South Carolina Mathematics

Pre-Calculus

Mathematical Process Standards MPS

1 Problem Solving MPS.PS

1a Make sense of problems and persevere in solving them strategically MPS.PS.1

2 Representation & Communication MPS.RC

2a Explain ideas using precise and contextually appropriate mathematical language, tools, and models. MPS.RC.1

3 Connections MPS.C

3a Demonstrate a deep and flexible conceptual understanding of mathematical ideas, operations, and relationships while making real-world connections. MPS.C.1

4 Analyze & Justify MPS.AJ

4a Use critical thinking skills to reason both abstractly and quantitatively. MPS.AJ.1

5 Structure & Patterns MPS.SP

5a Identify and apply regularity in repeated reasoning to make generalizations. MPS.SP.1

Measurement, Geometry, and Spatial Reasoning PC.MGSR

1 Analyze the behaviors of conic sections and polar coordinates to model mathematical and real-world situations. PC.MGSR.1

1a Identify and graph different conic sections given the equations in standard form. PC.MGSR.1.1

1b Identify different conic sections in general form and complete the square to convert the equation of a conic section into standard form. PC.MGSR.1.2

1c Define polar coordinates and relate polar coordinates to Cartesian coordinates. PC.MGSR.1.3

2 Solve problems and model periodic phenomena with trigonometric expressions and functions. PC.MGSR.2

- 2a Determine the area of a triangle to solve problems. PC.MGSR.2.1
- 2b Prove and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles. PC.MGSR.2.2
- 2c Derive the formulas for the length of an arc and the area of a sector in a circle and apply these formulas to solve mathematical and real-world situations. PC.MGSR.2.3
- 2d Determine geometrically the values of the sine, cosine, and tangent for $\pi/6$, $\pi/4$, and $\pi/3$ by special triangles, and use the unit circle to express the values of sine, cosine, and tangent for π - x, π + x, and 2π - x in terms of their values for x, where x is any real number. PC.MGSR.2.4
- 2e Define the six trigonometric ratios in terms of x, y, and r using the unit circle centered at the origin of the coordinate plane and interpret radian measures of angles as a rotation both counterclockwise and clockwise around the unit circle. PC.MGSR.2.5
- 2f Explain symmetry, both odd and even, and periodicity of trigonometric functions PC.MGSR.2.6

Numerical Reasoning PC.NR

1 Represent and manipulate data using matrices. PC.NR.1

- 1a Identify the identity and zero matrices for any dimension and add, subtract, and multiply matrices. PC.NR.1.1
- 1b Find the additive and multiplicative inverses of square matrices. PC.NR.1.2
- 1c Explain the role of the determinant in determining if a square matrix has a multiplicative inverse. PC.NR.1.3
- 1d Find the determinant of a square matrix if and only if the matrix has a multiplicative inverse. PC.NR.1.4

2 Represent and model with vector quantities. PC.NR.2

- 2a Represent vector quantities as directed line segments and represent magnitude and direction of vectors in component form. PC.NR.2.1
- 2b Find the components of a vector by adding and subtracting vectors on a coordinate plane using a variety of methods. PC.NR.2.2
- 2c Solve problems, including real-life situations, that can be represented by vectors. PC.NR.2.3
- 2d Add and subtract vectors and multiply vectors by a scalar to find the resultant vector. PC.NR.2.4

3 Represent complex numbers and their operations on the complex plane. PC.NR.3

- 3a 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. PC.NR.3.1
- 3b Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. PC.NR.3.2

Patterns, Algebra, and Functional Reasoning PC.PAFR

1 Build new functions from existing functions to solve mathematical and realworld situations. PC.PAFR.1

- 1a Combine and compose functions algebraically, tabularly, and graphically. PC.PAFR.1.1
- 1b Find the inverse of functions and verify algebraically, numerically, and graphically. PC.PAFR.1.2
- 1c Compare the key features of a function and its inverse function and use the relationship to model real-world situations and solve problems. PC.PAFR.1.3
- 1d Graph and describe the effect on the graph $f(x)$ of $f(x)+k$, $f(x-k)$, $k\ (x)$, and $f(k\ )$, for specific values of both negative and positive values of k. PC.PAFR.1.4

2 Explore and analyze the behaviors of rational and piecewise functions to model contextual mathematical problems. PC.PAFR.2

- 2a Graph rational functions and describe their key features. PC.PAFR.2.1
- 2b Solve rational equations and inequalities in one variable and explain when extraneous solutions may arise. PC.PAFR.2.2
- 2c Transform rational expressions in different forms. PC.PAFR.2.3
- 2d Graph piecewise-defined functions, including step functions and absolute value functions, and describe their key features. PC.PAFR.2.4

3 Explore and analyze structures and patterns for radical functions and use radical expressions, equations, and functions to model real-life phenomena. PC.PAFR.3

- 3a Transform radical expressions as expressions with rational exponents and extend the properties of integer exponents to rational exponents. PC.PAFR.3.1
- 3b Solve radical equations and describe how extraneous solutions may arise. PC.PAFR.3.2
- 3c Analyze and graph radical functions. PC.PAFR.3.3

4 Explore and analyze structures and patterns for exponential and logarithmic functions and use exponential and logarithmic expressions, equations, and functions to model real-life phenomena. PC.PAFR.4

- 4a Graph logarithmic functions and describe their key features. PC.PAFR.4.1
- 4b Use the definition of a logarithm, logarithmic properties, and the inverse relationship between exponential and logarithmic functions to solve problems, including real-life context. PC.PAFR.4.2
- 4c Model real-life situations and solve problems involving exponential and logarithmic functions. PC.PAFR.4.3

5 Explore and analyze structures and patterns of trigonometric functions and use trigonometric functions to model real-life phenomena. PC.PAFR.5

- 5a Graph trigonometric functions and their inverses and describe their key features. PC.PAFR.5.1
- 5b Restrict the domain of a trigonometric function to define the six inverse trigonometric functions, graph the inverse function, and evaluate inverse trigonometric expressions. PC.PAFR.5.2
- 5c Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions and interpret them in terms of the context. PC.PAFR.5.3

6 Manipulate, prove, and apply trigonometric identities and equations to solve contextual mathematical problems. PC.PAFR.6

- 6a Apply the fundamental trigonometric identities to simplify expressions and verify other identities. PC.PAFR.6.1
- 6b Apply the sum, difference, double-angle, and half-angle formulas for sine, cosine, and tangent and use them to solve problems. PC.PAFR.6.2
- 6c Model real-life situations and solve problems involving trigonometric equations. PC.PAFR.6.3

7 Represent data with matrices, perform mathematical operations, and solve systems of linear equations for mathematical problems. PC.PAFR.7

- 7a Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. Understand that such systems may have zero, one, or two solutions. PC.PAFR.7.1
- 7b Solve an equation of the form $f(x) = g(x)$ graphically by identifying the x-coordinate(s) of the point(s) of intersection of the graphs of $y = f(x)$ and $y = g(x)$. PC.AFR.7.2
- 7c Represent a system of linear equations as a single matrix equation in a vector variable. PC.PAFR.7.3