Marking Period	Unit Title	Recommended Instructional Days
4	Matrices	14-15 days

Domain:		
NJSLS Strand: **H.VM.1** (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., v, |v|, ||v||, v). **H.VM.2**(+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point. **H.VM.3** (+) Solve problems involving velocity and other quantities that can be represented by vectors. B. Perform operations on vectors. **H.VM.4**(+) Add and subtract vectors.	*Progress Indicator:* *Tests ● Quizzes ● Practice problems for homework ● Online textbook ● Worksheets ● IXL ● Leveled assessments*	**Recommended Activities, Investigations, Interdisciplinary Connections, and/or Student Experiences to Explore NJSLS-CLKS within Unit** **Essential Question/s:** **How can you use matrices to help you solve problems?** **Activity Description:** Operations with matrices Matrix Multiplications Vectors **Interdisciplinary Connections:** **Students will use matrices to model and predict traffic patterns.** **Content: Create a traffic pattern** **NJSLS#: HS.ESS3-4-1, HS.ETS1-1** **Example Tasks:** **At the end of each topic please review the Assessment Practice and Performance Tasks questions.**

a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.
 b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.
c. Understand vector subtraction v – w as v + (–w), where –w is the additive inverse of w, with the same magnitude as w and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.
H.VM.5 (+) Multiply a vector by a scalar.
a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication

Mixed Review Available Online

✅ **ASSESSMENT PRACTICE**

34. Use these matrices to complete the statements.

$$A = \begin{bmatrix} 0 & 9 & 6 \\ 1 & 2 & 4 \\ 7 & -3 & 1 \end{bmatrix} \qquad B = \begin{bmatrix} 2 & -7 & -2 \\ 0 & 5 & 8 \\ -3 & 1 & 1 \end{bmatrix}$$

In matrix A, the value of a_{31} is _____ the value of a_{12}. In matrix B, the value of a_{31} is _____ the value of a_{12}.

Ⓐ less than; less than

Ⓑ less than; greater than

Ⓒ greater than; less than

Ⓓ greater than; greater than

component-wise, e.g., as c(vx, vy) = (cvx, cvy).
b. Compute the magnitude of a scalar multiple cv using $\|cv\| = |c|v$. Compute the direction of cv knowing that when $|c|v \neq 0$, the direction of cv is either along v (for c > 0) or against v (for c < 0). C. Perform operations on matrices and use matrices in applications.
H.VM.6(+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.
H.VM.7 (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.
H.VM.8(+) Add, subtract, and multiply matrices of appropriate dimensions.
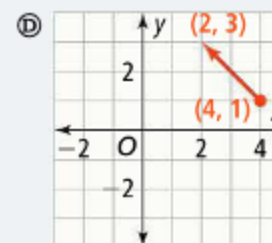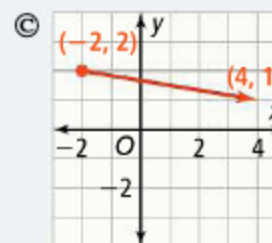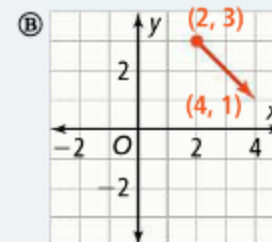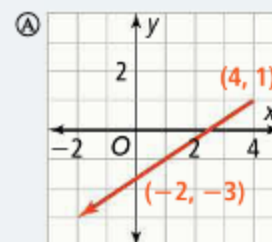**H.VM.9**(+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but

Mixed Review Available Online

☑ **ASSESSMENT PRACTICE**

35. Which of the following vectors have the same magnitude? Select all that apply.

still satisfies the associative and distributive properties.
H.VM.10 (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.
H.VM.11 (+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.
H.VM.12(+) Work with 2 × 2 matrices as a transformations of the plane, and interpret the absolute value of the determinant in terms of area.

37. **Performance Task** Starting from her cabin, Marta hikes 2 mi east to a cove and then turns 60° toward the north to hike 6 mi to a waterfall. The component form, $\vec{v}$, of Marta's hike to the cove is $\langle 2, 0 \rangle$. Let $\vec{u}$ represent Marta's hike from the cove to the waterfall.
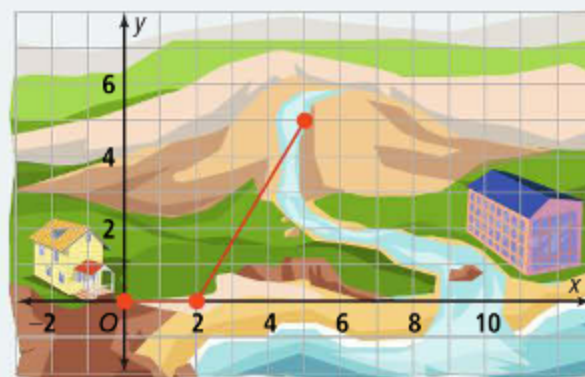
Part A Find the component form of $\vec{u}$.

Part B Use vector addition to find the component form of the vector that represents the straight distance from Marta's current location back to her cabin.

Part C Find Marta's actual straight distance from her cabin by finding the magnitude of the vector in part (b).

