Grade 12 Mathematics
Fourth Year High School Math

Sequences, and Series, and Math Induction

Stage 1: Desired Results

Catholic Standards

Targeted Standards

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Life and Dignity of the Human Person

Solidarity

Care for God's Creation

Summary

Applying sequences and series to everyday and workplace problem situations and introducing formal proof by induction, with applications to summing various series.

Unit Goals

1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems.
2. Understand patterns, relations, and functions; represent and analyze mathematical situations and structures using algebraic symbols.
3. Students use mathematical processes and knowledge to solve problems.Students apply problem-solving and decision-making techniques, and communicate mathematical ideas.

Big Ideas

Mathematical induction is a formal method of proof used to verify formulas that otherwise could not be shown to be true even with an infinite number of examples.

Enduring Understandings

1. Fluency in operations with real numbers gives me the power to make informed decisions in order to live more effectively in the world.
2. There are a variety of mathematical techniquesas well asuses of various measurement scales used in problem solving that will help me in the workplace and in everyday life.
3. There are variuos types of reasoning and methods of proof to construct logical arguements in order to justify or refute solutions to problems that will give me opportunities to make the world a better place.
4. The appropriate reasoning and method of proof used for any one real-world problem allows me to communicate effectively across disciplines and cultures.

Content

1. Arithmetic and geometric sequences, series and their sums.
2. Applications to Finance.
3. Sigma Notation.
4. Binomial Theorem and Fibonacci numbers.
5. Mathematical Induction.

Skills

1. Analyze the behavior of arithmetic and geometric sequences and series as the number of terms increases and make connections to everyday and workplace problem situations. (12P1)
2. Translate between the numeric and symbolic form of a sequence or series. (12P2)
3. Discover formulas for the sum of the first *n* whole numbers, their squares and cubes. (ode)
4. Apply combinations as a method to create coefficients for the Binomial Theorem, and make connections to everyday and workplace problem situations.(12N2)
5. Make arguments about mathematical properties using mathematical induction. (12P6)

Essential Questions

1. To what extent will being fluent in operations with real numbers give me the power to make informed decisions in order to live more effectively in the world?
2. How will solving problems using factorials, exponents, and recursive functions help me in the workplace and in everyday life?
3. How would being able to solve problemsusing various measurement scales, derived measurements, or computing areas and volumehelp me in the workplace and in everyday life?
4. To what extent will mathematical reasoning and proof give me opportunities to make the world a better place?
5. How will knowing when to use inductiveor deductive reasoning as well asverifying mathematically or empirically allow me to communicate effectively across disciplines and cultures?

Stage 2: Assessment Evidence

Diagnostic: Diagnostic

Pretest on determining the power of a fraction, the square of a binomial, and the value of a trigonometric ratio of radian angle measures.

Diagnostic: Teacher Observation

Cooperative Learning activity solving some real-world problem

Formative: Homework

Solving word problems using arithmetic and geometric formulas for sequences and series.

Formative: Teacher Observation

Students present their solutions to word problems to the class. Cooperative Learning activity solving some real world problem

Formative: Quiz

Short quiz to monitor progress in mastery of material.

Summative: Test

Summative: Project

Individual or group project combining content and skills presented in the unit.

Stage 3: Learning Plan

Learning Experiences

1. (Diagnostic) Have students guess how much money they would have at the end of one month if their parents gave them1 penny the first day, 2 pennies the second day, 4 pennies the third day, and so on. Then have them work in groups to calculate exactlyhow much they would have at the end of one month, (2 months, 3 months, 1 year).
2. (Formative) The homework problems should provide students the opportunityof communicating mathematics, practicing with the content of the lesson on a basic as well as critical thinking level, and using their understanding to application and problem solving.
3. Have the students in groups and supply eachgroup with a different real world problem, such as.The group deposits $200 into an annuity every 3 months.The annuity pays an APR of 8% and interest is compounded quarterly.What will be the total value of the annuity at the end of 10 years?
4. (Summative)Organize students into groups. Have each group choose four infinite sequences from the unit and create a spreadshet to verify the calculated limit of each.Let the number of terms vary from 1 to 50. Have them investigate the limit of a sequence they choose, predicting the limit before creating the spreadsheet.Have them also use a spreadsheet to verify the formula for the sum of an infinite geometric series.Then with their work have them generalize their results, and prepare a presentation to the class.

Technology Integration

1. TI-83 or TI-84 graphing calculators.
2. Mathematical Software, (Geometers Sketchpad, Derive, etc).

Resources

1. Textbook
2. Websitesthat may be usefulin developing lesson plans include the following.
3. Ohio Department of Education www.ode.state.oh.us
4. NCTMwww.nctm.org
5. NCISLAwww.wcer.wise,edu/ncisla/publications
6. Education Worldwww.education-world.com
7. Glencoe Publishing Company www.glencoe.com
8. Fibonacci Sequence: http://school.discoveryeducation.com/lessonplans/programs/numbersnature/
9. Websites that may be useful to students:
10. A place to start with links to other math sites = www.npac.syr.edu/textbook/kidsweb/math.html
11. Provides links to math resources = www.tc.cornell.edu/Edu/MathSciGateway
12. Students ask Dr. Math their own questions = www.forum.swarthmore.edu/dr.math/

Grade 12 Mathematics
Fourth Year High School Math

Standard Functions

Stage 1: Desired Results

Catholic Standards

Targeted Standards

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Life and Dignity of the Human Person

Solidarity

Care for God's Creation

Summary

Functions represented in any of their four viewpoints provide us with a mathematical and practical model to analyze, interpret, and predict real-world phenomena.

