Township of Ocean Schools

Assistant Superintendent
Office of Teaching and Learning

SPARTAN MISSION:
Meeting the needs of all students with a proud tradition of academic excellence.

DEPARTMENT <u>Mathematics</u>   COURSE <u>Discrete Math</u>

Curriculum Development Timeline

School: Ocean Township High School

Course: Discrete Math

Department: Mathematics

Board Approval	Supervisor	Notes
July 2007	Janet Bluefield	Born Date
January 2010	Janet Bluefield	Revisions
July 2012	Janet Bluefield	Revisions
June 2017	Nichole Kerney	Revisions
August 2018	Nichole Kerney	Revisions
August 2019	Nichole Kerney	Review
August 2022	Gerard Marrone	Alignment to Standards

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#spartanlegacy

DEPARTMENT <u>Mathematics</u>   COURSE <u>Discrete Math</u>

Township of Ocean Pacing Guide			
Week	Marking Period 1	**Week**	Marking Period 3
1	Binary Numbers and Operations	11	Logic (if p then q)
2	Binary Numbers and Operations	12	Logic (if p then q)
3	Matrix Operations and Applications	13	Logic (if p then q)
4	Matrix Operations and Applications	14	Graph Theory
5	Matrix Operations and Applications	15	Graph Theory
Week	Marking Period 2	**Week**	Marking Period 4
6	Sets, Relations and Functions	16	Graph Theory
7	Sets, Relations and Functions	17	Color Theory
8	Probability and Combinatorics	18	Trees and Spanning Trees
9	Probability and Combinatorics	19	Trees and Spanning Trees
10	Probability and Combinatorics	20	Patterns with Pascal's Triangle

Core Instructional & Supplemental Materials including various levels of Texts
Core Instruction: Discrete Math Through Applications (Freeman)   Supplemental: IXL Math, Kuta and Desmos   Special Education and ELL Supplemental: Video Tutor-bigideasmath.com

Time Frame	**2 weeks (10 blocks)**
Topic	
Binary Numbers and Operations	
Alignment to Standards	

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N.RN.1

Learning Objectives and Activities

SWBAT answer the following questions:
- Why might we want to use a system that is only based on 2 numbers?
- How can binary coding be applied to computer science?
- How can we translate a binary code into our decimal system?
- Is it possible to add, subtract and multiply binary numbers?

SWBAT demonstrate understanding of the following:
- Computing enhances communication and interaction.
- There are number systems other than base 10

Learning Activities:
- Understand the relationship between binary numbers and decimal numbers.
- Utilize addition, subtraction and multiplication in decimal form and translate to binary form.
- Understand the use for binary coding in computer science.

Assessments

Formative:
- Daily Practice Problems
- Teacher Observation
- Math Scavenger Hunt/Trail
- Entrance/Exit Cards

Summative:
- Quizzes on both types of conversions
- Quizzes on addition, subtraction and multiplication of binary numbers
- Binary Test

Alternative:
- Binary coding and decoding project
- Kahoot/Quizizz

Interdisciplinary Connections

Career Readiness, Life Literacies, and Key Skills

DEPARTMENT <u>Mathematics</u>   COURSE <u>Discrete Math</u>

Technology Integration
All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge. ● 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem. Students will use internet based game sites such as Quizizz, Kahoot, and Quizlet live to reflect on their learning progress. ● 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems. Supplemental instruction and math games will be presented using IXL Math and Video Tutor bigideasmath.com. ● 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion utilizing pre-learned etiquette about blended learning platforms. ● 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Career Education
CRP2: Apply appropriate academic and technical skills. CRP6: Demonstrate creativity and innovation.

