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Integrated Mathematics

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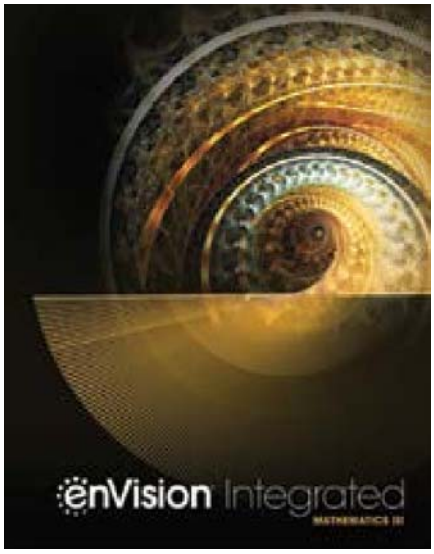

To the

Georgia Standards of Excellence Mathematics Standards – High School

SAVVAS

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To the Georgia Standards of Excellence Mathematics Standards

Introduction

enVision Integrated Mathematics ©2019 is a brand-new high school mathematics program.

enVision Integrated helps students see how the disciplines of mathematics are intertwined, with engaging and relevant content. The program offers time-saving options and resources. Re-energize students and help them become more self-directed and independent learners.

Engage
Motivate student learning with relevant math and individualized pathways.

- Math concepts come to life through embedded interactives powered by Desmos.
- Mathematical modeling in 3 acts levels the playing field with reality-based instruction.
- Individualized study plans help students master prerequisite skills.

Understand
A firm foundation of conceptual understanding allows students to connect and apply new math ideas in amazing ways. Using this balanced approach, students retain what they have learned, meaning less re-teaching later on.

Empower
Leverage technology to save time and provide better insight into students' mastery of mathematics. enVision Integrated makes this simple and easy to do.

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Mathematical Practices	
1 Make sense of problems and persevere in solving them.	**Mathematics I** **SE:** 177-183 **TE:** 177A-183B **Mathematics II** **SE:** 11-17 **TE:** 11A-17B **Mathematics III** **SE:** 169-176, 177-184 **TE:** 169A-176B, 177A-184B
2 Reason abstractly and quantitatively.	Mathematical practices are referenced throughout the enVision Integrated Mathematics series. The following citations are sample references. **Mathematics I** **SE/TE:** 23, 27, 63, 86, 105, 111, 118, 131-133, 141, 145 **TE:** 12A, 63A, 83A, 104A, 112A, 137A, 144A, 151B, 219A, 236A **Mathematics II** **SE/TE:** 10, 31, 54, 62, 86, 88, 99, 109, 301, 352 **TE:** 47A, 83A, 89A, 205B, 212A, 229A-229B, 297A, 311A-311B, 319B, 328 **Mathematics III** **SE/TE:** 52, 108, 153, 164, 219, 245, 251, 260, 304, 313 **TE:** 47A, 69A, 84A, 131A, 136, 140B, 155, 177A, 181, 185A

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3 Construct viable arguments and critique the reasoning of others.	Mathematical practices are referenced throughout the enVision Integrated Mathematics series. The following citations are sample references. **Mathematics I** **SE/TE:** 11, 17, 28, 56, 67, 102, 116, 120, 170, 182 **TE:** 12, 18B, 24A, 53, 57A, 63A, 89B, 177A, 184A, 195 **Mathematics II** **SE/TE:** 9, 15-16, 23-24, 31, 38, 52-53, 60, 66, 341, 482 **TE:** 5B, 11A, 47A, 69B, 117A, 145A, 191B, 205A, 374A, 391A **Mathematics III** **SE/TE:** 10-11, 21, 28, 37, 44, 51, 66, 73, 82, 245 **TE:** 5A, 102, 109A, 113, 141, 154, 180, 355, 379A, 456

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4 Model with mathematics.	Mathematical practices are referenced throughout the enVision Integrated Mathematics series. The following citations are sample references. **Mathematics I** **SE/TE:** 44, 62, 68, 77, 88, 91, 128, 133, 157, 171-172 **TE:** 30, 51A, 69, 89A, 96A, 103, 164, 165A, 191A, 212 **Mathematics II** **SE/TE:** 26, 82, 131, 176, 190, 236, 327, 364, 444, 498 **TE:** 26A-26B, 82A-82B, 131A-131B, 176A-176B, 190A-190B, 236A-236B, 327A-327B, 364A-364B, 444A-444B, 498A-498B **Mathematics III** **SE/TE:** 53, 100, 162, 202, 246, 332, 363, 439, 480, 527 **TE:** 53A-53B, 100A-100B, 162A-162B, 202A-202B, 246A-246B, 332A-332B, 363A-363B, 439A-439B, 480A-480B, 527A-527B
5 Use appropriate tools strategically.	Mathematical practices are referenced throughout the enVision Integrated Mathematics series. The following citations are sample references. **Mathematics I** **SE/TE:** 23, 144, 148, 156, 168, 183, 197, 204, 210, 234 **TE:** 85, 98, 112B, 120A, 139, 160, 185, 224, 228A, 236B **Mathematics II** **SE/TE:** 17, 30, 32, 39, 60-61, 65, 76, 80, 147, 168 **TE:** 27A, 37, 64, 70, 75A, 84, 118, 170B, 237B, 283 **Mathematics III** **SE/TE:** 18, 43, 63, 111, 126, 145, 149, 171, 200, 276 **TE:** 13A, 34, 61A, 65, 101A, 147A, 169A, 270, 283, 369

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6 Attend to precision.	Mathematical practices are referenced throughout the enVision Integrated Mathematics series. The following citations are sample references. **Mathematics I** **SE/TE:** 10-11, 21, 54, 66, 87, 93, 109, 117, 142, 412-413 **TE:** 31A, 33, 57A, 89A, 104A, 250A, 319A, 335A, 363A, 396A **Mathematics II** **SE/TE:** 8, 15, 23-24, 33, 40, 43, 52, 79, 107, 121 **TE:** 13, 27A, 28, 51, 55B, 65, 89B, 126, 132B, 146 **Mathematics III** **SE/TE:** 12, 28-29, 37, 44, 50-51, 54, 73, 136, 138, 144 **TE:** 23A-23B, 47B, 62, 85, 127, 129, 136, 157, 173, 185B
7 Look for and make use of structure.	Mathematical practices are referenced throughout the enVision Integrated Mathematics series. The following citations are sample references. **Mathematics I** **SE/TE:** 42, 46, 55, 66-67, 75-76, 83, 89, 95, 100, 104 **TE:** 19, 26, 51A, 70A, 96A, 187, 207, 265B, 319B, 329 **Mathematics II** **SE/TE:** 17, 51, 123, 125, 135, 174, 218, 267, 352, 363 **TE:** 47B, 69A, 83A, 89A, 103A, 120, 216, 330, 383, 521B **Mathematics III** **SE/TE:** 33, 55, 82, 86, 147, 184, 189, 201, 250, 254 **TE:** 42, 80, 96, 143, 230, 336, 367, 409, 417, 443

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8 Look for and express regularity in repeated reasoning.	Mathematical practices are referenced throughout the enVision Integrated Mathematics series. The following citations are sample references. **Mathematics I** **SE/TE:** 16, 35, 60, 62, 127, 156, 162, 172, 197, 202-203 **TE:** 31A, 70A, 83A, 120A, 151A, 158A, 177A, 199A, 242A, 285A **Mathematics II** **SE/TE:** 11, 35, 57, 63, 67, 108, 137, 149, 155, 188 **TE:** 18B-18, 20, 22, 34A, 63A, 103A, 132A, 183A, 304A, 422A **Mathematics III** **SE/TE:** 56, 74, 85, 98, 116, 129, 145, 152, 160, 287 **TE:** 49, 92A, 101A, 142, 161, 247A, 297A, 340A, 393A, 423A
Number and Quantity	
The Real Number System N.RN	
Extend the properties of exponents to rational exponents.	
MGSE9-12.N.RN.1. Explain how the meaning of rational exponents follows from extending the properties of integer exponents to rational numbers, allowing for a notation for radicals in terms of rational exponents. For example, we define $5^{(1/3)}$ to be the cube root of 5 because we want $[5^{(1/3)}]^3 = 5^{[(1/3) \times 3]}$ to hold, so $[5^{(1/3)}]^3$ must equal 5.	**Mathematics I** **SE:** 177-183 **TE:** 177A-183B **Mathematics II** **SE:** 11-17 **TE:** 11A-17B **Mathematics III** **SE:** 169-176, 177-184 **TE:** 169A-176B, 177A-184B