Unit Goals

1. Apply appropriate techniques, tools, and formulas to determine measurements.
2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems.
3. Apply transformations and use symmetry to analyze mathematical situations.
4. Understand patterns, relations, and functions; represent and analyze mathematical situations and structures using algebraic symbols.
5. Use mathematical models to represent and understand quantitative relationships; analyze change in various contexts.
6. Select and use appropriate statistical methods to analyze data.
7. Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas.

Big Ideas

Functions make sense of Gods Creation.

Enduring Understandings

1. Functions help me recognize and appreciate the inherent order and beauty of God's creation.
2. Functions are the fuel for technology, progress, invention, discovery and creativity.
3. Functions play a central role in the cultural, recreational, and aesthetic aspects of my life.
4. The universal language of functions allows me to communicate effectively across disciplines and cultures.

Content

1. Elementary, transcendental and periodic functions from a descriptive, numerical, graphical and symbolical viewpoint.
2. Inverse of a function.
3. Families of functions.
4. Radian unit measures.
5. Trigonometric identities.
6. Modeling bivariate data sets with their appropriate function.

Skills

1. Describe and compare from all viewpoints the characteristics of elementary, transcendental and periodic functions. (12P3)
2. Relate graphical and algebraic representations of lines and simple curves. (12G3)
3. Represent the inverse of a function symbolically and graphically as a reflection about *y* = *x*. (11P6)
4. Represent the inverse of a transcendental function symbolically. (12P4)
5. Identify families of functions with graphs that have rotation symmetry or reflection symmetry about the *y*-axis, *x*-axis or *y* = *x*. (11P5)
6. Use radian measures in the solution of problems involving angular velocity and acceleration symbolically. (12M2)(11M2)
7. Derive and apply the basic trigonometric identities. (12G2)
8. Transform bivariate data so it can be modeled by a function. (12D2)
9. Use regressions with technology to determine curves that fit the data. (ode)
10. Solve problems involving derived measurements. (12M1)

Essential Questions

1. How will a functions rate of change, intercepts, zeroes, asymptotes, local and global behavior help me recognize and appreciate the inherent order and beauty of God's creation?
2. How will assessing the adequacy and reliability of tabular and graphical displays of data as well as knowing the differences among accuracy, precision, and error in measurement help me recognize and appreciate the inherent order and beauty of God's creation?
3. How will constructing algorithms for multi-step and non-routine problems and using trigonometric relationships to verify and determine solutions in problem situations help me recognize and appreciate the inherent order and beauty of God's creation?
4. Why and how will the answers to the three previous questions be the fuel for technology, progress, invention, discovery and creativity as well as show functions to be a center role in the cultural, recreational, and aesthetic aspects of my life?
5. How will using formal mathematical language and notation to represent ideas both orally and in writting allow me to communicate effectively across disciplines and cultures?

Stage 2: Assessment Evidence

Diagnostic: Diagnostic

Pretest on evaluating algebraic expressions for given values of the variable, using the pythagorean theorem, the associative and commutative property of multiplication, factoring polynomial expressions, determining the L.C.M. of a set of algebraic expressions, termonology related to the coordinate plane, formulas related to circles, triangle congruencies, the absolute value, using the distance formula, using the zero-product property, slopes of perpendicular lines, and properties of exponents

Diagnostic: Teacher Observation

Cooperative learning activity solving some real-world problem

Formative: Homework

Solving problems involving basic concepts and applications

Formative: Teacher Observation

Students present their solutions of the homework problems to the class. Cooperative learning activity solving some real-world problem

Formative: Quiz

Short quiz to assess progress in mastery of material

Summative: Test

Summative: Project

Individual or group project combining content and skills presented it the unit

Stage 3: Learning Plan

Learning Experiences

1. (Diagnostic) Give Students old magazines and have them pick out interesting photographs that display various types of symmetry.
2. (Formative) The homework problems should provide students the opportunity to communicating mathematics, practicing with the content of the lesson on a basic as well as critical thinking level, and using their understanding to application and problem solving.
3. Have students work in pairs where each student thinks of a function. Then they work together to determine the sum, difference, product, and quotient of their functions. Then, also, the composite of their functions in both orders and finally the inverse of each of their functions.
4. (Summative) Gather the following materials: variety of sponges with different textures, measuring flasks, a balance, water, and other liguids. Organize students into groups with each group investigating how the porosity, C, and permeability, K, of the sponges affects their ability to hold water and be wrong out. The groups must first classify their sponges according to their porosity, and conduct trials using water to compare their permeability and how much pressure, p, is required to extract the water. Then go on to investigate how different liguids having different viscosities, v, affect the sponges brhavior. Make sure careful records are kept at each stage of the investigation so that the groups can determine some equations that relate the different varibles with which they have been experimenting with. Finally have each group present their reulsts to the class.

