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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

Objective

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

Ojective

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

Objective

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

Objective

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

Objective

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.

3. 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

Objective

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 $y = a \cos$

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

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

Objective

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

Objective

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

Objective

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

Objective

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.

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 ${}_nP_n$ and $n!$
3. Define and use ${}_nP_r$; 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

Objective

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