Pre-Calculus

Implement start year – 2014-2015

Revision Committee Members, email, extension

Chris Melograna cmelograna@lrhsd.org ext. 8679
Christina Mull cmull@lrhsd.org ext. 8051
Joanne Wagner jwagner@lrhsd.org ext. 8887
Maryann Wilson mwilson@lrhsd.org ext. 8665

Unit #6, Sequences and Series

Transfer Goal: Students will be able to independently use their learning to recognize apply patterns to real world problems.

Stage 1 – Desired Results

Established Goals

2009 NJCCC Standard(s), Strand(s)/CPI #
(http://www.nj.gov/education/cccs/2009/final.htm)

Common Core Curriculum Standards for Math and English
(http://www.corestandards.org/)

HSA-SSE 4

- Write expression in equivalent forms to solve problems

HSA-APR.C.5

- Use polynomial identities to solve problems

HSF-BF A.2

- Build a function that models a relationship between two quantities

21st Century Themes
(www.21stcenturyskills.org)

☒ Global Awareness
☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy
☒ Health Literacy
☒ Environmental Literacy

21st Century Skills

Learning and Innovation Skills:
☒ Creativity and Innovation
☒ Critical Thinking and Problem Solving
☒ Communication and Collaboration

Information, Media and Technology Skills:
☒ Information Literacy
☒ Media Literacy
☒ICT (Information, Communications and Technology) Literacy

Life and Career Skills:
☒ Flexibility and Adaptability
☒ Initiative and Self-Direction
☒ Social and Cross-Cultural Skills
☒ Productivity and Accountability
☒ Leadership and Responsibility

Enduring Understandings:

Students will understand that . . .

EU 1

- Various methods can be used to evaluate sequences and series.

EU 2

Patterns of change are related to the behaviors of functions.

EU 3

- Mathematical patterns can help simplify complex situations.

Essential Questions:

EU 1

Why is it helpful to know more than one way to evaluate sequences and series?

EU 2

How are patterns of change related to the behaviors of functions?

EU 3

How are mathematical patterns used to simplify complex situations?

Knowledge:

Students will know . . .

EU 1

Formulas that relate to geometric and arithmetic functions

EU 2

Sequences and series are related to functions

EU 3

- Pascal's Triangle can be used to expand binomials

Skills:

Students will be able to . . .

EU 1

Distinguish between geometric and arithmetic sequences
Apply the appropriate formula to a given situation
Identity patterns in a given set of numbers

- Apply appropriate formulas to solve real life problems

EU 2

- Find the linear equation that models an arithmetic sequences
- Find the exponential equation that models a geometric sequences
- Use appropriate equations to find specific terms of sequences

EU 3

- Apply Pascal's Triangle to expand a binomial
- Apply Pascal's Triangle to find specific terms of a binomial

Stage 2 – Assessment Evidence

Recommended Performance Task: Your Own Reality Series! EU1, EU2

Stage 3 – Learning Plan

Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections:

Activity #1: Expanding Binomials – TI-nspire (A)
http://education.ti.com/en/us/activity/detail?id=E48BACF036D741168B18EDC6B7D7B78B&ref=/en/us/activity/search/subject?d=F988B132B1A74080AC6C1D0A68C5E3BB&s=B843CE852FC5447C8DD88F6D1020EC61&sa=2728754A144142118F13165941B9056E&t=0DF68A75BFF44FD88AEE6ECB6F9739D5

Activity #2: Exploring Geometric Sequences – TI-nspire (A)
http://education.ti.com/en/us/activity/detail?id=B7CA01660B11416497A9569FE4F52020&ref=/en/us/activity/search/subject?d=F988B132B1A74080AC6C1D0A68C5E3BB&s=B843CE852FC5447C8DD88F6D1020EC61&sa=2728754A144142118F13165941B9056E&t=0DF68A75BFF44FD88AEE6ECB6F9739D5

Activity #3: Students are to research the Fibonacci sequences. The must find real life connections to architecture, art, music, and nature. Students must turn in a written explanation of 3 situations where this sequence is used. (M)

Activity #4: Sum of an Infinite Geometric Series Hot Air Balloon Application – TI-nspire (T)
http://education.ti.com/en/us/activity/detail?id=9B04140D74F0430AA41100AFDABCE447&ref=/en/us/activity/search/subject?d=F988B132B1A74080AC6C1D0A68C5E3BB&s=B843CE852FC5447C8DD88F6D1020EC61&sa=2728754A144142118F13165941B9056E&t=0DF68A75BFF44FD88AEE6ECB6F9739D5

The following is a suggested sequence of learning activities and number of days for the Pre-Calc ACC class. Adjustments should be made accordingly for other levels.