Technology Integration

1. TI-83 or TI-84 graphing calculators.
2. Mathematical Software, (Geometers Sketchpad, Derive, etc).

Resources

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2. Websites that may be useful in developing lesson plans include the following.
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4. NCTM www.nctm.org
5. NCISLA www.wcer.wise,edu/ncisla/publications
6. Education World www.education-world.com
7. Glencoe Publishing Company www.glencoe.com
8. Websites that may be useful to students include the following.
9. A place to start with links to other math sites = www.npac.syr.edu/textbook/kidsweb/math.html
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Grade 12 Mathematics
Fourth Year High School Math

Polar Coordinates

Stage 1: Desired Results

Catholic Standards

Targeted Standards

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Life and Dignity of the Human Person

Solidarity

Care for God's Creation

Summary

Applying operations performed in the rectangular coordinate system to the polar coordinate system.

Unit Goals

1. Specify locations and describe spatial relationships using coordinate geometry and other representational systems.
2. Understand patterns, relations, and functions; represent and analyze mathematical situations and structures using algebraic symbols.
3. Employ mathematical processes and knowledge to solve problems.
4. Apply problem-solving and decision-making techniques, and communicate mathematical ideas.

Big Ideas

Polar coordinates, as an alternative to rectangular coordinates, model more complex real-world phenomena.

Enduring Understandings

1. Polar Coordinates help me recognize and appreciate the inherent order and beauty of Gods creation.
2. Learning polar coordinates is satisfying, enjoyable, and gives me confidence.
3. The Polar coordinate system is a fuel for technology, progress, invention, discovery and creativity.

Content

1. Polar coordinate systems.
2. Cartesian coordinate systems.
3. Graphs of polar curves.

Skills

1. Define polar coordinates in the plane. (ODE)
2. Use polar coordinates to specify locations on a plane. (11G1)
3. Translate freely between polar and Cartesian coordinate systems. (12P9)
4. Graph various polar curves on paper and with technology. (ODE)

Essential Questions

1. How do polar coordinates help me recognize and appreciate the inherent order and beauty of Gods creation?
2. To what extent is learning polar coordinates; satisfying, enjoyable, and self-confidence building?
3. How can the polar coordinate system be used as fuel for technology, progress, invention, discovery and creativity?

Stage 2: Assessment Evidence

Diagnostic: Diagnostic

Students will take a pretest on converting between degree and radian units of measure of angles, and the normal form of a linear equation.

Diagnostic: Teacher Observation

Class discusion on using different means to describe and locate a point on the coordinate plane.

Formative: Homework

Students will solve problems involving basic concepts and applications of polar coordinates.

Formative: Teacher Observation

Students will present their solutions of the homework problems to the class. Then the students will break into groups for a cooperative learning activity solving some real-world problem.

Formative: Quiz

Students will take a short quiz to assess progress in mastery of material.

Summative: Test

Students will take a written test to check their understanding of polar coordinates.

Summative: Project

There will be an individual or group project combining content and skills presented it the unit

Stage 3: Learning Plan

Learning Experiences

1. (Diagnostic) Have students graph the point P, (1,square root of 3) on a coordinate plane and then draw the line segment ,OP, from the orgin to that point. Then have them determine the lenght of OP and the angle that OP makes with the x-axis.
2. (Formative) The homework problems should provide students the opportunity to communicating mathematics, practicing with the content of the lesson on a basic as well as critical thinking level, and using their understanding to application and problem solving.
3. Using cooperative groups have students in each group decide a method for randomly choosing a point in the polar plane. One student then chooses a point and writes its polar coordinates. Then the other students, in turn, write different pairs of polar coordinates that represent the same point.
4. (Summative) Organize students into groups and have them research and build a sextant, an instrument to measure a star's altitude, desribe its use, and use it at night to determine their latitude.

Technology Integration

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Resources

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4. NCTM [www.nctm.org](http://www.nctm.org/)
5. NCISLA www.wcer.wise,edu/ncisla/publications
6. Education World [www.education-world.com](http://www.education-world.com/)
7. Glencoe Publishing Company [www.glencoe.com](http://www.glencoe.com/)
8. Websites that may be useful to students include the following.
9. A place to start with links to other math sites = [www.npac.syr.edu/textbook/kidsweb/math.html](http://www.npac.syr.edu/textbook/kidsweb/math.html)
10. Provides links to math resources = [www.tc.cornell.edu/Edu/MathSciGateway](http://www.tc.cornell.edu/Edu/MathSciGateway)
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Grade 12 Mathematics
Fourth Year High School Math

Complex Numbers

Stage 1: Desired Results

Catholic Standards

Targeted Standards

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Life and Dignity of the Human Person

Solidarity

Care for God's Creation

Summary

Operating with complex numbers in their rectangular andpolar form.

Unit Goals

1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems.
2. Understand meanings of operations and how they relate to one another.
3. Understand patterns, relations, and functions; represent and analyze mathematical situations and structures using algebraic symbols.
4. Employ mathematical processes and knowledge to solve problems.
5. Apply problem-solving and decision-making techniques, and communicate mathematical ideas.

