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Module 11: Introduction to Polynomial Functions

Objective

- 1. Recognize a polynomial function.
- 2. Classify a given polynomial function according to degree and coefficients (integral, rational, or real).
- 3. Divide an integral polynomial in one variable by a binomial of the form (x a) using the division algorithm.
- 4. Divide an integral polynomial in one variable by a binomial of the form (x a) using synthetic division.

Module 12: The Remainder Theorem and Factor Theorem

Objective

- 1. Evaluate an integral polynomial function for a given value of the domain by substitution.
- 2. Develop and prove the Remainder Theorem.
- 3. Evaluate an integral polynomial function for a given value of the domain using the Remainder Theorem.
- 4. Develop and prove the Factor Theorem.

Module 13: Factoring and Zeros

- 1. Develop integral and Rational Zero Theorems.
- 2. Factor a given integral polynomial over the integers.
- 3. Apply the factor theorem to solve equations involving polynomials of degree greater than 2.
- 4. Determine an integral polynomial function given its rational zeros.

Module 14: Graphing

Objective

- 1. Sketch the graph of a given polynomial function.
- 2. Determine a polynomial function that defines a given graph.
- 3. Determine the possible sums of the multiplicities of the zeros of a given real polynomial function.
- 4. Identify all zeros of a given real polynomial function.

Module 21: Exponential Functions

Objective

- 1. Maintain previous skills with exponential expressions.
- 2. Identify and graph exponential functions.
- 3. Solve exponential equations by transforming both sides to a common base.
- 4. Write and solve exponential functions describing problems involving exponential growth and decay.

Module 22: Introduction To Logarithms

Objective

- 1. Define the logarithmic functions.
- 2. Identify and graph logarithmic functions.
- 3. Transform an equation in exponential form to logarithmic form and vice versa.
- 4. Solve equations of the form $y = \log_a x$, a > 0, a is not equal to 1 using exponential form.

Module 23: Laws of Logarithms

- 1. Derive the laws of logarithms from the exponent laws.
- 2. Apply the laws of logarithms in simplifying or evaluating expressions involving logarithms.

Module 24: Applications

Objective.

- 1. Solve exponential equations.
- 2. Solve logarithmic equations.
- 3. Apply exponential and logarithmic functions to solve problems.

Module 31: Sequences

Objective

- 1. Identify and use the following: sequences, terms of a sequence, finite sequences, and infinite sequences.
- 2. Determine the terms of a sequence given its defining rule.
- 3. Investigate patterns in sequences.
- 4. Determine the terms of a sequence that is defined recursively.
- 5. Determine a recursive formula of a sequence given the first three terms of the sequence.

Module 32: Arithmetic Sequences

- 1. Identify an arithmetic sequence.
- 2. Determine the common difference of a given arithmetic sequence.
- 3. Derive the general term formula for an arithmetic sequence.
- 4. Apply the general term formula to determine the first term, the n^{th} term, the common difference, or the number of terms for a given arithmetic sequence.
- 5. Solve problems involving arithmetic sequences.

Module 33: Geometric Sequences

Objective

- 1. Recognize a geometric sequence.
- 2. Determine the common ratio (r) of a given geometric sequence.
- 3. Derive the general term formula for a geometric sequence.
- 4. Apply the general formula to determine the first term, the last term, the common ratio, or the number of terms for a given sequence.
- 5. Derive and apply the formula $A = P(1 + i)^n$.
- 6. Solve problems involving geometric sequences.

Module 34: Series

Objective

- 1. Identify and use the following: series, term of a series, infinite series, and finite series.
- 2. Expand a series given in sigma notation.
- 3. Express a given series in sigma notation.
- 4. Determine the sum of a given finite series.

Module 35: Arithmetic Series

- 1. Identify an arithmetic series.
- 2. Derive the sum formulas for an arithmetic series.
- 3. Apply a sum formula to determine the number of terms, the first term, the last term, or the sum of terms for a given arithmetic series.
- 4. Solve problems involving a finite arithmetic series.

Module 36: Geometric Series

Objective

- 1. Identify a geometric series.
- 2. Derive the sum formula for a geometric series.
- 3. Apply a sum formula to determine the number of terms, the first term, or the sum of the terms for a given geometric series.
- 4. Solve problems involving a finite geometric series.
- 5. Apply concepts of geometric series to solve problems involving annuities.

Module 37 Infinite Series and Limits

Objective

- 1. Identify an infinite sequence as convergent or divergent.
- 2. Determine the limit of an infinite convergent sequence.
- 3. Determine the limit of a given function as n approaches infinity.
- 4. Determine the sum of an infinite geometric series (|r|<1) by finding the limit of its sequence of partial sums.
- 5. Derive the sum formula of an infinite geometric series.
- 6. Solve problems involving the application of $S = \frac{1}{1-r}$, for |r| < 1.