Time Frame	**3 weeks (15 blocks)**
Topic	
Matrix Operations and Applications	
Alignment to Standards	
N.VM.5.a(+), N.VM.5.b(+), N.VM.6(+), N.VM.7(+), N.VM.8(+), N.VM.9(+), N.VM.10(+), N.VM.11(+), N.VM.12(+), A.REI.8(+), A.REI.9(+)	
Learning Objectives and Activities	
SWBAT answer the following questions:	

DEPARTMENT <u>Mathematics</u>   COURSE <u>Discrete Math</u>

- How can large collections of data be organized and managed in an efficient way?
- What calculations provide meaningful information to people who use the data?
- How can computers and calculators assist them?
- What is the inverse of a matrix and how do you find the inverse?

SWBAT demonstrate understanding of the following:
- How can large collections of data be organized and managed in an efficient way?
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- How can computers and calculators assist them?
- What is the inverse of a matrix and how do you find the inverse?

Learning Activities:
- Utilize properties of matrices-addition, subtraction & multiplication
- Understand what an inverse matrix is and how to find it
- Understand the determinant and how to find the inverse of matrices
- Utilize concepts on systems of equations to translate into a matrix
- Patterns for Profit Project
- Sub Shop Project
- Coding & Decoding messages

Assessments

Formative:
- Classwork and Homework
- IXL Practice
- Teacher Observation
- Graphic Organizer

Summative:
- Quiz on basic operations with Matrices
- Matrices Operations & Application test

Alternative:
- Projects – Population Growth & Patterns for Profit
- Individual or group productive struggle assessment during introductory lessons

Interdisciplinary Connections

Career Readiness, Life Literacies, and Key Skills

9.3.IT-PRG.6: In the decoding messages activity students will be introduced to programming a computer application using the appropriate programming language.

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Career Education
CRP6: Demonstrate creativity and innovation. CRP11: Use technology to enhance productivity.

Time Frame	**2 weeks (10 blocks)**
Topic	
Sets, Relations and Functions	
Alignment to Standards	
S.CP.1, F.IF.1, F.IF.5, F.BF.4b, F.LE.2	
Learning Objectives and Activities	
SWBAT answer the following questions: • How are sets useful in organizing data?	

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- What are the symbols' meanings in sets?
- How can we visually represent sets?
- How can we distinguish a one-to-one function?
- What are compositions of functions?
- What symbols are used in relations and functions?
- Why are relations and functions represented in numerous ways?

SWBAT demonstrate understanding of the following:
- Many real world functional relationships can be represented by equations. Equations can be used to find the solution of given real-world problems.
- One to one functions are for every input there is an individual output.

Learning Activities:
- Understand multiple ways to represent sets, relations and functions
- Ability to identify the numerous symbols of sets, relations and functions
- Understand how to compute compositions of functions
- Ability to identify relations for functions and determine one-to-one functions
- Sets in real life Project
- Computing compositions of functions Exercise
- Identifying one-to-one functions activity
- Setting up a relation activity

Assessments

<u>Formative:</u>
- Teacher Observation
- Graphic Organizer
- Math Scavenger Hunt/Trail
- Entrance/Exit Cards

<u>Summative:</u>
- Sets quiz; Relations quiz; Compositions of functions quiz
- Unit Test

<u>Alternative:</u>
- Observation Assessment with Problem-solving
- Kahoot/Quizizz

Interdisciplinary Connections

Career Readiness, Life Literacies, and Key Skills

DEPARTMENT <u>Mathematics</u>   COURSE <u>Discrete Math</u>

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Career Education
CRP4: Communicate clearly and effectively with reason.   CRP8: Utilize critical thinking to make sense of problems and persevere in solving them

Time Frame	**3 weeks (15 blocks)**
Topic	
Probability and Combinatorics	
Alignment to Standards	
<u>S.CP.1, S.CP.2, S.CP.3, S.CP.6, S.CP.7, S.CP.8, S.CP.9</u>	
Learning Objectives and Activities	

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SWBAT answer the following questions:
- In how many ways can a lottery participant choose several numbers from those on a lottery ticket?
- What is the probability of winning a lottery jackpot?
- What is the difference between permutations and combinations?