Big Ideas

Complex numbers provide solutions to functions that can not be evaluated in the real number system.

Enduring Understandings

1. Complex numbers help me recognize and appreciate the inherent order and beauty of Gods creation.
2. Learning complex numbers is satisfying, enjoyable, and gives me confidence.
3. Complex numbers are a fuel for technology, progress, invention, discovery and creativity.

Content

1. Arithmetic operations of complex numbers in rectangular and polar form.
2. Complex conjugates.
3. Real equations and pairs of complex roots.
4. Polynomials and the Fundamental Theorem of Algebra.
5. DeMoivres theorem and complex *n*th roots.

Skills

1. Represent complex numbers on the complex plane. (11N3)
2. Compute sums, differences, products and quotients of complex numbers. (11N7)
3. Solve equations involving radical expressions and complex roots. (11P8)
4. Determine what properties (closure, identity, inverse, commutative and associative) hold for operations with complex numbers. (12N1)
5. Translate complex numbers freely between rectangular and polar form. (ODE)
6. Perform arithmetic operations of complex numbers in polar form. (ODE)
7. Solve quadratic and polynomial equations that have complex roots. (ODE)
8. Determine powers and roots of complex numbers in polar form using DeMoivres theorem. (ODE)

Essential Questions

1. How does representing and computing with complex numbers help me recognize and appreciate the inherent order and beauty of Gods creation?
2. To what extent is learningcomplex numbers;satisfying, enjoyable, andself-confidence building?
3. Howcansolving quadratic equations that havecomplex rootsbe used as fuel for technology, progress, invention, discovery and creativity?

Stage 2: Assessment Evidence

Diagnostic: Diagnostic

Students will take a short prequiz on multiplying two binomials.

Diagnostic: Teacher Observation

The teacher will lead a class discussion on the solutions to the equations x^2 = 4 and x^2 = -4.

Formative: Homework

Students will solve problems involving basic concepts and applications of complex numbers.

Formative: Teacher Observation

Students will present their solutions of the homework problems to the class. Then break into groups for a cooperative learning activity using technology.

Formative: Quiz

Students will take a short quiz to assess progress in mastery of material.

Summative: Test

Students will take a written test to check their understanding of complex numbers.

Summative: Project

There will be an individual or group project combining content and skills presented it the unit.

Stage 3: Learning Plan

Learning Experiences

1. (Diagnostic) The teacher will lead the class in discussing the solutions to the two equations: x^2 = 4 and x^2 = -4.
2. (Formative) The homework problems should provide students the opportunity to communicating mathematics, practicing with the content of the lesson on a basic as well as critical thinking level, and using their understanding to application and problem solving.
3. Using cooperative groups have students in each group consider the rectangular coordinate plane and discuss how the x- and y-axis are related and how ordered pairs are determined.Then discuss the complex plane and how the **R** and i-axis are related and how ordered pairs aare determined.Then explore how the graphing calculator would simplify the analysis of these relations.
4. (Summative) Pair up students to search the internetto find types of coordinate systems tyhat are used to locate objects in space.Have them find atleast two different types.Then they write a summary that describes each coordinate system found comparing them to rectangular and polar coordinates in their compex number form.They should include diagrams illustrating how to use each coordinate system and all information found about converting between systems.

Technology Integration

1. TI-83 or TI-84 graphing calculators.
2. Mathematical Software, (Geometers Sketchpad, Derive, etc).

Resources

1. Textbook
2. Websitesthat may be usefulin developing lesson plans include the following.
3. Ohio Department of Education www.ode.state.oh.us
4. NCTMwww.nctm.org
5. NCISLA www.wcer.wise,edu/ncisla/publications
6. Education Worldwww.education-world.com
7. Glencoe Publishing Company www.glencoe.com
8. Websites that may be useful to students include the following.
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10. Provides links to math resources = www.tc.cornell.edu/Edu/MathSciGateway
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Grade 12 Mathematics
Fourth Year High School Math

Conics

Stage 1: Desired Results

Catholic Standards

Targeted Standards

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Life and Dignity of the Human Person

Solidarity

Care for God's Creation

Summary

The algebraical and graphical representations of the different conic cross-sections provide us with yet another mathematical model to many real-world applications.

Unit Goals

1. Analyze characteristics and properties of two-and three-dimensional geometric shapes anddevelop mathematical arguments aboutgeometric relationships.
2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems.
3. Apply transformations and use symmetry to analyze mathematical situations.
4. Use visualization, spatial reasoning, and geometric modeling to solve problems.
5. Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas.

Big Ideas

Conic Cross-Sectionshave their specific uses in modeling real-world phenomena.

Enduring Understandings

1. Conics help me recognize and appreciate the inherent order and beauty of Gods creation.
2. Learning conics is satisfying, enjoyable, and gives me confidence.
3. The Conic functions are a fuel for technology, progress, invention, discovery and creativity.

Content

1. Equations and graphs of conic sections.
2. Focus and directrix.
3. General quadratic equations in two variables and their applications.
4. Polar coordinate form of conic and their applications.

