world problems.</p> <p>Find the intersection of two lines analytically, graphically, and numerically.</p>	<p>Use previously learned knowledge of algebra and geometry (such as writing equations of lines, graphing conic sections, solving linear, quadratic, and exponential equations both analytically and graphically.</p> <p>Analyze charts and tables to determine the relationship between functions and their graphs.</p> <p>Analyze properties and relationships of functions such as linear, rational, polynomial, logarithmic, and trigonometric.</p> <p>Calculate: the midpoints of line segments, the distance between two points, and the distance from a point to a line.</p> <p>Write the equations of lines, lines parallel to a given line, lines perpendicular to a given line.</p>	<p>Class presentation, quizzes, tests.</p>

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
<p>Find and apply slopes of lines.</p> <p>Solve higher order equations and applications.</p> <p>Locate points of intersection of functions in 2-space. (3-space*)</p> <p>Sketch graphs of non-linear functions.</p> <p>Solve inequalities in a variety of formats, including higher order.</p> <p>Perform operations on functions.</p>	<p>Write linear equations in two variables given the particulars of the corresponding lines including lines for altitudes, medians, and perpendicular bisectors of triangles.</p> <p>Use DesCartes Rule of Signs, the Remainder Theorem, the Factor Theorem, factoring, and the quadratic formula, to find roots of higher order equations.</p> <p>Simultaneously solve linear and higher order systems or any combination thereof.</p> <p>Sketch graphs of piecewise defined functions and higher order functions emphasizing zeros, end behavior, noting multiple roots.</p> <p>Solve single parameter inequalities in Euclidean 2-space.</p> <p>Students will write new functions using addition, subtraction, multiplication, division, composition, and inverses if they exist.</p>	<p>Class presentation, quizzes, tests.</p>

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
<p>Apply the concept of inverse graphically.</p> <p>Apply rules of exponents.</p> <p>Apply variable exponents.</p> <p>Apply inverses regarding variable exponents in Euclidean 2-space.</p> <p>Represent functional relationships in tables, charts, and graphs.</p>	<p>Graph inverse functions and verify analytically.</p> <p>Use rules of exponents to simplify expressions.</p> <p>Write exponential functions, including base <i>e</i>.</p> <p>Understand the relationship between exponential functions and logarithmic functions write one function from another.</p> <p>Write equations of conic sections from given data.</p> <p>Apply conic sections to create and solve real world applications.</p> <p>Graph conic sections involving xy terms.*</p> <p>Use the definition of absolute value and its properties to solve problems.</p>	<p>Class presentation, quizzes, tests.</p>

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
<p>Test analytically the symmetry of graphs.</p> <p>Write the equations of geometrically transformed graphs.</p> <p>Sketch graphs using the particulars of graphs and parent functions.</p> <p>Apply the arithmetic of matrices.</p> <p>Use matrices to solve real world problems.</p>	<p>Identify axes of symmetry and symmetry with respect to the origin.</p> <p>Use the concept of parent graph to write new equations.</p> <p>Graph functions using the properties of intercepts, zeros, symmetry, asymptotes.(And the relationship between the graph of: $y = f(x)$ and the graphs of $y = kf(x)$, $y = f(kx)$, $y - k = f(x - h)$, $y = f(x)$, and $y = f(x)$.</p> <p>Perform the following matrix operations: addition, subtraction, scalar multiplication, and multiplication</p> <p>Use matrix structure, row operations, equality of matrices, and reduced row echelon form to effect solutions.</p>	<p>Class presentation, quizzes, tests.</p>

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Standard And Strand 2.9 Geometry

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
<p>Utilize the concepts of congruence and similarity.</p> <p>Formulate solutions to problems where the concepts leading to solution involve inscribed and circumscribed polygons.</p> <p>Determine particulars of conics.</p> <p>Sketch physical systems under consideration.</p>	<p>Solve problems where congruence and similarity are integral concepts leading to solutions.</p> <p>Utilize inscribed angles, inscribed triangles, and circumscribed circles to arrive at solutions to a variety of general geometric problems.</p> <p>Find centers and radii of circles: vertices, opening direction, axis of symmetry, focus, directrix and vertex of parabolas, vertices, major and minor axes, foci and eccentricity of ellipses: vertices, center, transverse axis, foci and asymptotes of hyperbolas.</p> <p>Draw diagrams where appropriate to facilitate solutions and display solution processes.</p>	<p>Class work, homework, quizzes, tests.</p>

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
Determine symmetry in various environments.	Analyze functions and relations for symmetry w.r.t. x – axis, y – axis, origin, $y=x$, $y= - x$, $x = a$ and $y = b$.	Class work, homework, quizzes, tests.