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MGSE9-12.N.RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.	**Mathematics I** **SE:** 177-183 **TE:** 177A-183B **Mathematics II** **SE:** 11-17 **TE:** 11A-17B **Mathematics III** **SE:** 169-176, 177-184 **TE:** 169A-176B, 177A-184B
Use properties of rational and irrational numbers.	
MGSE9-12.N.RN.3 Explain why the sum or product of rational numbers is rational; why the sum of a rational number and an irrational number is irrational; and why the product of a nonzero rational number and an irrational number is irrational.	**Mathematics I** **TE:** 2B, 2G, 180, 219A, 277B **Mathematics II** **SE:** 5-10 **TE:** 5A-10B **Mathematics III** **SE/TE:** 104
Quantities N.Q	
Reason quantitatively and use units to solve problems.	
MGSE9-12.N.Q.1 Use units of measure (linear, area, capacity, rates, and time) as a way to understand problems:	**Mathematics I** **SE/TE:** 22, 33, 55-56, 69, 93-95, 108, 112-113, 119, 227, 422 **TE:** 69A-69B, 431-434, 467-467B **Mathematics II** **SE/TE:** 10, 43, 68, 88, 94, 109, 163, 178, 373, 382 **TE:** 10B, 17A, 29, 33A, 36, 99A-99B, 130B **Mathematics III** **SE/TE:** 68, 113, 222, 429, 487, 565, 568, 570, 573, 580 **TE:** 275, 472B, 563, 587A-587B

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a. Identify, use, and record appropriate units of measure within context, within data displays, and on graphs;	**Mathematics I** **SE/TE:** 11, 17, 46, 84, 92, 93, 124, 126, 128, 140, 183, 441 **Mathematics II** **SE/TE:** 129, 136, 147, 162-163, 166, 168-169, 235, 268, 286
b. Convert units and rates using dimensional analysis (English-to-English and Metric-to-Metric without conversion factor provided and between English and Metric with conversion factor);	**Mathematics I** **SE/TE:** 8-11, 20, 92
c. Use units within multi-step problems and formulas; interpret units of input and resulting units of output.	**Mathematics I** 10-11, 17, 46, 84, 92, 93, 95, 116, 119, 129, 132, 136, 176, **Mathematics II** **SE/TE:** 4, 40, 105, 109, 129, 163, 268
MGSE9-12.N.Q.2 Define appropriate quantities for the purpose of descriptive modeling. Given a situation, context, or problem, students will determine, identify, and use appropriate quantities for representing the situation.	**Mathematics I** **SE/TE:** 30, 69, 103, 164, 212, 249, 313, 356, 380, 467 **TE:** 30A-30B, 69A-69B, 103A-103B, 164A-164B, 212A-212B, 249A-249B, 313A-313B, 356A-356B, 380A-380B, 467A-467B **Mathematics II** **SE/TE:** 26, 82, 131, 176, 190, 236, 327, 364, 444, 498 **TE:** 26A-26B, 82A-82B, 131A-131B, 176A-176B, 190A-190B, 236A-236B, 327A-327B, 364A-364B, 444A-444B, 498A-498B **Mathematics III** **SE/TE:** 53, 100, 162, 202, 246, 332, 363, 439, 480, 527 **TE:** 53A-53B, 100A-100B, 162A-162B, 202A-202B, 246A-246B, 332A-332B, 363A-363B, 439A-439B, 480A-480B, 527A-527B

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MGSE9-12.N.Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. For example, money situations are generally reported to the nearest cent (hundredth). Also, an answers' precision is limited to the precision of the data given.	**Mathematics I** **SE/TE:** 238, 239, 240, 377, 379 **TE:** 11A, 23B, 47C, 79C, 212B, 236, 241B, 379A **Mathematics II** **SE/TE:** 20, 197, 219, 286, 324, 395, 443, 467, 576, 626 **TE:** 25A-25B, 33A-33B, 130B, 163A, 382B, 460B, 467B, 541B, 562B **Mathematics III** **SE/TE:** 46, 153, 184, 210, 220, 237, 259-260, 275, 303, 322 **TE:** 153B, 161B, 223A-223B, 242A-242B, 315B
The Complex Number System N.CN	
Perform arithmetic operations with complex numbers.	
MGSE9-12.N.CN.1 Understand there is a complex number i such that $i^2 = -1$, and every complex number has the form a + bi where a and b are real numbers.	**Mathematics II** **SE:** 183-189, 192, 200, 221-222 **TE:** 183A-189B, 192, 198A-198B, 204B **Mathematics III** **SE/TE:** 103, 104, 106-107, 169 **TE:** 101A, 108B, 169B, 387
MGSE9-12.N.CN.2 Use the relation $i^2 = –1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	**Mathematics II** **SE:** 183-189 **TE:** 183A-189B
MGSE9-12.N.CN.3 Find the conjugate of a complex number; use the conjugate to find the absolute value (modulus) and quotient of complex numbers.	**Mathematics II** **SE:** 183-189 **TE:** 183A-189B **Mathematics III** **SE:** 101-108 **TE:** 101A-108B

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Represent complex numbers and their operations on the complex plane.	
MGSE9-12.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.	**Mathematics II** **SE/TE:** 189 **TE:** 189B **Mathematics III** **TE:** 352A, 363, 387
MGSE9-12.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°.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
MGSE9-12.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.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
Use complex numbers in polynomial identities and equations.	
MGSE9-12.N.CN.7 Solve quadratic equations with real coefficients that have complex solutions by (but not limited to) square roots, completing the square, and the quadratic formula.	**Mathematics II** **SE/TE:** 183, 186-189, 192, 200, 221-222 **TE:** 183A-183B, 189A-189B, 192, 198A-198B, 204B **Mathematics III** **SE/TE:** 103, 104, 106-107, 169 **TE:** 101A, 108B, 169B, 387
MGSE9-12.N.CN.8 Extend polynomial identities to include factoring with complex numbers. For example, rewrite $x^2 + 4$ as $(x + 2i)(x – 2i)$.	**Mathematics II** **SE/TE:** 186, 188 **TE:** 189B
MGSE9-12.N.CN.9 Use the Fundamental Theorem of Algebra to find all roots of a polynomial equation.	**Mathematics II** **SE/TE:** 220-221 **TE:** 222 **Mathematics III** **SE/TE:** 103, 105-107 **TE:** 100B, 101A, 108B

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Vector and Matrix Quantities N.VM	
Represent and model with vector quantities.	
MGSE9-12.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).	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
MGSE9-12.N.VM.2 Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
MGSE9-12.N.VM.3 Solve problems involving velocity and other quantities that can be represented by vectors.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
Perform operations on vectors.	
MGSE9-12.N.VM.4 Add and subtract vectors.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
MGSE9-12.N.VM.4a 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.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
MGSE9-12.N.VM.4b Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.

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MGSE9-12.N.VM.4c 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.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
MGSE9-12.N.VM.5 Multiply a vector by a scalar.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
MGSE9-12.N.VM.5a Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as $c(v_x, v_y) = (cv_x, cv_y)$.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
MGSE9-12.N.VM.5b 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 $c < 0$).	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
Perform operations on matrices and use matrices in applications.	
MGSE9-12.N.VM.6 Use matrices to represent and manipulate data, e.g., transformations of vectors.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
MGSE9-12.N.VM.7 Multiply matrices by scalars to produce new matrices.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
MGSE9-12.N.VM.8 Add, subtract, and multiply matrices of appropriate dimensions.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.

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MGSE9-12.N.VM.9 Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
MGSE9-12.N.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.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
MGSE9-12.N.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.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
MGSE9-12.N.VM.12 Work with 2 X 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
Algebra	
Seeing Structure in Expressions A.SSE	
Interpret the structure of expressions	
MGSE9-12.A.SSE.1 Interpret expressions that represent a quantity in terms of its context.	**Mathematics I** **SE/TE:** 6-8, 14, 19, 22-23, 26, 29, 30, 31, 33, 38 **TE:** 7, 18B, 20, 24B, 30A-30B, 31, 37B, 69A-69B, 103A-103B **Mathematics II** **SE/TE:** 51, 54, 59, 61, 74, 81, 88, 105, 109, 113 **TE:** 83B, 88B, 130A, 132B, 170B, 175B, 197B, 204A, 255A, 262A **Mathematics III** **SE/TE:** 19, 30, 65, 67, 71, 73, 95, 99, 115, 125 **TE:** 91B, 92B, 139B, 146B, 153B, 161B, 201B, 210A, 219B, 234A