Skills

1. Identify, sketch and classify the cross sections, (circles, ellipses, parabolas, and hyperbolas), of three-dimensional objects. (11G5)
2. Define the focus and directrix of the different conic sections. (ODE)
3. Describe the characteristics of the graphs of conic sections. (11P10)
4. Relate graphical and algebraic representations of conic sections. (12G3)
5. Recognize and compare specific shapes and properties in multiple geometries. (12G4)
6. Graph and solve systems of second-degree equations and inequalities. (ODE)
7. Use polar coordinates to specify locations on a plane. (11G1)

Essential Questions

1. How do conics help me recognize and appreciate the inherent order and beauty of Gods creation?
2. To what extent is learning conics; satisfying, enjoyable, and self-confidence building?
3. How can conic functions be used as fuel for technology, progress, invention, discovery and creativity?

Stage 2: Assessment Evidence

Diagnostic: Diagnostic

Students will take a short prequiz on how to complete the square, solve systems of equations, matrix addition and multiplication.

Diagnostic: Teacher Observation

Students will break into groups for a cooperative learning activity solving some real-world problem.

Formative: Homework

Students will solve problems involving basic concepts and applications concerning conics.

Formative: Teacher Observation

Students will present their solutions of the homework problems to the class. Then break into groups for a cooperative learning activity solving some real-world problem.

Formative: Quiz

Students will take a short quiz to assess progress in mastery of material.

Summative: Test

Students will take a written test to check their understanding of conics.

Summative: Project

There will be an individual or group project combining content and skills presented in the unit.

Stage 3: Learning Plan

Learning Experiences

1. (Diagnostic) Give studentsa map of the area around the school.Then ask students how they would determine the distance between two landmarks on the map.Have students brainstorm how to measure the distance without physically measuring it outdoors.
2. (Formative) The homework problems should provide students the opportunity to communicating mathematics, practicing with the content of the lesson on a basic as well as critical thinking level, and using their understanding to application and problem solving.
3. Using cooperative groupshave each group draw a set of coordinate axes on a piece of graph paper.Then ask each group to list and plot ordered pairs that satisfy an equation such as xy = 16 and not just integer solutions.After they plot a lot of points have them show the class the two branches of the hyperbolaxy = C in the first and third quadrants.
4. (Summative) Pair up students and have them search the internet for a satellite, space vehicle or planet that travels in orbit around a planet or star.Then find data onits orbit.Include the closest and farthest distance of the object from the planet or star that it is orbiting.Make a scale drawing of the orbit labeling important features and demensions.Finally write a summary of the orbit and discuss in the summary which conic best models the orbit.

Technology Integration

1. TI-83 or TI-84 graphing calculators.
2. Mathematical Software, (Geometers Sketchpad, Derive, etc).

Resources

1. Textbook
2. Websitesthat may be usefulin developing lesson plans include the the following.
3. Ohio Department of Education www.ode.state.oh.us
4. NCTMwww.nctm.org
5. NCISLAwww.wcer.wise,edu/ncisla/publications
6. Education Worldwww.education-world.com
7. Glencoe Publishing Companywww.glencoe.com
8. A place to start with links to other math sites = www.npac.syr.edu/textbook/kidsweb/math.html
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Grade 12 Mathematics
Fourth Year High School Math

System of Equations and Matrices

Stage 1: Desired Results

Catholic Standards

Targeted Standards

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Life and Dignity of the Human Person

Solidarity

Care for God's Creation

Summary

Matrices offer an abstract view of systems of linear equations and point to efficient methods for solving them.

Unit Goals

1. Understand patterns, relations, and functions; represent and analyze mathematical situations and structures using algebraic symbols.
2. Use mathematical models to represent and understand quantitative relationships.
3. Apply transformations and use symmetry to analyze mathematical situations.
4. Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas.

Big Ideas

Matrices are an abstract and efficient method to solve problems in the business and science world.

Enduring Understandings

1. Fluency in operations with matrices either mentally, with paper/pencil, or with technology will help me solve problems in the workplace and in everyday life.
2. Understanding and using matrices as amathematical modelfor situations in the workplace and consumerismwill giveme opportunities to make the world a better place.

Content

1. Matrices and graphs solve systems of equations.
2. Matrices representation oftranslations, reflections, rotations, dilations and their compositions.
3. Applications of matrices.

Skills

1. Define matrices and matrix operations. (ODE)
2. Set up and solve systems of equations using matrices and graphs, with and without technology. (12P5)
3. Use matrices to represent translations, reflections, rotations, dilations and their compositions. (12G1)
4. Solve systems of linear equations using inverse matrices when possible. (ODE)
5. Solve systems of non-linear equations algebraically when appropriate and graphically using technology. (ODE)
6. Model and solve real world problems with matrices. (ODE)

Essential Questions

1. How can the properties of the real number system that apply to matrices help me solve problems in the workplace and in everyday life?
2. How can the properties of and representations for addition and multiplication of matrices help me solve problems in the workplace and in everyday life?
3. To what extent can representing transformations within a coordinate system using matrices giveme opportunities to make the world a better place?
4. To what extent can applying algebraic methods to represent and generalize problem situations involving matrices giveme opportunities to make the world a better place?