- YWBAT use Pascal's Triangle to expand binomials (A, M)
  - Activity #1
- YWBAT find any term an polynomial expression (A)
- YWBAT express arithmetic sequences and series (A, M)
- YWBAT express geometric sequences and series (A, M)
  - Activity #2
  - Activity #3
  - Activity #4
- YWBAT use mathematical induction to prove mathematical generalizations (A)
- Performance Task (M, T)

Critical Vocabulary

Pascal's Triangle	Binomial Theorem	Sequences	Series	Arithmetic	Geometric	Common Difference
Common Ratio	Summation Notation	Induction	The Anchor	The Inductive Hypothesis	The Inductive Step	

Performance Task Helpful Guidelines:

· Depreciation of a car can be an arithmetic sequence if the car depreciates by a certain dollar amount every year. The sequence becomes geometric if the car depreciates by a percentage each year.
· Investments can be represented by arithmetic sequences or series if a set dollar amount is added at given intervals.
· If salary increases are given at a particular percentage per year, a geometric sequence can be used.
· It is also interesting to calculate the distance traveled by a ball as it bounces. If a ball bounces to 80% of its previous height, you can use this as the common ratio to evaluate the geometric series. Be sure to take into account the distance up and down between each bounce.
· An athlete in training might add a set distance to each workout. An arithmetic series can be used to calculate the total distance after one month of training.

· Real-life series (Choose real-life situations which use arithmetic or geometric sequences and series. You must have at least one of each type for this project.)
· Research (Include any research you did to discover the real-life applications of sequences and series. If you created the real-life applications yourself, explain your thinking. If you used ideas from other sources, show how you changed the terms, common difference, or common ratio to make your application unique.)
· Diagrams or pictures (Include a diagram or picture of the situations you have chosen. Either write out the 1st several terms, or use pictures to represent what is taking place. For example, if a ball is bouncing you might want to show the distance traveled in the 1^{st} several bounces.)
· Formulas (Write the recursive and explicit formulas for each sequence in the series. Then write the series using summation notation.)
· Show what you know! (Use as many of the concepts about arithmetic and geometric sequences and series as you can to describe your real-life situations. For example, show how to find the nth term of your arithmetic sequence or describe how to evaluate the 1st *n* terms. Discuss whether your geometric series is finite or infinite and how you know. Pretend you have only 2 terms in the sequence. Describe how you could write a rule for the nth term. Make up your own questions about your sequences and series and then answer them yourself.)

Pre-Calculus

Implement start year – 2014-2015

Revision Committee Members, email, extension

Chris Melograna cmelograna@lrhsd.org ext. 8679
Christina Mull cmull@lrhsd.org ext. 8051
Joanne Wagner jwagner@lrhsd.org ext. 8887
Maryann Wilson mwilson@lrhsd.org ext. 8665

Unit #7, Polar Graphing

Transfer Goal: Students will be able to independently use their learning to create multiple representations of real world phenomena.

Stage 1 – Desired Results

Established Goals

2009 NJCCC Standard(s), Strand(s)/CPI #
(http://www.nj.gov/education/cccs/2009/final.htm)

Common Core Curriculum Standards for Math and English
(http://www.corestandards.org/)

HSF-IF.C7

- Analyze functions using different representations.

21st Century Themes
(www.21stcenturyskills.org)

☒ Global Awareness
☒ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy
☒ Health Literacy
☒ Environmental Literacy

21st Century Skills

Learning and Innovation Skills:
☒ Creativity and Innovation
☒ Critical Thinking and Problem Solving
☒ Communication and Collaboration

Information, Media and Technology Skills:
☒ Information Literacy
☒ Media Literacy
☒ICT (Information, Communications and Technology) Literacy

Life and Career Skills:
☒ Flexibility and Adaptability
☒ Initiative and Self-Direction
☒ Social and Cross-Cultural Skills
☒ Productivity and Accountability
☒ Leadership and Responsibility