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MGSE9-12.A.SSE.1a Interpret parts of an expression, such as terms, factors, and coefficients, in context.	**Mathematics I** **SE/TE:** 9, 13-15, 19, 25, 27, 51, 53-54, 74, 99-102, 130 **TE:** 18A, 23B, 31A, 51A-51B, 70, 102B, 157A, 184, 198B, 272B **Mathematics II** **SE/TE:** 30, 47, 49, 52, 71, 75, 195, 199, 203, 215 **TE:** 47B, 54B, 55B, 69A, 83B, 89A-89B, 151B, 158A, 170A-170B, 249A **Mathematics III** **SE/TE:** 17, 20, 71, 74, 81, 83, 85, 102, 149, 230 **TE:** 61A-61B, 68B, 69A-69B, 75A, 84A-84B, 91B, 92B, 100A-100B, 131A, 140A
MGSE9-12.A.SSE.1b Given situations which utilize formulas or expressions with multiple terms and/or factors, interpret the meaning (in context) of individual terms or factors.	**Mathematics I** **SE:** 191-198 **TE:** 191A-198B **Mathematics II** **SE:** 18-25, 27-33, 47-54, 55-62, 63-68, 110-116, 117-123, 229-235, 237-242, 275-280 **TE:** 18A-25B, 27A-33B, 47A-54B, 55A-62B, 63A-68B, 110A-116B, 117A-123B, 229A-235B, 237A-242B, 275A-280B **Mathematics III** **SE:** 13-22, 23-30, 69-75, 109-116, 131-139, 140-146, 147-153, 185-192, 203-210, 227-234 **TE:** 13A-22B, 23A-30B, 69A-75B, 109A-116B, 131A-139B, 140A-146B, 147A-153B, 185A-192B, 203A-210B, 227A-234B

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MGSE9-12.A.SSE.2 Use the structure of an expression to rewrite it in different equivalent forms. For example, see $x^4 – y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.	**Mathematics I** **SE/TE:** 5, 9-10, 13, 15, 28, 44, 46, 58, 107, 146 **TE:** 11B, 12A-12B, 17B, 18A-18B, 23B, 24B, 43B, 76B, 183B, 265B **Mathematics II** **SE:** 63-68, 69-74, 75-81, 83-88, 89-94, 110-116, 117-123, 151-157, 158-163, 212-222 **TE:** 63A-68B, 69A-74B, 75A-81B, 83A-88B, 89A-94B, 110A-116B, 117A-123B, 151A-157B, 158A-163B, 212A-222B **Mathematics III** **SE:** 76-83, 84-91, 92-99, 169-176, 177-184, 267-272, 379-386 **TE:** 76A-83B, 84A-91B, 92A-99B, 169A-176B, 177A-184B, 267A-272B, 379A-386B
Write expressions in equivalent forms to solve problems	
MGSE9-12.A.SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.	**Mathematics I** **SE:** 51-56, 57-62, 63-68, 137-143, 144-150, 151-157, 184-190, 191-198, 206-211 **TE:** 48C, 51A-56B, 57A-62B, 63A-68B, 137A-143B, 144A-150B, 151A-157B, 184A-190B, 191A-198B, 206A-211B **Mathematics II** **SE:** 63-68, 69-74, 75-81, 83-88, 89-94, 110-116, 117-123, 151-157, 158-163, 212-222 **TE:** 63A-68B, 69A-74B, 75A-81B, 83A-88B, 89A-94B, 110A-116B, 117A-123B, 151A-157B, 158A-163B, 212A-222B **Mathematics III** **SE:** 76-83, 84-91, 92-99, 169-176, 177-184, 267-272, 379-386 **TE:** 76A-83B, 84A-91B, 92A-99B, 169A-176B, 177A-184B, 267A-272B, 379A-386B

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MGSE9-12.A.SSE.3a Factor any quadratic expression to reveal the zeros of the function defined by the expression.	**Mathematics II** **SE:** 69-74, 75-81, 83-88, 89-94, 151-157 **TE:** 69A-74B, 75A-81B, 83A-88B, 89A-94B, 151A-157B **Mathematics III** In Integrated Mathematics III, students find zeros of polynomials and roots of polynomial equations. **SE:** 92-99, 101-108 **TE:** 92A-99B, 101A-108B
MGSE9-12.A.SSE.3b Complete the square in a quadratic expression to reveal the maximum or minimum value of the function defined by the expression.	**Mathematics II** **SE:** 191-197 **TE:** 191A-197B
MGSE9-12.A.SSE.3c Use the properties of exponents to transform expressions for exponential functions. For example, the expression 1.15^t , where t is in years, can be rewritten as $[1.15^{(1/12)}]^{(12t)} \approx 1.012^{(12t)}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.	**Mathematics I** **SE:** 177-183, 184-190, 191-198, 199-205, 206-211, 212 **TE:** 177A-183B, 184A-190B, 191A-198B, 199A-205B, 206A-211B, 212-212B **Mathematics II** **SE:** 11-17, 18-25 **TE:** 11A-17B, 18A-25B **Mathematics III** **SE:** 169-176, 177-184, 227-234, 235-245 **TE:** 169A-176B, 177A-184B, 227A-234B, 235A-245B
MGSE9-12.A.SSE.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.	**Mathematics I** Geometric sequences are introduced **SE:** 199-205 **TE:** 199A-205B **Mathematics III** **SE/TE:** 280-288 **TE:** 280A-288B

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Arithmetic with Polynomials and Rational Expressions A.APR	
Perform arithmetic operations on polynomials	
MGSE9-12.A.APR.1 Add, subtract, and multiply polynomials; understand that polynomials form a system analogous to the integers in that they are closed under these operations.	**Mathematics II** **SE:** 47-54, 55-62, 63-68 **TE:** 47A-54B, 55A-62B, 63A-68B **Mathematics III** **SE:** 69-75, 76-83 **TE:** 69A-75B, 76A-83B
Understand the relationship between zeros and factors of polynomials	
MGSE9-12.A.APR.2 Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x).	**Mathematics III** **SE:** 84-91 **TE:** 84A-91B
MGSE9-12.A.APR.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.	**Mathematics II** **SE:** 69-74, 75-81, 83-88, 89-94, 103-109, 110-116, 117-123, 145-150, 151-157 **TE:** 69A-74B, 75A-81B, 83A-88B, 89A-94B, 103A-109B, 110A-116B, 117A-123B, 145A-150B, 151A-157B **Mathematics III** **SE:** 92-99 **TE:** 92A-99B
Use polynomial identities to solve problems	
MGSE9-12.A.APR.4 Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 – y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.	**Mathematics II** **SE:** 63-68, 89-94, 212-222 **TE:** 63A-68B, 89A-94B, 212A-222B **Mathematics III** **SE:** 76-83 **TE:** 76A-83B

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MGSE9-12.A.APR.5 Know and apply that the Binomial Theorem gives 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 using Pascal's Triangle.	**Mathematics III** **SE/TE:** 76-83 **TE:** 76A-83B
Rewrite rational expressions	
MGSE9-12.A.APR.6 Rewrite simple rational expressions in different forms using inspection, long division, or a computer algebra system; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x).	**Mathematics III** **SE:** 131-139, 140-146, 147-153 **TE:** 131A-139B, 140A-146B, 147A-153B
MGSE9-12.A.APR.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.	**Mathematics III** **SE:** 140-146, 147-153 **TE:** 140A-146B, 147A-153B
Creating Equations A.CED	
Create equations that describe numbers or relationships	
MGSE9-12.A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear, quadratic, simple rational, and exponential functions (integer inputs only).	**Mathematics I** **SE:** 5-11, 12-17, 24-29, 31-36, 89-95, 184-190, 191-198 **TE:** 5A-11B, 12A-17B, 24A-29B, 31A-36B, 89A-95B, 184A-190B, 191A-198B **Mathematics II** **SE:** 145-150, 151-157, 164-169, 191-197, 198-204 **TE:** 145A-150B, 151A-157B, 164A-169B, 191A-197B, 198A-204B **Mathematics III** **SE:** 40-46, 101-108, 154-161, 193-201, 273-279 **TE:** 40A-46B, 101A-108B, 154A-161B, 193A-201B, 273A-279B

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MGSE9-12.A.CED.2 Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (The phrase "in two or more variables" refers to formulas like the compound interest formula, in which $A = P(1 + r/n)^{nt}$ has multiple variables.)	**Mathematics I** **SE:** 18-23, 51-56, 57-62, 63-68, 70-76, 89-95, 96-102, 184-190, 191-198, 206-211 **TE:** 18A-23B, 51A-56B, 57A-62B, 63A-68B, 70A-76B, 89A-95B, 96A-102B, 184A-190B, 191A-198B, 206A-211B **Mathematics II** **SE:** 18-25, 27-33, 34-40, 103-109, 110-116, 117-123, 124-130, 229-235, 237-242, 243-248 **TE:** 18A-25B, 27A-33B, 34A-40B, 103A-109B, 110A-116B, 117A-123B, 124A-130B, 229A-235B, 237A-242B, 243A-248B **Mathematics III** **SE:** 23-30, 61-68, 131-139, 185-192, 227-234, 235-245, 247-253, 261-266, 323-331, 333-339 **TE:** 23A-30B, 61A-68B, 131A-139B, 185A-192B, 227A-234B, 235A-245B, 247A-253B, 261A-266B, 323A-331B, 333A-339B
MGSE9-12.A.CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret data points as possible (i.e. a solution) or not possible (i.e. a non-solution) under the established constraints.	**Mathematics I** **SE:** 5-11, 12-17, 24-29, 31-36, 37-43, 137-143, 144-150, 151-157, 158-163, 165-170 **TE:** 5A-11B, 12A-17B, 24A-29B, 31A-36B, 37A-43B, 137A-143B, 144A-150B, 151A-157B, 158A-163B, 165A-170B **Mathematics II** **SE:** 145-150, 151-157, 164-169, 170-175, 191-197, 198-204, 205-211 **TE:** 145A-150B, 151A-157B, 164A-169B, 170A-175B, 191A-197B, 198A-204B, 205A-211B **Mathematics III** **SE:** 40-46, 47-52, 101-108, 154-161, 193-201, 273-279, 355-362 **TE:** 40A-46B, 47A-52B, 101A-108B, 154A-161B, 193A-201B, 273A-279B, 355A-362B

