North Carolina Mathematics

Precalculus

Number and Quantity N

1 Apply properties of complex numbers and the complex number system. PC.N.1.

1. Execute the sum and difference algorithms to combine complex numbers. PC.N.1.1
2. Execute the multiplication algorithm with complex numbers. PC.N.1.2

2 Apply properties and operations with matrices. PC.N.2

1. Execute the sum and difference algorithms to combine matrices of appropriate dimensions. PC.N.2.1
2. Execute associative and distributive properties to matrices. PC.N.2.2
3. Execute commutative property to add matrices. PC.N.2.3
4. Execute properties of matrices to multiply a matrix by a scalar. PC.N.2.4
5. Execute the multiplication algorithm with matrices. PC.N.2.5

3 Understand properties and operations with vectors. PC.N.3

1. Represent a vector indicating magnitude and direction. PC.N.3.1
2. Execute sum and difference algorithms to combine vectors. PC.N.3.2

Algebra A

1 Apply properties of solving inequalities that include rational and polynomial expressions in one variable. PC.A.1

1. Implement algebraic (sign analysis) methods to solve rational and polynomial inequalities. PC.A.1.1
2. Implement graphical methods to solve rational and polynomial inequalities. PC.A.1.2

2 Apply properties of solving equations involving exponential, logarithmic, and trigonometric functions. PC.A.2

1. Use properties of logarithms to rewrite expressions. PC.A.2.1
2. Implement properties of exponentials and logarithms to solve equations. PC.A.2.2
3. Implement properties of trigonometric functions to solve equations including PC.A.2.3
   a. inverse trigonometric functions PC.A.2.3A
   b. double angle formulas PC.A.2.3B
   c. Pythagorean identities. PC.A.2.3C

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4 Implement algebraic techniques to rewrite parametric equations in cartesian form by eliminating the parameter. PC.A.2.4

Functions

1 **Understand key features of sine, cosine, tangent, cotangent, secant and cosecant functions.** PC.F.1

1 Interpret algebraic and graphical representations to determine key features of transformed sine and cosine functions. Key features include: amplitude, domain, midline, phase shift, frequency, period, intervals where the function is increasing, decreasing, positive or negative, relative maximums and minimums. PC.F.1.1

2 Interpret algebraic and graphical representations to determine key features of tangent, cotangent, secant, and cosecant. Key features include: domain, frequency, period, intervals where the function is increasing, decreasing, positive or negative, relative maximums and minimums, and asymptotes. PC.F.1.2

3 Integrate information to build trigonometric functions with specified amplitude, frequency, period, phase shift, or midline with or without context. PC.F.1.3

4 Implement graphical and algebraic methods to solve trigonometric equations and inequalities in context with support from technology. PC.F.1.4

2 **Apply properties of a unit circle with center (0,0) to determine the values of sine, cosine, tangent, cotangent, secant, and cosecant.** PC.F.2

1 Use a unit circle to find values of sine, cosine, and tangent for angles in terms of reference angles. PC.F.2.1

2 Explain the relationship between the symmetry of a unit circle and the periodicity of trigonometric functions. PC.F.2.2

3 **Apply properties of trigonometry to solve problems involving all types of triangles.** PC.F.3

1 Implement a strategy to solve equations using inverse trigonometric functions. PC.F.3.1

2 Implement the Law of Sines and the Law of Cosines to solve problems. PC.F.3.2

3 Implement the Pythagorean identity to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle. PC.F.3.3

4 **Understand the relationship of algebraic and graphical representations of exponential, logarithmic, rational, power functions, and conic sections to their key features.** PC.F.4

1 Interpret algebraic and graphical representations to determine key features of exponential functions. Key features include: domain, range, intercepts, intervals where the function is increasing, decreasing, positive or negative, concavity, end behavior, limits, and asymptotes. PC.F.4.1

2 Integrate information to build exponential functions to model phenomena involving growth or decay. PC.F.4.2

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3 Interpret algebraic and graphical representations to determine key features of logarithmic functions. Key features include: domain, range, intercepts, intervals where the function is increasing, decreasing, positive or negative, concavity, end behavior, continuity, limits, and asymptotes. PC.F.4.3

4 Implement graphical and algebraic methods to solve exponential and logarithmic equations in context with support from technology. PC.F.4.4

5 PC.F.4.5 Interpret algebraic and graphical representations to determine key features of rational functions. Key features include: domain, range, intercepts, intervals where the function is increasing, decreasing, positive or negative, concavity, end behavior, continuity, limits, and asymptotes. PC.F.4.5

6 Implement graphical and algebraic methods to solve optimization problems given rational and polynomial functions in context with support from technology. PC.F.4.6

7 Construct graphs of transformations of power, exponential, and logarithmic functions showing key features. PC.F.4.7

8 Identify the conic section (ellipse, hyperbola, parabola) from its algebraic representation in standard form. PC.F.4.8

9 Interpret algebraic and graphical representations to determine key features of conic sections (ellipse: center, length of the major and minor axes; hyperbola: vertices, transverse axis; parabola: vertex, axis of symmetry). PC.F.4.9

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5 Apply properties of function composition to build new functions from existing functions. PC.F.5

1 Implement algebraic procedures to compose functions. PC.F.5.1

2 Execute a procedure to determine the value of a composite function at a given value using algebraic, graphical, and tabular representations. PC.F.5.2

3 Implement algebraic methods to find the domain of a composite function. PC.F.5.3

4 Organize information to build models involving function composition. PC.F.5.4

5 Deconstruct a composite function into two functions. PC.F.5.5

6 Implement algebraic and graphical methods to find an inverse function of an existing function, restricting domains if necessary. PC.F.5.6

7 Use composition to determine if one function is the inverse of another function. PC.F.5.7

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6 Apply mathematical reasoning to build recursive functions to model and solve problems. PC.F.6

1 Use algebraic representations to build recursive functions. PC.F.6.1

2 Construct a recursive function for a sequence represented numerically. PC.F.6.2

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1 Implement algebraic methods to write parametric equations in context. PC.F.7.1

2 Implement technology to solve contextual problems involving parametric equations. PC.F.7.2