Stage 2: Assessment Evidence

Diagnostic: Diagnostic

Pretest on the commutative and associative properties of multiplication,

Diagnostic: Teacher Observation

Class Discussion

Formative: Homework

Solving problems involving basic concepts and applications

Formative: Teacher Observation

Students present their solutions of the homework problems to the class. Cooperative learning activity solving some real-world problem

Formative: Quiz

Short quiz to assess progress in mastery of material

Summative: Test

Summative: Project

Individual or group project combining content and skills presented it the unit

Stage 3: Learning Plan

Learning Experiences

1. (Diagnostic) The teacher will lead a discussion on the break-even point as it relates to putting on the school dance.How many tickets must be sold to break even, that is to cover all expences? Expences shuch as the food, the hiring of a DJ, decorations and so on.
2. (Formative) The homework problems should provide students the opportunity to communicating mathematics, practicing with the content of the lesson on a basic as well as critical thinking level, and using their understanding to application and problem solving.
3. Using cooperative groups have students in each group act as a board of directors running their ownbusiness.Sales results are recorded by item number and by month.Have them determine how the information could be organized so it could be read easily.
4. (Summative) Have students in groups devise a real-world problem that can be solved by linear programming.Have them define whether they are seeking a maximum or minimum.Then write the inequalities that define the polygonal convex set used to determine the solution.Lastly have them explain what the solution means.

Technology Integration

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Resources

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2. Websitesthat may be usefulin developing lesson plans include the following.
3. Ohio Department of Education [www.ode.state.oh.us](http://www.ode.state.oh.us/)
4. NCTM[www.nctm.org](http://www.nctm.org/)
5. NCISLA www.wcer.wise,edu/ncisla/publications
6. Education World[www.education-world.com](http://www.education-world.com/)
7. Glencoe Publishing Company [www.glencoe.com](http://www.glencoe.com/)
8. Websites that may be useful to students include the following.
9. A place to start with links to other math sites = [www.npac.syr.edu/textbook/kidsweb/math.html](http://www.npac.syr.edu/textbook/kidsweb/math.html)
10. Provides links to math resources = [www.tc.cornell.edu/Edu/MathSciGateway](http://www.tc.cornell.edu/Edu/MathSciGateway)
11. Students ask Dr. Math their own questions = [www.forum.swarthmore.edu/dr.math/](http://www.forum.swarthmore.edu/dr.math/)

Grade 12 Mathematics
Fourth Year High School Math

Vectors

Stage 1: Desired Results

Catholic Standards

Targeted Standards

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Life and Dignity of the Human Person

Solidarity

Care for God's Creation

Summary

Vectors with their algebraic and geometric properties create another view of geometry.

Unit Goals

1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems.
2. Understand meanings of operations and how they relate to one another.
3. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.
4. Specify locations and describe spatial relationships using coordinate geometry and other representational systems.
5. Apply transformations and use symmetry to analyze mathematical situations.
6. Use visualization, spatial reasoning, and geometric modeling to solve problems.
7. Use mathematical models to represent and understand quantitative relationships.
8. Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas.

Big Ideas

Vectors are everywhere in our daily lives, particularly involving the world of motion.

Enduring Understandings

1. Fluency in operations withvectors either mentally, with paper/pencil, or with technology will giveme opportunities to make the world a better place.
2. Vectors help me recognize and appreciate the inherent order and beauty of God's creation.
3. Vectors are a fuel for technology, progress, invention, discovery and creativity.

Content

1. Properties of vectors
2. Vectors modeled in the coordinate plane
3. Translations represented with vectors
4. Graphical and algebraic operations with vectors and a scalar
5. Dot products and the Law of Cosines
6. Applications and problem solving with vectors
7. Vectors in space

Skills

1. Determine what properties hold for vector addition and multiplication, and for scalar multiplication. (11N2)
2. Model, using the coordinate plane, vector addition and scalar multiplication. (11N5)
3. Represent translations using vectors. (11G2)
4. Use vector addition and scalar multiplication to solve problems. (11N9)
5. Describe multiplication of a vector and a scalar graphically and algebraically, and apply to problem situations. (11G3)
6. Model and solve problems with vectors. (11P7)
7. Determine the length of vectors and the angle between them. (ode)
8. Use vectors to represent a moving particle: parametric curves. (ode)
9. Determine position vectors and force vectors. (ode)
10. Add, subtract, and determine the magnitude of vectors in 3-dimensional coordinate system. (ode)

Essential Questions

1. How can the properties of the real number system that apply to vectors giveme opportunities to make the world a better place?
2. How can the properties of and representations for addition and multiplication of vectors giveme opportunities to make the world a better place?
3. To what extent can representing transformations within a coordinate system using vectors help me recognize and appreciate the inherent order and beauty of Gods creation?
4. To what extent can applying algebraic methods to represent and generalize problem situations involving vectors help me recognize and appreciate the inherent order and beauty of Gods creation?
5. How will the answers to the two previous questions show vectors to be a fuel for technology, progress, invention, discovery and creativity?