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MGSE9-12.A.CED.4 Rearrange formulas to highlight a quantity of interest using the same reasoning as in solving equations. Examples: Rearrange Ohm's law V = IR to highlight resistance R; Rearrange area of a circle formula $A = \pi r^2$ to highlight the radius r.	**Mathematics I** **SE:** 18-23 **TE:** 18A-23B **Mathematics II** **SE/TE:** 50 **Mathematics III** **TE:** 201B
Reasoning with Equations and Inequalities A.REI	
Understand solving equations as a process of reasoning and explain the reasoning	
MGSE9-12.A.REI.1 Using algebraic properties and the properties of real numbers, justify the steps of a simple, one-solution equation. Students should justify their own steps, or if given two or more steps of an equation, explain the progression from one step to the next using properties.	**Mathematics I** **SE:** 5-11, 12-17, 37-39, 41-42, 178-183 **TE:** 5A-11B, 12A-17B, 37A-39, 43A-43B, 178-183B **Mathematics II** **SE:** 145-150, 151-157, 164-169, 191-197, 198-204 **TE:** 145A-150B, 151A-157B, 164A-169B, 191A-197B, 198A-204B **Mathematics III** **SE:** 40-46, 101-108, 154-161, 193-201, 273-279, 355-362 **TE:** 40A-46B, 101A-108B, 154A-161B, 193A-201B, 273A-279B, 355A-362B
MGSE9-12.A.REI.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	**Mathematics III** **SE:** 154-161, 193-201 **TE:** 154A-161B, 193A-201B
Solve equations and inequalities in one variable	
MGSE9-12.A.REI.3 Solve linear equations and inequalities in one variable including equations with coefficients represented by letters. For example, given ax + 3 = 7, solve for x.	**Mathematics I** **SE:** 5-11, 12-17, 18-23, 24-29, 31-36 **TE:** 5A-11B, 12A-17B, 18A-23B, 24A-29B, 31A-36B **Mathematics II** **TE:** 50 **Mathematics III** **SE:** 40-46 **TE:** 40A-46B, 201B

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MGSE9-12.A.REI.4 Solve quadratic equations in one variable.	**Mathematics II** **SE:** 145-150, 151-157, 164-169, 191-197, 198-204 **TE:** 145A-150B, 151A-157B, 164A-169B, 191A-197B, 198A-204B **Mathematics III** **SE:** 40-46, 92-99, 101-108 **TE:** 40A-46B, 92A-99B, 101A-108B
MGSE9-12.A.REI.4a Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from $ax^2 + bx + c = 0$.	**Mathematics II** **SE:** 191-197, 198-204 **TE:** 191A-197B, 198A-204B
MGSE9-12.A.REI.4b Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, factoring, completing the square, and the quadratic formula, as appropriate to the initial form of the equation (limit to real number solutions).	**Mathematics II** **SE:** 145-150, 151-157, 164-169, 191-197, 198-204 **TE:** 145A-150B, 151A-157B, 164A-169B, 191A-197B, 198A-204B **Mathematics III** **SE:** 40-46, 92-99, 101-108 **TE:** 40A-46B, 92A-99B, 101A-108B
Solve systems of equations	
MGSE9-12.A.REI.5 Show and explain why the elimination method works to solve a system of two-variable equations.	**Mathematics I** **SE:** 144-150, 151-157 **TE:** 144A-150B, 151A-157B **Mathematics II** **SE:** 170-175, 205-211 **TE:** 170A-175B, 205A-211B **Mathematics III** **SE:** 47A-52B **TE:** 47A-52B

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MGSE9-12.A.REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.	**Mathematics I** **SE:** 137-143, 144-150, 151-157 **TE:** 137A-143B, 144A-150B, 151A-157B **Mathematics II** **SE:** 170-175, 205-211 **TE:** 170A-175B, 205A-211B **Mathematics III** **SE:** 47A-52B **TE:** 47A-52B
MGSE9-12.A.REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = –3x$ and the circle $x^2 + y^2 = 3$.	**Mathematics II** **SE:** 170-175, 205-211 **TE:** 170A-175B, 205A-211B **Mathematics III** **SE:** 47-52 **TE:** 47A-52B
MGSE9-12.A.REI.8 Represent a system of linear equations as a single matrix equation in a vector variable.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
MGSE9-12.A.REI.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).	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.

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Represent and solve equations and inequalities graphically	
MGSE9-12.A.REI.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.	**Mathematics I** **SE/TE:** 51-56, 57-62, 63-68, 70-76, 137-143 **TE:** 51A-56B, 57A-62B, 63A-68B, 70A-76B, 137A-143B **Mathematics II** **SE:** 27-33, 34-40, 103-109, 110-116, 117-123, 124-130, 229-235, 256-262, 263-268, 269-274 **TE:** 27A-33B, 34A-40B, 103A-109B, 110A-116B, 117A-123B, 124A-130B, 229A-235B, 256A-262B, 263A-268B, 269A-274B **Mathematics III** **SE:** 5-12, 13-22, 40-46, 47-52, 61-68, 109-116, 123-130, 131-139, 185-192, 261-266 **TE:** 5A-12B, 13A-22B, 40A-46B, 47A-52B, 61A-68B, 109A-116B, 123A-130B, 131A-139B, 185A-192B, 261A-266B
MGSE9-12.A.REI.11 Using graphs, tables, or successive approximations, show that the solution to the equation f(x) = g(x) is the x-value where the y-values of f(x) and g(x) are the same.	**Mathematics I** **SE:** 137-143 **TE:** 137A-143B **Mathematics II** **SE:** 170-175 **TE:** 170A-175B **Mathematics III** **SE:** 40-46 **TE:** 40A-46B
MGSE9-12.A.REI.12 Graph the solution set to a linear inequality in two variables.	**Mathematics I** **SE:** 158-163, 165-170 **TE:** 158A-163B, 165A-170B **Mathematics II** **SE/TE:** 207-208 **Mathematics III** **SE:** 47-52 **TE:** 47A-52B

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Functions	
Interpreting Functions F.IF	
Understand the concept of a function and use function notation	
MGSE9-12.F.IF.1 Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and f(x) is the output (an element of the range). Graphically, the graph is y = f(x).	**Mathematics I** **SE:** 83-88, 89-95, 184-190 **TE:** 83A-88B, 89A-95B, 184A-190B **Mathematics II** **SE:** 18-25, 27-33, 34-40, 103-109, 110-116, 117-123, 124-130, 229-235, 237-242, 243-248 **TE:** 18A-25B, 27A-33B, 34A-40B, 103A-109B, 110A-116B, 117A-123B, 124A-130B, 229A-235B, 237A-242B, 243A-248B **Mathematics III** **SE:** 5-12, 13-22, 23-30, 61-68, 109-116, 123-130, 131-139, 185-192, 227-234, 261-266 **TE:** 5A-12B, 13A-22B, 23A-30B, 61A-68B, 109A-116B, 123A-130B, 131A-139B, 185A-192B, 227A-234B, 261A-266B
MGSE9-12.F.IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. (Continued) MGSE9-12.F.IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	**Mathematics I** **SE:** 83-88, 89-95, 96-102, 184-190, 206-211 **TE:** 83A-88B, 89A-95B, 96A-102B, 184A-190B, 206A-211B **Mathematics II** **SE:** 18-25, 27-33, 34-40, 103-109, 110-116, 117-123, 124-130, 229-235, 237-242, 243-248 **TE:** 18A-25B, 27A-33B, 34A-40B, 103A-109B, 110A-116B, 117A-123B, 124A-130B, 229A-235B, 237A-242B, 243A-248B **Mathematics III** **SE:** 5-12, 13-22, 23-30, 61-68, 109-116, 123-130, 131-139, 185-192, 227-234, 261-266 **TE:** 5A-12B, 13A-22B, 23A-30B, 61A-68B, 109A-116B, 123A-130B, 131A-139B, 185A-192B, 227A-234B, 261A-266B