SWBAT demonstrate understanding of the following:
- Problems of arrangement and choice can be solving using combination and permutation formulas, and varieties of these.
- Permutations and combinations are tools that allow us to count large quantities quickly.
- Randomness is a kind of order that emerges after many repetitions.

Learning Activities:
- Define & Explore Counting Techniques (mutually exclusive & disjoint)
- Understand Probability, Permutation & Factorials
- Work with combinations of Probability, Permutation & Factorials
- Understand Binomial Probability Distribution
- Lottery Activity
- Probability Activity (Die, cards, & Chips)
- Combining probability with permutation & probability with combinations

Assessments

Formative:
- Probability Activity
- Classwork and Homework
- Math Scavenger Hunt/Trail
- Entrance/Exit Cards

Summative:
- Quiz on Multiplication & Addition Principles
- Counting & Probability Test

Alternative:
- Factorial Exploration
- Kahoot/Quizizz

Interdisciplinary Connections

Science: HS-ETS1-4: In this probability unit students use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

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ELA: W.9-10.1: When students are justifying their reasoning on short answer and extended constructed response questions they write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

Career Readiness, Life Literacies, and Key Skills

9.3.ST.2: When examining experimental probability data students will use technology to acquire, manipulate, analyze and report data.

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Career Education

CRP2: Apply appropriate academic and technical skills.
CRP4: Communicate clearly and effectively with reason.
CRP8: Utilize critical thinking to make sense of problems and persevere in solving them.

Time Frame	**3 weeks (15 blocks)**

DEPARTMENT <u>Mathematics</u>   COURSE <u>Discrete Math</u>

Topic
Logic (If p then q)
Alignment to Standards
[N.Q.2](#)
Learning Objectives and Activities

SWBAT answer the following questions:
- What are the symbols used in logic?
- How can the truth of a proposition be determined?
- How can we translate a statement into a truth table?

SWBAT demonstrate understanding of the following:
- Common language is often riddled with fallacies; sometimes when we communicate, our assumed meaning is not necessarily the logical meaning.
- Truth tables can be converted into the English language to understand what it is asking.

Learning Activities:
- Utilize truth tables to represent statements
- Understanding a statement or proposition
- Ability to use quantifiers in truth tables
- Work with compound statements
- Illustrate the importance of logic with applications
- Translate sentences into logical statements
- Show compound propositions are logically equivalent
- Translate statements into logical expressions using predicates, quantifiers, and logical connectives
- Given the domain, determine the truth value of statements
- Inheritance table Project
- Hypotheses in truth tables
- Create Logical Expressions from english statements

Assessments

<u>Formative:</u>
- Daily Practice Problems
- Teacher Observation
- Graphic Organizer
- Entrance/Exit Cards

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Summative:
- Quiz truth tables
- Quiz translating statements into logical expressions
- Quiz compound statements
- Test logical expressions and truth tables

Alternative:
- Inheritance table Project
- Individual or group productive struggle assessment during introductory lessons

Interdisciplinary Connections

Career Readiness, Life Literacies, and Key Skills

Technology Integration

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Career Education

CRP4: Communicate clearly and effectively with reason.
CRP6: Demonstrate creativity and innovation.

DEPARTMENT <u>Mathematics</u>   COURSE <u>Discrete Math</u>

CRP8: Utilize critical thinking to make sense of problems and persevere in solving them.

Time Frame	**3 weeks (15 blocks)**
Topic	
Graph Theory	
Alignment to Standards	
[N.Q.1, N.Q.2, N.Q.3](#)	
Learning Objectives and Activities	

SWBAT answer the following questions:
- How can the existence of circuits and paths be determined in a graph?
- How can the path from one location to another be determined most efficient with the restriction of connectivity?
- How can efficient groups be formed with constraints amongst the elements?