Enduring Understandings: *Students will understand that . . .*	**Essential Questions:**
EU 1 It is helpful to have more than one coordinate system. *EU 2* • Various systems can be used to represent corresponding data. *EU 3* • It is possible to determine what type of graph results from a given equation.	*EU 1* Why is it helpful to have more than one coordinate system? *EU 2* How does the polar coordinate system compare to the rectangular coordinate system? *EU 3* How can the type of polar graph be determined by looking at the equation?
Knowledge: *Students will know . . .*	**Skills:** *Students will be able to . . .*
EU 1 • The differences and similarities between the polar and rectangular coordinate systems *EU 2* The formulas necessary to convert from rectangular to polar and vice versa *EU 3* The types of polar graphs	*EU 1* Determine which coordinate system is more practical to use depending on the situation. *EU 2* Convert polar coordinates to rectangular coordinates and vice versa *EU 3* Sketch circles, limacons, and rose curves in a polar coordinate system without a t-chart

Stage 2 – Assessment Evidence

Recommended Performance Tasks: Polar Coordinates Art Project EU2, EU 3

Students will explore polar equations.
(a) Express coordinates of points in rectangular and polar form.
(b) Graph and identify characteristics of simple polar equations including lines, circles, cardioids, limacons, and roses.

Instructions
1. Create a design in the polar coordinate system using polar equations. Using your graphing calculator, you will experiment on your own with different equations until you get an aesthetically pleasing design.
(a) Include at least 3 types of polar equations (see (b) from above) in your design. You may also include types of polar equations not noted in the standards that you find in your research
(b) Attach a sheet with a table for each graph where θ increases by increments no greater than π/6. On the same sheet, note the type of design and describe the domain.

2. Write 2 paragraphs on the polar coordinate system. The objective is for the essay to be understandable by peers who have not yet studied the polar coordinate system.
(a) You must cite your sources.
(b) Content:
What is the polar coordinate system, and how do you use it?
Compare it to the Cartesian coordinate system. What are the pros/cons?
How do you graph polar equations in a calculator? By hand? What types of designs do you get?
How is the polar coordinate system applied in the world?

Other Recommended Evidence: *Tests, Quizzes, Prompts, Self-assessment, Observations, Dialogues, etc.*

- Test on transferring coordinates and equations and graphing three types of equations
- Assessed elements from recommended performance task.

Stage 3 – Learning Plan

Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: *Consider the WHERETO elements. Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.*

Activity #1: Cardioid Patterns Discovery – TI-nspire (A)
http://education.ti.com/en/us/activity/detail?id=302F3F44465341519A53AE555DCCC9EB&ref=/en/us/activity/search/subject?d=F988B132B1A74080AC6C1D0A68C5E3BB&s=B843CE852FC5447C8DD88F6D1020EC61&sa=2728754A144142118F13165941B9056E&t=BE80EEEFB7B04B1DB750BFE3CDC3C7A9

Activity #2: Limacons: A Polar Investigation – TI-nspire (M)
http://education.ti.com/en/us/activity/detail?id=5FFDD2CAC3C0452AA5E9DB8ADB4EF47A&ref=/en/us/activity/search/subject?d=F988B132B1A74080AC6C1D0A68C5E3BB&s=B843CE852FC5447C8DD88F6D1020EC61&sa=2728754A144142118F13165941B9056E&t=BE80EEEFB7B04B1DB750BFE3CDC3C7A9

- Activity #3: Create a design for a T-Shirt the read "I love math" using polar graphs to create a heart instead of the world love. (T)

The following is a suggested sequence of learning activities for the Accelerated Pre-Calculus class. Approximate days for completion: 10. Adjustments should be made accordingly for other levels.

- YWBAT plot point in polar form and their corresponding forms (A)
- YWBAT transfer polar coordinates to rectangular coordinates and vice versa. (A, M)
- YWBAT transfer polar equations to rectangular equations and vice versa. (A, M)
- YWBAT graph circle and limacon polar equations (A)
  - Activity #1
  - Activity #2
- YWBAT graph rose curves (A)
  - Activity #3
- Performance Task (M, T)

Critical Vocabulary

Polar Coordinate System	Pole	Polar Axis	Polar Coordinates	Polar Equation	Polar Graph	Limacon	Cardiod	Rose