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MGSE9-12.F.IF.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. (Generally, the scope of high school math defines this subset as the set of natural numbers 1,2,3,4…) By graphing or calculating terms, students should be able to show how the recursive sequence $a_1=7$, $a_n=a_n$-1 +2; the sequence $s_n = 2(n-1) + 7$; and the function $f(x) = 2x + 5$ (when x is a natural number) all define the same sequence.	**Mathematics I** **SE:** 104-111, 199-205 **TE:** 104A-111B, 199A-205B **Mathematics II** **SE/TE:** 439 **TE:** 460B, 576B, 593B **Mathematics III** **SE:** 31-39, 280-288 **TE:** 31A-39B, 280A-288B, 518B, 535B
Interpret functions that arise in applications in terms of the context	
MGSE9-12.F.IF.4 Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.	**Mathematics I** **SE:** 83-88, 89-95, 96-102, 184-190, 206-211 **TE:** 83A-88B, 89A-95B, 96A-102B, 184A-190B, 206A-211B **Mathematics II** **SE:** 18-25, 27-33, 34-40, 103-109, 110-116, 117-123, 124-130, 229-235, 237-242, 243-248 **TE:** 18A-25B, 27A-33B, 34A-40B, 103A-109B, 110A-116B, 117A-123B, 124A-130B, 229A-235B, 237A-242B, 243A-248B **Mathematics III** **SE:** 5-12, 13-22, 23-30, 61-68, 109-116, 123-130, 131-139, 185-192, 227-234, 261-266 **TE:** 5A-12B, 13A-22B, 23A-30B, 61A-68B, 109A-116B, 123A-130B, 131A-139B, 185A-192B, 227A-234B, 261A-266B

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MGSE9-12.F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.	**Mathematics I** **SE:** 83-88, 89-95, 96-102, 184-190, 206-211 **TE:** 83A-88B, 89A-95B, 96A-102B, 184A-190B, 206A-211B **Mathematics II** **SE:** 18-25, 27-33, 34-40, 103-109, 110-116, 117-123, 124-130, 229-235, 237-242, 243-248 **TE:** 18A-25B, 27A-33B, 34A-40B, 103A-109B, 110A-116B, 117A-123B, 124A-130B, 229A-235B, 237A-242B, 243A-248B **Mathematics III** **SE:** 5-12, 13-22, 23-30, 61-68, 109-116, 123-130, 131-139, 185-192, 227-234, 261-266 **TE:** 5A-12B, 13A-22B, 23A-30B, 61A-68B, 109A-116B, 123A-130B, 131A-139B, 185A-192B, 227A-234B, 261A-266B
MGSE9-12.F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.	**Mathematics I** **SE:** 83-88, 89-95, 96-102, 184-190, 206-211 **TE:** 83A-88B, 89A-95B, 96A-102B, 184A-190B, 206A-211B **Mathematics II** **SE/TE:** 27-33, 34-40, 103-109, 132-139, 242, 248 **TE:** 243A, 248A-248B, 270 **Mathematics III** **SE/TE:** 9, 11-12, 63, 67, 68, 231, 233, 251, 263, 265 **TE:** 5A-5B, 12A, 234A, 249, 253A-253B, 266A-266B, 323A

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Analyze functions using different representations	
MGSE9-12.F.IF.7 Graph functions expressed algebraically and show key features of the graph both by hand and by using technology.	**Mathematics I** **SE:** 83-88, 89-95, 96-102, 184-190, 206-211 **TE:** 83A-88B, 89A-95B, 96A-102B, 184A-190B, 206A-211B **Mathematics II** **SE:** 18-25, 27-33, 34-40, 103-109, 110-116, 117-123, 124-130, 229-235, 237-242, 243-248 **TE:** 18A-25B, 27A-33B, 34A-40B, 103A-109B, 110A-116B, 117A-123B, 124A-130B, 229A-235B, 237A-242B, 243A-248B **Mathematics III** **SE:** 5-12, 13-22, 23-30, 61-68, 109-116, 123-130, 131-139, 185-192, 227-234, 261-266 **TE:** 5A-12B, 13A-22B, 23A-30B, 61A-68B, 109A-116B, 123A-130B, 131A-139B, 185A-192B, 227A-234B, 261A-266B
MGSE9-12.F.IF.7a Graph linear and quadratic functions and show intercepts, maxima, and minima (as determined by the function or by context).	**Mathematics I** **SE:** 83-88, 89-95, 96-102 **TE:** 83A-88B, 89A-95B, 96A-102B **Mathematics II** **SE:** 103-109, 110-116, 117-123, 124-130 **TE:** 103A-109B, 110A-116B, 117A-123B, 124A-130B **Mathematics III** **SE:** 5-12, 13-22, 23-30, 61-68, 109-116 **TE:** 5A-12B, 13A-22B, 23A-30B, 61A-68B, 109A-116B

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MGSE9-12.F.IF.7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.	**Mathematics I** **SE:** 83-88, 89-95, 96-102 **TE:** 83A-88B, 89A-95B, 96A-102B **Mathematics II** **SE:** 27-33, 34-40, 229-235, 237-242, 243-248, 249-255 **TE:** 27A-33B, 34A-40B, 229A-235B, 237A-242B, 243A-248B, 249A-255B **Mathematics III** **SE:** 23-30, 40-46, 185-192 **TE:** 23A-30B, 40A-46B, 185A-192B
MGSE9-12.F.IF.7c Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.	**Mathematics II** **SE:** 103-109, 110-116, 117-123, 124-130 **TE:** 103A-109B, 110A-116B, 117A-123B, 124A-130B **Mathematics III** **SE:** 61-68, 92-99, 109-116 **TE:** 61A-68B, 92A-99B, 109A-116B
MGSE9-12.F.IF.7d Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.	**Mathematics III** **SE:** 123-130, 131-139 **TE:** 123A-130B, 131A-139B
MGSE9-12.F.IF.7e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	**Mathematics I** **SE:** 184-190, 206-211 **TE:** 184A-190B, 206A-211B **Mathematics II** **SE:** 18-25 **TE:** 18A-25B **Mathematics III** **SE:** 227-234, 235-245, 246, 261-266, 323-331, 333-339, 340-347 **TE:** 227A-234B, 235A-245B, 246A-246B, 261A-266B, 323A-331B, 333A-339B, 340A-347B

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MGSE9-12.F.IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.	**Mathematics I** **SE:** 51-56, 57-62, 63-68, 70-76 **TE:** 51A-56B, 57A-62B, 63A-68B, 70A-76B **Mathematics II** **SE:** 103-109, 110-116, 117-123 **TE:** 103A-109B, 110A-116B, 117A-123B **Mathematics III** **SE:** 5-12, 13-22, 61-68, 101-108, 109-116, 379-386 **TE:** 5A-12B, 13A-22B, 61A-68B, 101A-108B, 109A-116B, 379A-386B
MGSE9-12.F.IF.8a Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. For example, compare and contrast quadratic functions in standard, vertex, and intercept forms.	**Mathematics II** **SE:** 69-74, 75-81, 83-88, 89-94, 151-157, 191-197 **TE:** 69A-74B, 75A-81B, 83A-88B, 89A-94B, 151A-157B, 191A-197B **Mathematics III** **SE:** 76-83, 92-99 **TE:** 76A-83B, 92A-99B
MGSE9-12.F.IF.8b Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{(12t)}$, $y = (1.2)^{(t/10)}$, and classify them as representing exponential growth and decay.	**Mathematics I** **SE:** 184-190, 191-198, 199-205, 206-211 **TE:** 184A-190B, 191A-198B, 199A-205B, 206A-211B **Mathematics II** **SE:** 18-25 **TE:** 18A-25B **Mathematics III** **SE:** 227-234, 235-245 **TE:** 227A-234B, 235A-245B
MGSE9-12.F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one function and an algebraic expression for another, say which has the larger maximum.	**Mathematics I** **SE/TE:** 186, 209, 211 **TE:** 174F, 206A **Mathematics II** **SE/TE:** 30 **TE:** 124B, 131 **Mathematics III** **SE/TE:** 72 **TE:** 69A