Stage 2: Assessment Evidence

Formative: Teacher Observation

Students present their solutions of the homework problems to the class. Cooperative learning activity solving some real-world problem

Formative: Quiz

Short quiz to assess progress in mastery of material

Summative: Test

Summative: Project

Individual or group project combining content and skills presented it the unit

Diagnostic: Diagnostic

Pretest on using the distance formula, expand a 3 X 3 determinant by minors using its first row, all forms of the equation of a line,

Diagnostic: Teacher Observation

Class Discussion

Formative: Homework

Solving problems involving basic concepts and applications

Stage 3: Learning Plan

Learning Experiences

1. (Diagnostic) The teacher will lead a discussion on the flight of a plane and the course of a boat in a river. Exploring what the path would be if the plane or boat headed directly to their destination. **(The wind or current would move the plane or boat off course.)** Demonstrate to the students that for accurate navigation, one must take into account the direction and magnitude of all external forces acting on the craft. Then explain that this is where the mathematics of trigonometry and vectors comes into play.
2. (Formative) The homework problems should provide students the opportunity to communicating mathematics, practicing with the content of the lesson on a basic as well as critical thinking level, and using their understanding to application and problem solving.
3. (Formative) Using cooperative groups have studentswork in pairs to analyze the flight of a flying disk. Determine a starting point fo the launch. One student throws the disk and the other times how long it takes to hit the ground. Then use parametricequations to show the disk's movement given its starting position and velocity.
4. (Summative) Have students in groups to devise a real-world problem that can be solved using vectors. Explain why vectors are needed to solve their problem. Solve their problem then have them show and explain all their work.

Technology Integration

1. TI-83 or TI-84 graphing calculators
2. Mathematical Software, (Geometers Sketchpad, Derive, etc)

Resources

1. Textbook
2. Websitesthat may be usefulin developing lesson plans:
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Grade 12 Mathematics
Fourth Year High School Math

Statistics and Probability

Stage 1: Desired Results

Catholic Standards

Targeted Standards

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Life and Dignity of the Human Person

Solidarity

Care for God's Creation

Summary

Collecting, organizing, and interpreting data and determining the outcome of an event with simple, combining, and conditional probability and the difference between odds and probability.

Unit Goals

1. Select and use appropriate statistical methods to analyze data.
2. Develop and evaluate inferences and predictions that are based on data.
3. Understand and apply basic concepts of probability.
4. Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas.

Big Ideas

The collection and interpretation of data and the computation of the probable outcome of an event will provide a better understanding of God's creation.

Enduring Understandings

1. There are appropriate tools used to create and analyze tabular and graphical displays of data which allow me to communicate effectively across disciplines and cultures.
2. Descriptive statistics connected to applications in workplace and consumer situations will help me in the workplace and in everyday life.
3. Knowing the probable outcome of an event gives me the power to make informed everyday decisions in order to live more effectively in the world.

Content

1. Sampling methods used in a study
2. Summary statistics for a set of univariate data
3. Probability distributions
4. Sampling distributions for informal inference
5. Theoretical and experimental probability

Skills

1. Identify and use various sampling methods, (voluntary response, convenience sample, random sample, statified random sample, census), in a study. (12D1)(12D2)(11D10)(11D2)
2. Describe the shape and determine all summary statistics for a set of univariate data, and desribe how a linear transformation affects shape, center and spread. (12D3)(11D3)
3. Apply the concept of a random variable to generate and interpret probability distributions, including binomial, normal and uniform. (12D4)
4. Use sampling distributions as the basis for informal inference. (12D5)
5. Design a statistical experiment,survey or study for a problem; collect and interpret the data with appropriate grapgical display, descriptive statistics, concepts of variability, causation, correlation and standard deviation. (11D1)
6. Evaluate the validity of results of a study based on characteristics of the study design, including sampling method, summary statistics and data analysis techniques. (11D9)
7. Use technology to compute standard deviation for a set of data and interpret the result in relation to the context. (11D6)
8. Describe the standard normal curve and its general properties, and analyze data assumed to be normal. (11D7)
9. Use theoretical or experimental probabilty, including simulations, to determine probabilities in real-world problem situations involving uncertainty, such as mutually exclusive events, complmentary events, and conditional probability. (12D6)
10. Examine statements and decisions involving risk. (11D11)

Essential Questions

1. How will spreadsheets and graphing calculators used to create and analyze tabular and graphical displays of data allow me to communicate effectively across disciplines and cultures?
2. How will the measures of center, dispersion, correlation and variability of sets of data help me in the workplace and in everyday life?
3. To what extent can using descriptive statistics to communicate and support predictions and conclusions of statistical experiments, simulations or studies help me in the workplace and in everyday life?
4. How can probability distributions or theoretical and experimental probability in real-world problem situations give me the power to make informed everyday decisions in order to live more effectively in the world?

Stage 2: Assessment Evidence

Diagnostic: Diagnostic

Pretest on Sigma notation, evaluating factorials, Pascal's triangle.