Module 41: Circular Paths

- 1. Define and identify the values of the trigonometric ratios for angles in standard position in terms of *x*, *y*, and *r*.
- 2. Derive the values of any trigonometric ratio given the value of one of the others.

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Determine the reference angle of any given angle and define the value of a trigonometric ratio for an angle in terms of the reference angle.

Module 42: The Unit Circle

Objective

- 1. Relate the trigonometric functions to coordinates of points on a unit circle.
- 2. Define and use radian measure.
- 3. Examine the relationship between radian and degree measure and determine trigonometric function values of angles measured in radians.
- 4. Determine and use the exact relative measures of the sides of $30^{\circ} 60^{\circ} 90^{\circ}$ triangles and $45^{\circ} 45^{\circ} 90^{\circ}$ triangles and derive the exact value of the trigonometric ratios for angles with radian measure $\frac{n\pi}{6}$ or $\frac{n\pi}{4}$, where *n* is an integer.

Module 43: Solving Equations

Objective

- 1. Solve first-degree trigonometric equations.
- 2. Solve second-degree trigonometric equations.
- 3. Solve trigonometric equations involving multiples of angles.

Module 44: Graphs of Trigonometric Functions

Objective

1. Graph the six trigonometric functions and identify their domain, range, and period.

Module 45: Amplitude, Period, Phase Shift, and Vertical Translation

- 1. Identify the amplitude, period, phase shift, vertical translation, and range of the graphs of functions of the form $y = a \sin b(\theta + c) + d$ or $y = a \cos b(\theta + c) + d$.
- 2. Identify and produce the graphs of functions of the form $y = a \sin b(\theta + c) + d$ or $y = a \cos \theta$

 $b(\theta+c)+d.$

Module 46: Trigonometric Identities

Objective

1. Derive and apply the quotient relations, reciprocal relations, or Pythagorean relations to expand or simplify the trigonometric expressions.

Module 47: Sum Formulas

Objective

- 1. Derive and apply the negative angle relations and complementary angle relations.
- 2. Derive and apply the sum and difference formulas.

Module 48: The Sine and Cosine Laws

Objective

- 1. Develop and apply the Sine Law.
- 2. Develop and apply the Cosine Law.
- 3. Solve problems involving the ambiguous case of the Law of Sines.
- 4. Solve problems involving regular polygons.

Module 51: Exploring Conics

- 1. Describe the different shapes that are produced when a plane intersects a cone (i.e., a styrofoam cone is cut with sharp knife.)
- 2. Describe the conditions necessary to produce the shapes that occur when a plane intersects a cone.
- 3. Show the position of the intersecting planes on a double napped cone that produce each of the different conics.

- 4. Generalize the curve of intersection (hyperbola, parabola, ellipse, circle) for various positions of the cutting plane of a double napped cone.
- 5. Summarize the conditions necessary to produce the conic shapes.

Module 52: Exploring Conics

Objective

- 1. Identify the point on a cone at which each of the conics becomes degenerate.
- 2. Describe the shape of a degenerate conic.
- 3. Describe the conditions necessary to produce degenerate conics.
- 4. Show the position of the intersecting planes on a double napped cone that produce each of the degenerate conics.
- 5. Generalize the degenerate conic for the parabola, hyperbola, ellipse, or circle for specific positions of the cutting plane of a double napped cone.
- 6. Summarize the conditions necessary to produce degenerate conics.

Module 53: General Quadratic Relations I

- 1. Graph the locus of points resulting from suggested values of A, B, C, D, E and F in quadratic relations.
- 2. List the coefficients, equations and resulting graphs from suggested values for A, B, C, D, E and F in quadratic relations.
- 3. Describe the locus of points resulting from suggested values of A, B, C, D, E and F in quadratic relations.
- 4. Describe the changes to the shapes produced when combinations of the coefficients A, B, C, D, E and F in a quadratic relation are varied and/or kept constant.
- 5. Infer the relationship between the type of shape and the coefficients in quadratic relations.

Module 54: General Quadratic Relations II

Objective

- 1. Describe the similarities and differences among the graphs of quadratic relations when their coefficients are changed.
- 2. Identify which coefficient has been changed to produce a given graph of a quadratic relation.
- 3. Describe the effect on the shapes when the coefficient B is not equal to zero in quadratic relations.
- 4. Generalize that when B=0 a graph that has a vertical and horizontal axis of symmetry is usally produced.
- 5. Predict the shape produced when the coeffcients of quadratic relations are changed.
- 6. Generalize the shapes that are possible when the coefficients of quadratic relations are changed.