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Building Functions F-BF	
Build a function that models a relationship between two quantities	
MGSE9-12.F.BF.1 Write a function that describes a relationship between two quantities.	**Mathematics I** **SE:** 89-95, 96-102, 103, 104-111, 112-119, 120-128, 184-190, 191-198, 206-211, 212 **TE:** 89A-95B, 96A-102B, 103A-103B, 104A-111B, 112A-119B, 120A-128B, 184A-190B, 191A-198B, 206A-211B, 212A-212B **Mathematics II** **SE:** 18-25, 27-33, 34-40, 103-109, 110-116, 117-123, 124-130, 229-235, 237-242, 243-248 **TE:** 18A-25B, 27A-33B, 34A-40B, 103A-109B, 110A-116B, 117A-123B, 124A-130B, 229A-235B, 237A-242B, 243A-248B **Mathematics III** **SE:** 5-12, 13-22, 23-30, 61-68, 109-116, 123-130, 131-139, 185-192, 227-234, 261-266 **TE:** 5A-12B, 13A-22B, 23A-30B, 61A-68B, 109A-116B, 123A-130B, 131A-139B, 185A-192B, 227A-234B, 261A-266B
MGSE9-12.F.BF.1a Determine an explicit expression and the recursive process (steps for calculation) from context. For example, if Jimmy starts out with \$15 and earns \$2 a day, the explicit expression "2x+15" can be described recursively (either in writing or verbally) as "to find out how much money Jimmy will have tomorrow, you add \$2 to his total today." $J_n=J_n-1+2$, $J_0=15$	**Mathematics I** **SE:** 104-111, 199-205 **TE:** 104A-111B, 199A-205B **Mathematics II** **SE/TE:** 188 **TE:** 183A **Mathematics III** **SE:** 31-39, 280-288 **TE:** 31A-39B, 280A-288B

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MGSE9-12.F.BF.1b Combine standard function types using arithmetic operations in contextual situations (Adding, subtracting, and multiplying functions of different types).	**Mathematics I** **SE:** 96-102, 206-211 **TE:** 96A-102B, 206A-211B **Mathematics II** **SE:** 275-280 **TE:** 275A-280B **Mathematics III** **SE:** 203-210 **TE:** 203A-210B
MGSE9-12.F.BF.1c 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.	**Mathematics III** **SE:** 203-210, 211-219 **TE:** 203A-210B, 211A-219B
MGSE9-12.F.BF.2 Write arithmetic and geometric sequences recursively and explicitly, use them to model situations, and translate between the two forms. Connect arithmetic sequences to linear functions and geometric sequences to exponential functions.	**Mathematics I** **SE:**104-111, 199-205 **TE:** 104A-111B, 199A-205B, 248B **Mathematics III** **SE:** 31-39, 280-288 **TE:** 31A-39B, 280A-288B
Build new functions from existing functions	
MGSE9-12.F.BF.3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.	**Mathematics I** **SE:** 96-102, 206-211 **TE:** 96A-102B, 206A-211B **Mathematics II** **SE:** 256-262, 263-268, 269-274 **TE:** 256A-262B, 263A-268B, 269A-274B **Mathematics III** **SE:** 13-22, 109-116, 131-139, 185-192, 227-234, 262, 265, 340-347 **TE:** 13A-22B, 109A-116B, 131A-139B, 185A-192B, 227A-234B, 340A-347B

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MGSE9-12.F.BF.4 Find inverse functions.	**Mathematics II** **SE:** 281-286 **TE:** 281A-286B **Mathematics III** **SE:** 211-219, 355-362 **TE:** 211A-219B, 355A-362B
MGSE9-12.F.BF.4a Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, $f(x) =2(x^3)$ or f(x) = (x+1)/(x-1) for $x \neq 1$.	**Mathematics II** **SE:** 281-286 **TE:** 281A-286B **Mathematics III** **SE:** 211-219, 355-362 **TE:** 211A-219B, 355A-362B
MGSE9-12.F.BF.4b Verify by composition that one function is the inverse of another.	**Mathematics III** **SE/TE:** 215, 217 **TE:** 211A, 216, 219B
MGSE9-12.F.BF.4c Read values of an inverse function from a graph or a table, given that the function has an inverse.	**Mathematics II** **SE:** 281-286 **TE:** 281A-286B **Mathematics III** **SE:** 211-219 **TE:** 211A-219B
MGSE9-12.F.BF.4d Produce an invertible function from a non-invertible function by restricting the domain.	**Mathematics II** **SE:** 281-286 **TE:** 281A-286B **Mathematics III** **SE:** 211-219, 355-362 **TE:** 211A-219B, 355A-362B
MGSE9-12.F.BF.5 Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.	**Mathematics III** **SE:** 254-260, 261-266, 267-272, 273-279 **TE:** 254A-260B, 261A-266B, 267A-272B, 273A-279B

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Linear, Quadratic, and Exponential Models F.LE	
Construct and compare linear, quadratic, and exponential models and solve problems	
MGSE9-12.F.LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.	**Mathematics I** **SE:** 89-95, 96-102, 103, 184-190, 191-198, 206-211, 212 **TE:** 89A-95B, 96A-102B, 103-103B, 104A-111B, 184A-190B, 191A-198B, 206A-211B, 212-212B **Mathematics II** **SE:** 18-25, 26, 132-139 **TE:** 18A-25B, 26A-26B, 132A-139B **Mathematics III** **SE:** 227-234, 235-245, 247-253 **TE:** 227A-234B, 235A-245B, 247A-253B
MGSE9-12.F.LE.1a Show that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. (This can be shown by algebraic proof, with a table showing differences, or by calculating average rates of change over equal intervals).	**Mathematics I** **SE:** 89-95, 96-102, 104-111, 184-190, 191-198, 199-205, 206-211 **TE:** 89A-95B, 96A-102B, 104A-111B, 184A-190B, 191A-198B, 199A-205B, 206A-211B **Mathematics II** **SE:** 18-25, 26, 132-139 **TE:** 18A-25B, 26A-26B, 132A-139B **Mathematics III** **SE/TE:** 227-234, 235-245, 247-253 **TE:** 227A-234B, 235A-245B, 247A-253B
MGSE9-12.F.LE.1b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.	**Mathematics I** **SE:** 89-95, 96-102, 103, 104-111 **TE:** 89A-95B, 96A-102B, 103-103B, 104A-111B **Mathematics II** **SE:** 132-139 **TE:** 132A-139B **Mathematics III** **SE:** 247-253 **TE:** 247A-253B

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MGSE9-12.F.LE.1c Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	**Mathematics I** **SE:** 184-190, 191-198, 199-205, 206-211, 212 **TE:** 184A-190B, 191A-198B, 199A-205B, 206A-211B, 212-212B **Mathematics II** **SE:** 18-25, 26, 132-139 **TE:** 18A-25B, 26A-26B, 132A-139B **Mathematics III** **SE:** 227-234, 235-245, 247-253 **TE:** 227A-234B, 235A-245B, 247A-253B
MGSE9-12.F.LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).	**Mathematics I** **SE:** 89-95, 96-102, 104-111, 184-190, 191-198, 199-205, 206-211 **TE:** 89A-95B, 96A-102B, 104A-111B, 184A-190B, 191A-198B, 199A-205B, 206A-211B **Mathematics II** **SE:** 18-25, 26, 132-139 **TE:** 18A-25B, 26A-26B, 132A-139B **Mathematics III** **SE/TE:** 227-234, 235-245, 247-253 **TE:** 227A-234B, 235A-245B, 247A-253B
MGSE9-12.F.LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	**Mathematics I** **SE/TE:** 187, 189-190, 192 **TE:** 184A-184B **Mathematics II** **SE/TE:** 18-25, 26, 132-139 **TE:** 18A-25B, 26A-26B, 132A-139B **Mathematics III** **SE/TE:** 227-234, 235-245, 247-253 **TE:** 227A-234B, 235A-245B, 247A-253B

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MGSE9-12.F.LE.4 For exponential models, express as a logarithm the solution to $ab^{(ct)} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.	**Mathematics III** **SE/TE:** 273-279 **TE:** 273A-279B
Interpret expressions for functions in terms of the situation they model	
MGSE9-12.F.LE.5 Interpret the parameters in a linear ($f(x) = mx + b$) and exponential ($f(x) = a \cdot d^x$) function in terms of context. (In the functions above, "m" and "b" are the parameters of the linear function, and "a" and "d" are the parameters of the exponential function.) In context, students should describe what these parameters mean in terms of change and starting value.	**Mathematics I** **SE:** 89-95, 96-102, 103, 120-128, 184-190, 191-198, 206-211, 212 **TE:** 89A-95B, 96A-102B, 103-103B, 104A-111B, 120A-128B, 184A-190B, 191A-198B, 206A-211B, 212-212B **Mathematics II** **SE:** 18-25, 26, 132-139 **TE:** 18A-25B, 26A-26B, 132A-139B **Mathematics III** **SE:** 227-234, 235-245, 247-253 **TE:** 227A-234B, 235A-245B, 247A-253B
Trigonometric Functions F-TF	
Extend the domain of trigonometric functions using the unit circle	
MGSE9-12.F.TF.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	**Mathematics II** **SE:** 569-576 **TE:** 569A-576B **Mathematics III** **SE:** 305-315 **TE:** 305A-315B
MGSE9-12.F.TF.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.	**Mathematics III** **SE:** 305-315, 316-322 **TE:** 305A-315B, 316A-322B