36. Performance Task A computer animator uses a screen that is 1,000 pixels wide and 800 pixels tall. The animator uses matrix columns to represent three locator points on an avatar. The top row represents the horizontal coordinate of each point, and the bottom row represents the vertical coordinate. Let $P = \begin{bmatrix} 100 & 150 & 200 \\ 50 & 150 & 50 \end{bmatrix}$ represent the initial position of the avatar.

(150, 150)

(100, 50)   (200, 50)

Part A The animator wants the avatar to move up at a rate of 100 pixels per second. Use addition of matrices to show the position of the avatar after 2 seconds and after 5 seconds.

Part B The animator wants the avatar to move right at a rate of 50 pixels per second. Use addition of matrices to show the position of the avatar after 3 seconds and after 8 seconds.

Part C How could the animator use scalar multiplication and matrix addition to show how the avatar moves across the screen?

		Spot Light on: *Seek multiple perspectives and different answers to questions.*

Mathematics Practices	
1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reason of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	

Social and Emotional Learning: *Competencies*	**Social and Emotional Learning:** *Sub-Competencies*
Self- awareness Social Awareness Self- Management	Recognizing the importance of self-confidence in handling daily tasks and challenges.

Relationship Skills Responsible Decision-Making	Demonstrate an awareness of the expectations for social interactions in a variety of ways. Demonstrate an understanding of the need for mutual respect when viewpoints differ. Recognize the skills needed to establish and achieve personal and educational goals. Utilize positive communication and social skills to interact effectively with others. Develop, implement, and model effective problem solving and critical thinking skills.

Assessments (Formative) *To show evidence of meeting the standard/s, students will successfully engage within:*	Assessments (Summative) *To show evidence of meeting the standard/s, students will successfully complete:*
Formative Assessments: ● Entry and Exit Slips ● Quizzes ● Self Assessments	**Benchmarks:** ● Chapter Tests ● Projects **Summative Assessments:** ● District Assessments ● Midterms ● Standardized Tests

Differentiated Student Access to Content: Teaching and Learning *Resources/Materials*			
Core Resources	**Alternate Core Resources *IEP/504/At-Risk/ESL***	**ELL Core Resources**	**Gifted & Talented Core Resources**
● Textbooks websites ● Achieve the core ● Khan Academy ● Desmos	● Skill building worksheets ● Math Manipulatives	● Dictionary for native languages ● Videos in their native language.	● Leveled Assessments ● Enrichment worksheets

Supplemental Resources

Technology:
- **Chromebooks, Graphing Calculators, Online math manipulatives**

Other:
- **Zoom and Google Meets, Google Classroom, Interactive Textbooks**

Differentiated Student Access to Content: Recommended *Strategies & Techniques*			
Core Resources	**Alternate Core Resources** *IEP/504/At-Risk/ESL*	**ELL Core Resources**	**Gifted & Talented Core**
● **Deliver instruction utilizing varied learning styles including audio, visual, and tactile/kinesthetic, provide individual instruction as needed, modify assessments and/or rubrics, repeat**	● **Utilize a multi-sensory (VAKT) approach during instruction, provide alternate presentations of skills by varying the method (repetition, simple explanations, additional examples, modeling, etc.), modify test content and/or format, allow students to retake test for additional credit, provide additional times and preferential seating as needed, review, restate and repeat directions, provide study guides, and/or break assignments into segments of shorter tasks.**	● **Extend time requirements, preferred seating, positive reinforcement, check often for understanding/review, oral/visual directions/prompts when necessary, supplemental materials including use of an online bilingual dictionary, and modified assessment and/or rubric.**	● **Create an enhanced set of introductory activities, integrate active teaching/learning opportunities, incorporate authentic components, propose interest-based extension activities, and connect student to related**

	Disciplinary Concept: Creativity and Innovation	
	Core Ideas:	Advanced search techniques can be used with digital and media resources to

NJSLS CAREER READINESS, LIFE LITERACIES & KEY SKILLS		locate information and to check the credibility and the expertise of sources to answer questions, solve problems, and inform the decision-making.
	Performance Expectation/s:	• 9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information. • 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, Social Studies Practice: Gathering and Evaluating Sources.
	Career Readiness, Life Literacies, & Key Skills Practices	
	Act as a responsible and contributing community member and employee. **Attend to financial well-being.** **Consider the environmental, social and economic impacts of decisions.** **Demonstrate creativity and innovation.** **Utilize critical thinking to make sense of problems and persevere in solving them.** **Model integrity, ethical leadership and effective management.** **Plan education and career paths aligned to personal goals.** **Use technology to enhance productivity, increase collaboration and communicate effectively.** **Work productively in teams while using cultural/global competence.**	

New Jersey Legislative Statutes and Administrative Code (place an "X" before each law/statute if/when present within the curriculum map)							
Amistad Law: *N.J.S.A. 18A 52:16A-88*		Holocaust Law: *N.J.S.A. 18A:35-28*		LGBT and Disabilities Law: *N.J.S.A. 18A:35-4.35*	X	Diversity & Inclusion: *N.J.S.A. 18A:35-4.36a*		Standards in Action: *Climate Change*