Module 55: Coefficient Effects on Conic Shapes

- 1. Draw the graphs of ellipses, parabolas, and hyperbols using caluclators and/or computers.
- 2. Describe the restrictions on coefficients of the general quadratic relation which are necessary to produce the conic shapes (i.e., ellipse, parabola, hyperbola).
- 3. Identify patterms resulting from the restrictions on coefficients of the general quadratic relation which are necessary to produce the conic shape (i.e., ellipse, parabola, hyperbola).
- 4. Predict the effect of restrictions on coefficients of the general quadratic relation.
- 5. Describe the restrictions on coefficients of the general quadratic relation that causes an ellipse to become a circle.
- 6. Generalize the effect of restrictions on coefficients of the general quadratic relation.
- 7. Describe the effect of the numerical coefficient on the orientation, size and shape of the graph of a quadratic relation.
- 8. Predict the equations of conics from problems based on analyzing the characteristics of conic sections.

9. Solve problems based on analyzing the characteristics of conic sections.

Module 56: Locus of Points

Objective

- 1. Construct models of quadratic relations (i.e., ellipse, parabola, hyperbola).
- 2. Write a rule or definition for the locus of the curves of quadratic relations (i.e., ellipse, parabola, hyperbola).
- 3. Draw the curve of quadratic relations from the locus defintion.
- 4. Determine the equation of the curve of quadratic relations which has been drawn from the definition of its locus.
- 5. Verify the locus defintion for the curve of quadratic relations given its equation.
- 6. Solve problems that involve analyzing and determining the characteristics of a body that follows a conical path.
- 7. Solve problems that involve analyzing and determining the characteristics of a conical surface.

Module 57: Eccentricity I

- 1. Determine the ratio of distance to the focus and the distance to the directrix for the quadratic relations (i.e., parabola, ellipse, hyperbola).
- 2. Draw the locus of points where the distance ratio has differing values from less than 1 to greater than 1.
- 3. Summarize the results from investigations of the eccentricities of quadratic relations.
- 4. Generalize that the eccentricity for :
 - a. a parabola is equal to 1.
 - b. an ellipse is between 0 and 1.
 - c. a hyperbola is greater than 1.
- 5. Infer that as the eccentricity of an ellipse approaches zero then the ellipse approaches a circle.

Module 58: Eccentricity II

Objective

- 1. Describe the change to the locus of points of quadratic relations when any combination of the focus, directrix, or eccentricity is allowed to vary or remain constant.
- 2. Determine the eccentricity of conics using the distance formaula and points that are on each conic.
- 3. Determine whether or not points are part of a locus given the directrix, focus, and eccentricity.
- 4. Verify that points are on a conic using the distance formula.
- 5. Determine the equation of a conic given the directrix, focus, and eccentricity.
- 6. Draw the graph of a conic given the directrix, focus, and eccetricity.
- 7. Draw the graph of a conic given the directrix, focus, and eccentricity.

Module 61: The Normal Distribution

Objective

- 1. Calculate and interpret the mean and standard deviation of a set of data.
- 2. Identify the normal distribution.
- 3. Use *z*-scores to solve situations that are normally distributed.
- 4. Use *z*-scores to calculate the probability of an event happening.

Module 62: Bivariate Data

Objective

- 1. Plot sets of bivariate data to produce a scatterplot.
- 2. Plot a line of best fit on a scatterplot using the median fit method.
- 3. Use the equation of the line of best fit to generate new data for a population.

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- 4. Determine the strength and type of correlation between the variables of a bivariate distribution.
- 5. Collect, organize, and analyze sets of bivariate data.

Module 63: Confidence

- 1. Design and administer a yes/no simple survey and collect and organize the results of the survey.
- 2. Draw box and whisker plots of the results of multiple samples.
- 3. Use a 90% box and whisker plot chart to find the confidence interval for a survey result.
- 4. Draw statistical conclusions and make inferences to populations, and explain the confidence with which such conclusions and inferences are made based on the results of yes/no surveys.
- 5. Assess the strength, weaknesses, and biases of given samples.

Module 71 Permutations

- 1. Solve problems using the Fundamental Counting Principle.
- 2. Define and use $_{n}P_{n}$ and n!
- 3. Define and use $_{n}P_{r}$; also solve linear permutations with repetitions and permutations with like elements.
- 4. Solve problems involving circular permutations and permutations with reflections.
- 5. Solve probability questions which involve the use of permutations.

Module 72: Combinations

- 1. Define the meaning and use applications of the formula ${}_{n}C_{r} = \frac{n!}{r!(n-r)!}$.
- 2. Solve probability questions which involve the use of combinations.
- 3. Define and use the Binomial Theorem and Pascal's Triangle.