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MGSE9-12.F.TF.3 Use special triangles to determine geometrically the values of sine, cosine, tangent for π/3, π/4 and π/6, 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.	**Mathematics III** **SE/TE:** 297-304, 305-315 **TE:** 297A-304B, 305A-315B
MGSE9-12.F.TF.4 Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.	**Mathematics III** **SE:** 305-315, 316-322, 323-331 **TE:** 305A-315B, 316A-322B, 323A-331B
Model periodic phenomena with trigonometric functions	
MGSE9-12.F.TF.5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.	**Mathematics III** **SE:** 323-331, 333-339 **TE:** 323A-331B, 333A-339B
MGSE9-12.F.TF.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.	**Mathematics III** **SE:** 355-362 **TE:** 355A-362B
MGSE9-12.F.TF.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.	**Mathematics III** **SE:** 355-362, 363, 364-372, 373-378 **TE:** 355A-362B, 363A-363B, 364A-372B, 373A-378B
Prove and apply trigonometric identities	
MGSE9-12.F.TF.8 Prove the Pythagorean identity $(\sin A)^2 + (\cos A)^2 = 1$ and use it to find sin A, cos A, or tan A, given sin A, cos A, or tan A, and the quadrant of the angle.	**Mathematics II** **SE/TE:** 468-470 **Mathematics III** **SE:** 316-322, 379-386 **TE:** 316A-322B, 379A-386B
MGSE9-12.F.TF.9 Prove addition, subtraction, double, and half-angle formulas for sine, cosine, and tangent and use them to solve problems.	**Mathematics III** **SE:** 379-386 **TE:** 379A-386B

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Geometry	
Congruence G.CO	
Experiment with transformations in the plane	
MGSE9-12.G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.	**Mathematics I** **SE:** 219-227, 285-291, 292-298, 299-305, 306-312, 415-422 **TE:** 219A-227B, 285A-291B, 292A-298B, 299A-305B, 306A-312B, 415A-422B **Mathematics II** **SE:** 304-310, 311-318, 569-576 **TE:** 304A-310B, 311A-318B, 569A-576B **Mathematics III** **SE:** 466-472, 511-518 **TE:** 466A-472B, 511A-518B
MGSE9-12.G.CO.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).	**Mathematics I** **SE:** 319-326, 327-334, 335-342, 343-349, 350-355 **TE:** 319A-326B, 327A-334B, 335A-342B, 343A-349B, 350A-355B **Mathematics II** **SE:** 413-421, 422-428 **TE:** 413A-421B, 422A-428B
MGSE9-12.G.CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	**Mathematics I** **SE:** 350-355, 356 **TE:** 350A-355B, 356A-356B
MGSE9-12.G.CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	**Mathematics I** **SE:** 319-326, 327-334, 335-342, 343-349, 350-355 **TE:** 319A-326B, 327A-334B, 335A-342B, 343A-349B, 350A-355B
MGSE9-12.G.CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.	**Mathematics I** **SE:** 319-326, 327-334, 335-342, 343-349, 350-355 **TE:** 319A-326B, 327A-334B, 335A-342B, 343A-349B, 350A-355B

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Understand congruence in terms of rigid motions	
MGSE9-12.G.CO.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.	**Mathematics I** **SE:** 343-349, 363-370 **TE:** 343A-349B, 363A-370B
MGSE9-12.G.CO.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.	**Mathematics I** **SE:** 363-370, 381-387, 388-395, 396-401, 402-407 **TE:** 363A-370B, 381A-387B, 388A-395B, 396A-401B, 402A-407B
MGSE9-12.G.CO.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. (Extend to include HL and AAS.)	**Mathematics I** **SE:** 363-370, 381-387, 388-395, 396-401, 402-407 **TE:** 363A-370B, 381A-387B, 388A-395B, 396A-401B, 402A-407B
Prove geometric theorems	
MGSE9-12.G.CO.9 Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.	**Mathematics I** **SE/TE:** 232, 265-271, 285-291, 292-298, 299-305, 306-312, 320, 324, 413 **TE:** 265A-271B, 285A-291B, 292A-298B, 299A-305B, 306A-312B **Mathematics II** **SE:** 304-310, 311-318 **TE:** 304A-310B, 311A-318B **Mathematics III** **SE:** 466-472 **TE:** 466A-472B
MGSE9-12.G.CO.10 Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180 degrees; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.	**Mathematics I** **SE/TE:** 71, 292, 299-305, 371-379 **TE:** 298B, 299A-305B, 371A-379B **Mathematics II** **SE/TE:** 319-326, 328-335, 336-342, 343-348, 445-451 **TE:** 319A-326B, 328A-335B, 336A-342B, 343A-348B, 445A-451B

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MGSE9-12.G.CO.11 Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.	**Mathematics I** **SE/TE:** 290, 351, 408-414 **TE:** 291, 353, 408A-414B **Mathematics II** **SE:** 374-382, 383-390, 391-397, 398-405 **TE:** 374A-382B, 383A-390B, 391A-397B, 398A-405B
Make geometric constructions	
MGSE9-12.G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.	**Mathematics I** **SE/TE:** 228-235, 297, 300, 339-340 **TE:** 228A-235B, 295, 336, 373 **Mathematics III** **SE:** 455-465 **TE:** 455A-465B
MGSE9-12.G.CO.13 Construct an equilateral triangle, a square, and a regular hexagon, each inscribed in a circle.	**Mathematics I** **SE/TE:** 418, 421 **Mathematics III** **SE:** 455-465 **TE:** 455A-465B
Similarity, Right Triangles, and Trigonometry G.SRT	
Understand similarity in terms of similarity transformations	
MGSE9-12.G.SRT.1 Verify experimentally the properties of dilations given by a center and a scale factor.	**Mathematics II** **SE:** 413-421, 422-428 **TE:** 413A-421B, 422A-428B
a. The dilation of a line not passing through the center of the dilation results in a parallel line and leaves a line passing through the center unchanged.	**Mathematics II** **SE:** 413-421 **TE:** 413A-421B
b. The dilation of a line segment is longer or shorter according to the ratio given by the scale factor.	**Mathematics II** **SE:** 413-421 **TE:** 413A-421B

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MGSE9-12.G.SRT.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain, using similarity transformations, the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.	**Mathematics II** **SE:** 422-428 **TE:** 422A-428B
MGSE9-12.G.SRT.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	**Mathematics II** **SE:** 422-428, 429-435 **TE:** 422A-428B, 429A-435B
Prove theorems involving similarity	
MGSE9-12.G.SRT.4 Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, (and its converse); the Pythagorean Theorem using triangle similarity.	**Mathematics II** **SE:** 436-443, 445-451, 452-460, 461-470 **TE:** 436A-443B, 445A-451B, 452A-460B, 461A-467B, 468-470
MGSE9-12.G.SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	**Mathematics I** **SE:** 381-387, 388-395, 396-401, 402-407 **TE:** 381A-387B, 388A-395B, 396A-401B, 402A-407B **Mathematics II** **SE:** 436-443, 445-451, 452-460, 461-470 **TE:** 436A-443B, 445A-451B, 452A-460B, 461A-467B, 468-470
Define trigonometric ratios and solve problems involving right triangles	
MGSE9-12.G.SRT.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.	**Mathematics II** **SE:** 436-443, 452-460, 461-470 **TE:** 436A-443B, 452A-460B, 461A-467B, 468-470
MGSE9-12.G.SRT.7 Explain and use the relationship between the sine and cosine of complementary angles.	**Mathematics II** **TE:** 463, 465

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MGSE9-12.G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.	**Mathematics II** **SE:** 452-460, 461-470 **TE:** 452A-460B, 461A-467B, 468-470 **Mathematics III** **SE:** 373-378 **TE:** 373A-378B
Apply trigonometry to general triangles	
MGSE9-12.G.SRT.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.	**Mathematics III** **SE/TE:** 375-378 **TE:** 378A-378B
MGSE9-12.G.SRT.10 Prove the Laws of Sines and Cosines and use them to solve problems.	**Mathematics III** **SE:** 364-372, 373-378 **TE:** 364A-372B, 373A-378B
MGSE9-12.G.SRT.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).	**Mathematics III** **SE:** 364-372, 373-378 **TE:** 364A-372B, 373A-378B
Circles G.C	
Understand and apply theorems about circles	
MGSE9-12.G.C.1 Understand that all circles are similar.	**Mathematics II** **SE:** 422-428 **TE:** 422A-428B
MGSE9-12.G.C.2 Identify and describe relationships among inscribed angles, radii, chords, tangents, and secants. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.	**Mathematics I** **SE:** 415-422 **TE:** 415A-422B **Mathematics II** **SE:** 577-584, 586-593, 594-600, 601-608 **TE:** 577A-584B, 586A-593B, 594A-600B, 601A-608B **Mathematics III** **SE:** 519-526, 528-535, 536-542, 543-550 **TE:** 519A-526B, 528A-535B, 536A-542B, 543A-550B