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Standard And Strand 2.10 Trigonometry

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
<p>Demonstrate expertise regarding the six trigonometric functions.</p> <p>Generate graphs of trigonometric functions using radians.</p> <p>Apply transformations to trigonometric functions.</p> <p>Utilize fundamental identities and Pythagorean identities.</p> <p>Convert between angular measures.</p> <p>Use angle measures in degrees and in radians to solve elementary applications.</p>	<p>Use such functions to arrive at solutions involving right triangles.</p> <p>Graph the six trigonometric functions using amplitude, frequency, period, domain and range.</p> <p>Display graphic transformations by depicting phase shift, vertical displacements and variations relative period and amplitude.</p> <p>Develop and apply relationships involving $\sin q$, $\cos q$, and $\tan q$ and their reciprocals including $\sin^2 q + \cos^2 q = 1$ and its variations.</p> <p>Convert degrees to radians and vice versa.</p> <p>Solve problems related to arc length and area of a sector.</p>	<p>Class work, homework, quizzes, tests.</p>

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
<p>Use trigonometric functions in elementary applications</p> <p>Identify sign results for trigonometric functions.</p> <p>Use trigonometric principles to solve oblique triangles.</p> <p>Derive relationships for trigonometric functions involving angle sums and angle differences.</p> <p>Derive and utilize double-angle formulas and triple-angle formulas.</p>	<p>Solve right triangle variations using right triangle trigonometry.</p> <p>Use rotation direction and quadrant position to determine the sign of trigonometric functions.</p> <p>Apply the Law of Sines and the Law of Cosines to solve oblique triangles. Make note of the ambiguous case related to the Law of Sines application.</p> <p>Develop and apply the following relationships: <i>a.</i> $\sin (a \pm b)$ <i>b.</i> $\cos (a \pm b)$ <i>c.</i> $\tan (a \pm b)$</p> <p>Apply the following relationships: <i>a.</i> $\sin 2x, \sin 3x$ <i>b.</i> $\cos 2x, \cos 3x$ <i>c.</i> $\tan 2x, \tan 3x$</p>	<p>Class work, homework, quizzes, tests.</p>

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
<p>Derive and utilize half-angle formulas</p> <p>Evaluate trigonometric functions.</p> <p>Render analysis and sketch graphs of inverse trigonometric functions.</p> <p>Solve trigonometric equations.</p>	<p>Apply the following relationships:</p> <p>$a. \sin \frac{x}{2}$</p> <p>$b. \cos \frac{x}{2}$</p> <p>$c. \tan \frac{x}{2}$</p> <p>Utilize tables, special right triangles, the unit circle, and graphing calculators to arrive at values for all six trigonometric functions.</p> <p>Determine domain and range for $y = \sin^{-1} x$, $y = \cos^{-1} x$ and $y = \tan^{-1} x$ and provide their graphic representations. Evaluate inverse functions, and function-inverse function compositions.</p> <p>Using algebraically oriented techniques, trigonometric identities and graphing calculators, solve a wide variety of trigonometric equations.</p>	<p>Class work, homework, quizzes, tests.</p>

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
<p>Write the trigonometric form of a complex number. *</p> <p>Perform operations on complex numbers in trigonometric form. *</p>	<p>Using the Complex plane and Pythagorean relationships, express $z = a + bi$ as $z = r(\cos \mathbf{q} + i \sin \mathbf{q})$</p> <p>Find products, quotients, powers using DeMoivre's Theorem and roots of trigonometric forms of complex numbers.</p>	<p>Class work, homework, quizzes, tests.</p>

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Standard And Strand 2.11 Concepts of Calculus

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
<p>Identify the location of extreme values of functions.</p> <p>Use concepts of Calculus to estimate bounded areas.</p> <p>Intuitively understand the concept of limit.*</p>	<p>The student will demonstrate 100% accuracy on at least 70% of each of the following performance indicators.</p> <p>Determine maximum and minimum values of a function over a given interval, and determine the meaning of these values.</p> <p>Write terms of arithmetic and geometric series.</p> <p>Evaluate sums of arithmetic, geometric, and infinite geometric series.</p> <p>Use rectangles to estimate area under the curve.</p> <p>Verbally explain the concept of limit*.</p>	<p>Class presentation, quizzes, tests.</p>

* Items included in Elementary Analysis Honors

OBJECTIVES	PERFORMANCE INDICATORS	ASSESSMENTS (Variety as per Section 4.52, Chapter 4)
<p>Students will calculate limits using algebra.*</p> <p>Students will estimate limits from graphs or tables of data.*</p> <p>Students will understand asymptotes in terms of graphical behavior, and limits involving infinity.*</p>	<p>Use the algebra of limits to calculate answers to limit problems.*</p> <p>Evaluate limits analytically and justify their answer by using tables and, graphs.*</p> <p>Solve limits using infinity.*</p> <p>Calculate limits of trigonometric functions.*</p> <p>Determine non-existent limits and the reasons for their non-existence.*</p> <p>Verbally explain the concept of limit*.</p> <p>Use limits to understand asymptotic behavior.*</p>	<p>Class presentation, quizzes, tests.</p>

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Resources

Stewart, James., Redlin, Lothar., and Watson, Saleem. Precalculus. Mathematics for Calculus.
New York: Brooks/Cole Publishing Co. 1993.

Gordon, Berchie W., Crosswhite, F. Joe., Yunker, Lee E., and Vanatta, Glen D. Advanced Mathematical Concepts.
New York: Glencoe/ Mc Graw-Hill. 1994.

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