SWBAT demonstrate understanding of the following:
- Relationships can be modeled with graphs in order to solve a variety of real world problems.
- Euler circuits and Hamiltonian circuits enable us to solve many graph theory problems.
- Hamiltonian Circuits visit each vertex exactly once and start and end at the same vertex.
- Euler Circuits trace each edge exactly once and start and end at the same vertex

Learning Activities:
- Determine Shortest Route
- Identifying the difference between Euler Circuits and Paths
- Understanding Hamiltonian circuits and paths
- Explore Vertex Edge graphs
- Understand the relationship between lists, graphs and Matrices
- Understand Isomorphisms of graphs
- Map design project
- Creating a vertex edge Graph
- Exercises of Paths and circuits
- Shortest Path exercises
- Information transfer worksheet

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Assessments

<u>Formative:</u>
- Classwork and Homework
- Teacher Observation
- Class Debate of Approaches/Mathematical Methods

<u>Summative:</u>
- Circuits and paths quiz
- Vertex edge graph quiz
- Shortest Path quiz
- Graph theory test

<u>Alternative:</u>
- Map design project
- Kahoot/Quizizz

Interdisciplinary Connections

Career Readiness, Life Literacies, and Key Skills

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DEPARTMENT <u>Mathematics</u>   COURSE <u>Discrete Math</u>

- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Career Education
CRP6: Demonstrate creativity and innovation.

Time Frame	**1 week (5 blocks**
Topic	
Color Theory	
Alignment to Standards	
[N.Q.1, N.Q.2, N.Q.3](#)	
Learning Objectives and Activities	

SWBAT answer the following questions:
- What is the definition of a chromatic number in color theory?
- How can color theory be applied to Graph theory to identify the multiple groups given the constraints?
- What is the minimum amount of numbers needed to color any map?
- How can color theory be translated to real world examples?

SWBAT demonstrate understanding of the following:
- Vertex coloring can provide a way to solve problems involving conflict resolution.
- The maximum number of colors required to color any plane map is four.

Learning Activities:
- Identify chromatic number
- Apply color theory to what is known about graph theory
- Understanding the correlation of color theory to real topics
- Utilize color theory to create not conflicting schedules
- Understand when to color certain vertices and what they mean
- Planarity and coloring
- Color theory scenario Worksheet
- Schedule project

Assessments

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<u>Formative:</u>
- Classwork and Homework
- Graphic Organizer
- Math Scavenger Hunt/Trail

<u>Summative:</u>
- Vertex coloring Quiz
- Schedule Quiz
- Color Theory Test

<u>Alternative:</u>
- Schedule Project
- Observation Assessment with Problem-solving

Interdisciplinary Connections

Career Readiness, Life Literacies, and Key Skills

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DEPARTMENT <u>Mathematics</u>   COURSE <u>Discrete Math</u>

Career Education
CRP8: Utilize critical thinking to make sense of problems and persevere in solving them.

Time Frame	**2 weeks (10 blocks)**
Topic	
Trees and Spanning Trees	
Alignment to Standards	
[A.REI.1, A.REI.2](#)	
Learning Objectives and Activities	

SWBAT answer the following questions:
- How can it be determined whether a tree is considered a spanning tree or not?
- What determines a binary tree?
- What are the different levels of a binary tree referred to?

SWBAT demonstrate understanding of the following:
- A tree is a connected undirected graph with no simple circuits.
- A minimum spanning tree in a connected weighted graph is a spanning tree that has the smallest possible sum of weights of its edges.

Learning Activities:
- Understand the definition of a spanning tree
- How to visually represent a Spanning tree
- Utilize the formula to convert a graph into a spanning tree
- Understand the definition of a binary tree
- Finding Spanning trees
- Relating trees to algebra using expressions
- Exercises on Binary trees

Assessments

<u>Formative:</u>
- Teacher Observation
- Graphic Organizer

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- Entrance/Exit Cards

Summative:
- Quiz converting a graph to spanning tree
- Quiz on identifying parts of a binary tree
- Test on Trees

Alternative:
- Observation Assessment with Problem-solving
- Kahoot/Quizizz
- Individual or group productive struggle assessment during introductory lessons

Interdisciplinary Connections

Career Readiness, Life Literacies, and Key Skills

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Career Education

CRP6: Demonstrate creativity and innovation.

