Mississippi Mathematics

Advanced Mathematics Plus

Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

1 Make sense of problems and persevere in solving them. AMP.SMP.1

2 Reason abstractly and quantitatively. AMP.SMP.2

3 Construct viable arguments and critique the reasoning of others. AMP.SMP.3

4 Model with mathematics. AMP.SMP.4

5 Use appropriate tools strategically. AMP.SMP.5

6 Attend to precision. AMP.SMP.6

7 Look for and make use of structure. AMP.SMP.7

8 Look for and express regularity in repeated reasoning. AMP.SMP.8

Number and Quantity (N)

Perform Arithmetic Operations with Complex Numbers

3 Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers. N-CN.3

Represent Complex Numbers and Their Operations on the Complex Plane

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.4

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.5

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. N-CN.6

Use Complex Numbers in Polynomial Identities and Equations

8 Extend polynomial identities to the complex numbers. For example, rewrite $x^2 + 4$ as $(x + 2i)(x - 2i)$. N-CN.8

9 Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials. N-CN.9

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Alg...

...se Polynomial Identities to Solve Problems

5 Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle. [1] A-APR.5

Note 1: The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.

Rewrite Rational Expressions

7 Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. A-APR.7

Solve Systems of Equations

8 Represent a system of linear equations as a single matrix equation in a vector variable. A-REI.8

9 Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater). A-REI.9

Functions (F)

Analyze Functions using Different Representations

7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. * d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. F-IF.7

Build a Function that Models a Relationship Between Two Quantities

1 Write a function that describes a relationship between two quantities. * c. Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time. F-BF.1

Build New Functions from Existing Functions

4 Find inverse functions. b. Verify by composition that one function is the inverse of another. c. Read values of an inverse function from a graph or a table, given that the function has an inverse. d. Produce an invertible function from a non-invertible function by restricting the domain. F-BF.4

5 Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. F-BF.5

Extend the Domain of Trigonometric Functions Using the Unit Circle

3 Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$, and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi-x$, $\pi+x$, and $2\pi-x$ in terms of their values for x, where x is any real number. F-TF.3

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4 Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions. F-TF.4

Model Periodic Phenomena with Trigonometric Functions

5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. * F-TF.5

6 Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed. F-TF.6

7 Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context. * F-TF.7

Prove and Apply Trigonometric Identities

9 Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems. F-TF.9

Geometry (G)

Apply Trigonometry to General Triangles

9 Derive the formula A = (1/2)ab sin(C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side. G-SRT.9

10 Prove the Laws of Sines and Cosines and use them to solve problems. G-SRT.10

11 Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces). G-SRT.11

Understand and Apply Theorems About Circles

4 Construct a tangent line from a point outside a given circle to the circle. G-C.4

Translate Between the Geometric Description and the Equation for a Conic Section

3 Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant. G-GPE.3

Explain Volume Formulas and use Them to Solve Problems

2 Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures. G-GMD.2

Statistics and Probability (S)

Use the Rules of Probability to Compute Probabilities of Compound Events in a Uniform Probability Model

8 Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model. * S-CP.8

9 Use permutations and combinations to compute probabilities of compound events and solve problems. * S-CP.9

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alculate Expected Values and use Them to Solve Problems

1. Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. * S-MD.1
2. Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. * S-MD.2
3. Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes. * S-MD.3
4. Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households? * S-MD.4

Use Probability to Evaluate Outcomes of Decisions

5. Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. * a. Find the expected payoff for a game of chance. For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant. b. Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident. * S-MD.5
6. Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). * S-MD.6
7. Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). * S-MD.7