Diagnostic: Teacher Observation

Cooperative learning activity solving some real-world problem

Formative: Homework

Solving problems involving basic concepts and applications

Formative: Teacher Observation

Students present their solutions of the homework problems to the class. Cooperative learning activity solving some real-world problem

Formative: Quiz

Short quiz to assess progress in mastery of material

Summative: Project

Individual or group project combining content and skills presented it the unit

Summative: Test

Stage 3: Learning Plan

Learning Experiences

1. (Diagnostic) Have studentswork in groups and examine the dress code in their student handbook. Have them list all possible shirts/blouses, pants/slacks/skirts, socks, etc. Then determine all the dress options one can have each day and think of a way to list these possibilities.
2. (Formative) The homework problems should provide students the opportunityto communicate mathematics, practicing with the content of the lesson on a basic as well as critical thinking level, and using their understanding to application and problem solving.
3. (Formative) Using cooperative groups have each group discuss and list several criteria in which colleges and universities select students for admission, for example a student's GPA. Arrange the criteria in such a way to help admissions choose students for scholarships, for prefered admissions, for admittance, to be put on a waiting list and finaly for those who are turned down.
4. (Summative)Have students in groups use the internet to find the population of the United States by age groups or ethnic background for the most recent census. Make a table or spreadsheet of the data. Suppose that a person was selected at random from all the people in the United States to answer some survey questions. Determine the probability that the person was from each one of the age or ethnic groups used for your table or spreadsheet. Write a summary describing how you calculated the probabilities. Include a graph and discuss why someone might be interested in your findings.

Technology Integration

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Resources

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6. Education World[www.education-world.com](http://www.education-world.com/)
7. Glencoe Publishing Company [www.glencoe.com](http://www.glencoe.com/)
8. Fibonacci Sequence: <http://school.discoveryeducation.com/lessonplans/programs/numbersnature/>
9. Websites that may be useful to students:
10. A place to start with links to other math sites = [www.npac.syr.edu/textbook/kidsweb/math.html](http://www.npac.syr.edu/textbook/kidsweb/math.html)
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Grade 12 Mathematics
Fourth Year High School Math

Limits

Stage 1: Desired Results

Catholic Standards

Targeted Standards

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Life and Dignity of the Human Person

Solidarity

Care for God's Creation

Summary

Exploring the existence of limits in the world of mathematics.

Unit Goals

1. Apply appropriate techniques, tools, and formulas to determine measurements.
2. Understand patterns, relations, and functions; represent and analyze mathematical situations and structures using algebraic symbols.
3. Use mathematical models to represent and understand quantitative relationships; analyze change in various contexts.
4. Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas.

Big Ideas

Mathematical limits open up a whole new branch of mathematics called calculus.

Enduring Understandings

1. Limits help me recognize and appreciate the inherent order and beauty of Gods creation.
2. Learning limits is satisfying, enjoyable, and gives me confidence.
3. Limits are a fuel for technology, progress, invention, discovery and creativity.

Content

1. Slope of a line tangent at a point.
2. Area under a curve over a bounded interval.
3. Successive approximation, upper and lower bounds, and limits in measurement situations.
4. Mathematical arguments using limits.

Skills

1. Use the concept of limit to find instantaneous rate of change for a point on a graph as the slope of a tangent at a point. (12P10)
2. Compare estimates of the area under a curve over a bounded interval by partitioning the region with rectangles. (12P8)
3. Apply informal concepts of successive approximation, upper and lower bounds, and limits in measurement situations. (12M3)
4. Make mathematical arguments using the concepts of limit. (12P7)

Essential Questions

1. How do limits in mathematicshelp me recognize and appreciate the inherent order and beauty of Gods creation?
2. To what extent is learning mathematical limits; satisfying, enjoyable, andself-confidence building?
3. How can limits in mathematics be used as fuel for technology, progress, invention, discovery and creativity?

Stage 2: Assessment Evidence

Diagnostic: Project

Formative: Homework

Solving problems involving basic concepts and applications

Formative: Teacher Observation

Students present their solutions of the homework problems to the class. Cooperative learning activity solving some real-world problem

Formative: Quiz

Short quiz to assess progress in mastery of material

Summative: Test

Summative: Project

Individual or group project combining content and skills presented it the unit

Stage 3: Learning Plan

Learning Experiences

1. (Diagnostic) Have a spring strong enough that some students might be able to compress it all the way, but not all the students.Measure the length of the compressed spring for each student pointing out that these lenghts are approaching a limiting value.
2. (Formative) The homework problems should provide students the opportunity to communicating mathematics, practicing with the content of the lesson on a basic as well as critical thinking level, and using their understanding to application and problem solving.
3. (Formative) Using cooperative groups have students in each group reveiw how to find the slope of a line and explore how they might applythis method to find the slope of a curve modeling some real-world problem and interpret what the derivative tells them.
4. (Summative) Pair students together and have them research the internet to find the number of cases reported or the number of deaths for one particular disease for a period of at least 10 years, such as , measles, tuberculosis, or Aids and make a table or spreadsheet of the data. Use computer software or a graphing calculator to find at least two polynomial functions that model the data. Determine the derivative for each of your function models and explain what the derivative represent. Use each model to predict the cases or deaths in the year 2012. Write a one page paper comparing the models. Discuss which model you think best fits the data Include any limitations of the model.

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