DEPARTMENT <u>Mathematics</u>   COURSE <u>Discrete Math</u>

Time Frame	**1 week (5 blocks)**
Topic	
Patterns with Pascal's Triangles	
Alignment to Standards	
<u>A.SSE.4, A.SSE.3</u>	
Learning Objectives and Activities	

SWBAT answer the following questions:
- What are different patterns that are represented in Pascal's Triangle?
- What are the different topics are represented in Pascal's Triangle?
- How is Pascal's Triangle useful in other topics of math?

SWBAT demonstrate understanding of the following:
- Analyze different patterns and how they can be used in other topics of math.
- Understand how Pascal came about creating Pascal's Triangle.
- Pascal's identity shows that when two adjacent binomial coefficients in this triangle are added, the binomial coefficient in the next row between these two coefficients is produced.

Learning Activities:
- Explore the different patterns in Pascal's Triangle
- Understanding the use of Pascal's Triangle in other mathematical topics
- Exploring the use of binomial expansion in Pascal's Triangle
- Exploring different patterns Project
- Finding Binomial Expansion

Assessments

<u>Formative:</u>
- Daily Practice Problems
- Teacher Observation
- Graphic Organizer
- Entrance/Exit Cards

<u>Summative:</u>
- Patterns of Pascal Quiz

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- Using Pascal's triangle to do a binomial expansion Quiz
- Pascal's Triangle Test

Benchmark:
- Cumulative final exam with multiple choice, short answer, and extended constructed response questions.

Alternative:
- Patterns Project
- Kahoot/Quizizz

Interdisciplinary Connections

ELA: W.11-12.1: When students are justifying their reasoning on short answer and extended constructed response questions they write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

Career Readiness, Life Literacies, and Key Skills

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DEPARTMENT <u>Mathematics</u>   COURSE <u>Discrete Math</u>

Career Education
CRP6: Demonstrate creativity and innovation.

Modifications (ELL, Special Education, At Risk Students, Gifted & Talented, & 504 Plans)

ELL:
- Work toward longer passages as skills in English increase
- Use visuals
- Introduce key vocabulary before lesson
- Teacher models reading aloud daily
- Provide peer tutoring
- Use of Bilingual Dictionary
- Guided notes and/or scaffold outline for written assignments
- Provide students with English Learner leveled readers.

Supports for Students With IEPs:
- Allow extra time to complete assignments or tests
- Guided notes and/or scaffold outline for written assignments
- Work in a small group
- Allow answers to be given orally or dictated
- Use large print books, Braille, or books on CD (digital text)
- Follow all IEP modifications

At-Risk Students:
- Guided notes and/or scaffold outline for written assignments
- Introduce key vocabulary before lesson
- Work in a small group
- Lesson taught again using a differentiated approach
- Allow answers to be given orally or dictated
- Use visuals / Anchor Charts
- Leveled texts according to ability

Gifted and Talented:
- Create an enhanced set of introductory activities (e.g. advance organizers, concept maps, concept puzzles)

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- Provide options, alternatives and choices to differentiate and broaden the curriculum
- Organize and offer flexible small group learning activities
- Provide whole group enrichment explorations
- Teach cognitive and methodological skills
- Use center, stations, or contracts
- Organize integrated problem-solving simulations
- Propose interest-based extension activities
- Expose students to beyond level texts.

Supports for Students With 504 Plans:
- Follow all the 504 plan modifications
- Text to speech/audio recorded selections
- Amplification system as needed
- Leveled texts according to ability
- Fine motor skill stations embedded in rotation as needed
- Modified or constrained spelling word lists
- Provide anchor charts with high frequency words and phonemic patterns