Coordinate Systems

	4 – Mastery	3 – Proficient	2 - Basic	1 – Below Basic	0 – No Evidence
Represent	Can extend	Use appropriate symbols for	Use appropriate symbols for	Use appropriate <u>symbols</u>	Little
vectors	thinking beyond	vectors and their	vectors and their magnitude	for vectors and their	evidence
(N.VM.1)	the standard,	magnitude, represent	and <u>represent vector</u>	<u>magnitude</u>	of
	including tasks	vector quantities by	quantities by directed line		reasoning
	that may involve	directed line segments, and	<u>segments</u> .		or
	one of the	find the magnitude and			application
	following:	direction of vector			to solve
		quantities.			the
Solve problems with vectors (N.VM.3)	 Designing Connecting Synthesizing Applying Justifying Critiquing Analyzing Creating Proving 	Solve problems involving velocity and other quantities by converting given direction and magnitude quantities into component vectors, calculate the resultant vector, <u>and find the</u> <u>resultant direction and</u> <u>magnitude or the angle</u> <u>between vectors</u>	Solve problems involving velocity and other quantities by converting given direction and magnitude quantities into component vectors <u>, and</u> <u>calculate the resultant</u> <u>vector</u>	Solve problems involving velocity and other quantities by <u>converting</u> <u>given direction and</u> <u>magnitude quantities into</u> <u>component vectors</u>	problem Does not meet the criteria in a level 1
Operations		Find the components of a	Find the components of a	Find the components of a	
with		vector by subtracting	vector by subtracting	vector by subtracting	
vectors		coordinates	coordinates	coordinates	
(N.VM.2,		Add, subtract vectors	Add, subtract vectors	Add, subtract vectors	
N.VM.4,		graphically and component-	graphically and component-	graphically <u>or</u> component-	
N.VM.5)		wise, and determine the	wise	wise	
		magnitude and direction	Multiply a vector by a scalar	Multiply a vector by a scalar	
		Multiply a vector by a scalar			
		and <u>determine the</u>			
		magnitude and direction			

Instructional Focus: Represent and calculate with vectors

N.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).

N.VM.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors.

N.VM.2 (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.

N.VM.4 (+) Add and subtract vectors.

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.

N.VM.5 (+) Multiply a vector by a scalar.

a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication componentwise, 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).

Coordinate Systems

Instructional Focus: Represent and calculate complex numbers

	4 – Mastery	3 – Proficient	2 - Basic	1 – Below Basic	0 – No Evidence
Represent	Can extend	Represent complex	Represent complex	Represent complex	Little
on the	thinking beyond	numbers on the complex	numbers on the complex	numbers on the complex	evidence
complex	the standard,	plane in rectangular and	plane in rectangular and	plane in rectangular form	of
plane	including tasks	polar form, <u>and explain</u> why	polar form		reasoning
(N.CN.4)	that may involve	the rectangular and polar			or
· ,	one of the	forms of a given complex			application
	following:	number represent the same			to solve
	_	number			the
	 Designing 				problem
Operations	Connecting	Represent and compute	Represent and compute	Represent and compute	
of Vectors	 Synthesizing 	addition and subtraction of	addition and subtraction of	addition and subtraction of	
in Polar	 Applying 	complex numbers	complex numbers	complex numbers	Does not
Form	 Justifying 	geometrically on the	geometrically on the	geometrically on the	meet the
(N.CN.3,	Critiquing	complex plane	complex plane	complex plane	criteria in
N.CN.5)	Analyzing				a level 1
	Creating	Represent and compute	Represent and compute		
	Proving	multiplication and division,	multiplication and division,		
		in polar form, of complex	in polar form, of complex		
		numbers geometrically on	numbers geometrically on		
		the complex plane	the complex plane		
		Represent and compute the			
		power and roots of			
		complex numbers, in polar			
		<u>form.</u>			
Calculate		Calculate the <u>distance</u>	Calculate the difference	Calculate the <u>midpoint of a</u>	
distance		between numbers in the	between numbers in the	segment in the complex	
and		<u>complex plane as the</u>	complex plane, and	<u>plane</u> as the average of the	
midpoint		modulus of the difference,	calculate the midpoint of a	numbers at its endpoints	
(N.CN.6)		and calculate the midpoint	segment in the complex		
		of a segment in the complex	plane as the average of the		
		plane as the average of the	numbers at its endpoints		
		numbers at its endpoints			

- N.CN.4 (+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.
- N.CN.3 (+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.
- N.CN.5 (+) Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. For example, $(-1 + \sqrt{3} i)^3 = 8$ because $(-1 + \sqrt{3} i)$ has modulus 2 and argument 120°.
- N.CN.6 (+) Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.

Limits

Instructional Focus: Find limits and continuity

4 – Mastery	3 – Proficient	2 - Basic	1 – Below Basic	0 – No
				Evidence
Can extend	Find limits and one-sided	Find limits and one-sided	Find limits and one-sided	Little
thinking beyond	limits graphically,	limits graphically and	limits graphically and	evidence
the standard,	numerically <u>, and</u>	numerically. Describe end	numerically	of
including tasks	algebraically, using proper	<u>behavior (as x approaches</u>		reasoning
that may involve	notation. Describe end	∞ or $-\infty$) using limit		or
one of the	behavior (as x approaches	notation).		application
following:	or -) using limit notation			to solve
				the
 Designing 	Determine continuity of	Determine continuity of	Determine continuity of	problem
00	functions graphically,	functions graphically and	functions graphically and	
-	numerically, <u>and</u>	numerically <u>on its domain</u>	numerically <u>at a given value</u>	
	algebraically on its domain	using the three-part	using the three-part	Does not
	using the three-part	definition of continuous	definition of continuous	meet the
	definition of continuous	functions.	functions.	criteria in
	functions.			a level 1
-	Determine values for which	Determine values for which	Determine values for which	
	a function is discontinuous,	a function is discontinuous,	a function is discontinuous.	
	understand the difference	and understand the		
	between removable and	difference between		
	nonremovable	removable and		
	discontinuities, <u>and be able</u>	nonremovable		
	to redefine functions to	discontinuities.		
	make them continuous			
	when possible.			
	Find finite and infinite one-	Find finite and infinite one-		
	sided limits, and describe	sided limits.		
	asymptotes using limit		infinite.	
	notation.			
	thinking beyond the standard, including tasks that may involve one of the following: Designing Connecting Synthesizing Applying Justifying Critiquing Analyzing Creating	Can extend thinking beyond the standard, including tasks that may involve one of the following:Find limits and one-sided limits graphically, numerically, and algebraically, using proper notation. Describe end behavior (as x approaches or -) using limit notation•Designing • Connecting • Synthesizing • Applying • Critiquing • Creating • ProvingDetermine continuity of functions graphically, numerically, and algebraically on its domain using the three-part definition of continuous functions.•Designing • Connecting • Synthesizing • Critiquing • • Creating 	Can extend thinking beyond the standard, including tasks that may involve one of the following:Find limits and one-sided limits graphically, numerically, and algebraically, using proper notation. Describe end behavior (as x approaches or -) using limit notationFind limits and one-sided limits graphically and numerically. Describe end behavior (as x approaches or -) using limit notation• Designing • Connecting • Synthesizing • Applying • Analyzing • Creating • ProvingDetermine continuity of functions graphically on its domain using the three-part definition of continuous functions.Determine continuity of functions graphically and numerically. and algebraically on its domain using the three-part definition of continuous functions.Determine continuity of functions graphically and numerically. and algebraically on its domain using the three-part definition of continuous, understand the difference between removable and nonremovable discontinuities, and be able to redefine functions to make them continuous when possible.Determine values for which a function is discontinuous, and understand the difference between removable discontinuities.Find finite and infinite one- sided limits, and describe asymptotes using limitFind finite and infinite one- sided limits.	Can extend thinking beyond the standard, including tasks that may involve one of the following:Find limits and one-sided limits graphically, and algebraically, using proper notation. Describe end behavior (as x approaches or -) using limit notationFind limits and one-sided limits graphically and numerically. Describe end behavior (as x approaches oor -) using limit notationFind limits and one-sided limits graphically and numerically. Describe end behavior (as x approaches oor -) using limit notationFind limits and one-sided limits graphically and numerically. Describe end behavior (as x approaches oor -) using limit notationFind limits and one-sided limits graphically and numerically and numerically on its domain using the three-part definition of continuous functions.Find limits and one-sided limits graphically and numerically and numerically on its domain using the three-part definition of continuous functions.Find limits and one-sided limits graphically and numerically and numerically on its domain using the three-part definition of continuous functions.Find limits and one-sided limits graphically and numerically and numerically and numerically on its domain using the three-part definition of continuous functions.Find limits and one-sided limits and one-sided limits graphically and numerically on its domain using the three-part definition of continuous, and understand the discontinuous, and understand the discontinuities.Find limits and one-sided limits.• ProvingDetermine values for which a function is discontinuous, understand the discontinuities.Eind finite and infinite one- sided limits.Eind finite and infinite on

Find limits and one-sided limits graphically, numerically, and algebraically, using proper notation. Describe end behavior (as x approaches or -) using limit notation.

Determine continuity of functions graphically, numerically, and algebraically on its domain using the three-part definition of continuous functions. Determine values for which a function is discontinuous, understand the difference between removable and nonremovable discontinuities, and be able to redefine functions to make them continuous when possible. Find finite and infinite one-sided limits, and describe asymptotes using limit notation.