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MGSE9-12.G.C.3 Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.	**Mathematics II** **SE/TE:** 322-326 **TE:** 326A-326B **Mathematics III** **SE/TE:** 463-465
MGSE9-12.G.C.4 Construct a tangent line from a point outside a given circle to the circle.	**Mathematics II** **SE/TE:** 578, 581 **TE:** 584A-584B **Mathematics III** **SE/TE:** 520, 523 **TE:** 526A-526B
Find arc lengths and areas of sectors of circles	
MGSE9-12.G.C.5 Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.	**Mathematics II** **SE:** 569-576 **TE:** 569A-576B **Mathematics III** **SE:** 511-518 **TE:** 511A-518B
Expressing Geometric Properties with Equations G.GPE	
Translate between the geometric description and the equation for a conic section	
MGSE9-12.G.GPE.1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.	**Mathematics II** **SE:** 550-555 **TE:** 550A-555B **Mathematics III** **SE:** 491-496 **TE:** 491A-496B
MGSE9-12.G.GPE.2 Derive the equation of a parabola given a focus and directrix.	**Mathematics II** **SE:** 556-562 **TE:** 556A-562B **Mathematics III** **SE:** 497-503 **TE:** 497A-503B

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MGSE9-12.G.GPE.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.	enVision Integrated Mathematics is designed to meet standards that address the first three years of a student's high school career. This standard is intended to address a student's career and college readiness in a 4th year course such as Precalculus.
Use coordinates to prove simple geometric theorems algebraically	
MGSE9-12.G.GPE.4 Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0,2).(Focus on quadrilaterals, right triangles, and circles.)	**Mathematics I** **SE:** 408-414 **TE:** 408A-414B **Mathematics II** **SE:** 543-549 **TE:** 543A-549B **Mathematics III** **SE:** 481-487 **TE:** 481A-487B
MGSE9-12.G.GPE.5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).	**Mathematics I** **SE:** 306-312 **TE:** 306A-312B **Mathematics III** **SE:** 466-472 **TE:** 466A-472B
MGSE9-12.G.GPE.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	**Mathematics III** **SE/TE:** 488-490
MGSE9-12.G.GPE.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.	**Mathematics I** **SE:** 408-414 **TE:** 408A-414B **Mathematics II** **SE:** 535-541 **TE:** 535A-541B **Mathematics III** **SE:** 473-479 **TE:** 473A-479B

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Geometric Measurement and Dimension G.GMD	
Explain volume formulas and use them to solve problems	
MGSE9-12.G.GMD.1 Give informal arguments for geometric formulas.	**Mathematics II** **SE:** 569-577 **TE:** 569A-577B **Mathematics III** **SE:** 511-518, 557-562, 563-570, 572-578 **TE:** 511A-518B, 557A-562B, 563A-570B, 572A-578B
a. Give informal arguments for the formulas of the circumference of a circle and area of a circle using dissection arguments and informal limit arguments.	**Mathematics II** **SE:** 569-577 **TE:** 569A-577B **Mathematics III** **SE:** 511-518 **TE:** 511A-518B
b. Give informal arguments for the formula of the volume of a cylinder, pyramid, and cone using Cavalieri's principle.	**Mathematics III** **SE:** 579-584 **TE:** 579A-584B
MGSE9-12.G.GMD.2 Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.	**Mathematics III** **SE:** 579-584 **TE:** 579A-584B
MGSE9-12.G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.	**Mathematics III** **SE:** 557-562, 563-570, 572-578, 579-584 **TE:** 557A-562B, 563A-570B, 572A-578B, 579A-584B
Visualize relationships between two-dimensional and three-dimensional objects	
MGSE9-12.G.GMD.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.	**Mathematics III** **SE:** 557-562 **TE:** 557A-562B

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Modeling with Geometry G.MG	
Apply geometric concepts in modeling situations	
MGSE9-12.G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).	**Mathematics I** **SE/TE:** 218, 227, 232-233, 238-241, 249, 271, 284, 290-291, 294-295, 298, 302, 305, 312, 313 **TE:** 236B, 249A-249B, 313A-313B **Mathematics II** **SE/TE:** 541, 546, 549, 555, 559, 562, 568, 573, 576, 584 **TE:** 555B, 585A-585B **Mathematics III** **SE/TE:** 459, 462, 465, 472, 487, 489-490, 496, 562, 564-567, 570 **TE:** 466B, 472B, 571A-571B
MGSE9-12.G.MG.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).	**Mathematics I** **SE/TE:** 119, 284, 411 **Mathematics II** **SE/TE:** 4, 624, 628, 639 **Mathematics III** **SE/TE:** 566, 570, 581
MGSE9-12.G.MG.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).	**Mathematics I** **SE/TE:** 218, 284, 298, 302, 318, 362, 374, 379, 380, 395 **TE:** 236B, 380A-380B **Mathematics II** **SE/TE:** 4, 26, 69, 70, 81, 109, 147, 182, 296, 365 **TE:** 26A-26B, 40B, 62B, 204B, 357A **Mathematics III** **SE/TE:** 52, 60, 75, 143, 168, 180, 354, 359, 363, 510 **TE:** 99B, 192B, 296, 363A

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Statistics and Probability	
Interpreting Categorical and Quantitative Data S.ID	
Summarize, represent, and interpret data on a single count or measurement variable	
MGSE9-12.S.ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).	**Mathematics I** **SE/TE:** 431-437, 438-445, 446-452 **TE:** 431A-437B, 438A-445B, 446A-452B **Mathematics III** **SE/TE:** 394-395, 398-399, 408-414 **TE:** 399B, 407B, 414B, 415B
MGSE9-12.S.ID.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, mean absolute deviation, standard deviation) of two or more different data sets.	**Mathematics I** **SE:** 438-445, 446-452, 453-460 **TE:** 438A-445B, 446A-452B, 453A-460B **Mathematics III** **SE/TE:** 407-414 **TE:** 407A-414B
MGSE9-12.S.ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	**Mathematics I** **SE:** 438-445, 446-452, 453-460 **TE:** 438A-445B, 446A-452B, 453A-460B, 467B **Mathematics III** **SE:** 407-414 **TE:** 407A-414B
MGSE9-12.S.ID.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.	**Mathematics I** **SE/TE:** 450, 453-460 **TE:** 453A-460B **Mathematics III** **SE:** 415-422 **TE:** 415A-422B

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Summarize, represent, and interpret data on two categorical and quantitative variables	
MGSE9-12.S.ID.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.	**Mathematics I** **SE:** 461-466 **TE:** 461A-466B **Mathematics II** **SE:** 477-482 **TE:** 477A-482B
MGSE9-12.S.ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.	**Mathematics I** **SE:** 112-119, 120-128 **TE:** 112A-119B, 120A-128B **Mathematics II** **SE/TE:** 22, 132-139 **TE:** 132A-139B **Mathematics III** **SE/TE:** 235-242, 243-245, 246, 247-253 **TE:** 235A-242B, 246A-246B, 247A-253B
MGSE9-12.S.ID.6a Decide which type of function is most appropriate by observing graphed data, charted data, or by analysis of context to generate a viable (rough) function of best fit. Use this function to solve problems in context. Emphasize linear, quadratic and exponential models.	**Mathematics I** **SE:** 112-119, 120-128 **TE:** 112A-119B, 120A-128B **Mathematics II** **SE/TE:** 22, 132-139 **TE:** 132A-139B **Mathematics III** **SE/TE:** 235-242, 243-245, 246, 247-253 **TE:** 235A-242B, 246A-246B, 247A-253B
MGSE9-12.S.ID.6c Using given or collected bivariate data, fit a linear function for a scatter plot that suggests a linear association.	**Mathematics I** **SE:** 112-119, 120-128 **TE:** 112A-119B, 120A-128B **Mathematics II** **SE/TE:** 22, 132-139 **TE:** 132A-139B

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Interpret linear models	
MGSE9-12.S.ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	**Mathematics I** **SE:** 112-119, 120-128 **TE:** 112A-119B, 120A-128B
MGSE9-12.S.ID.8 Compute (using technology) and interpret the correlation coefficient "r" of a linear fit. (For instance, by looking at a scatterplot, students should be able to tell if the correlation coefficient is positive or negative and give a reasonable estimate of the "r" value.) After calculating the line of best fit using technology, students should be able to describe how strong the goodness of fit of the regression is, using "r".	**Mathematics I** **SE:** 112-119, 120-128 **TE:** 112A-119B, 120A-128B **Mathematics II** **SE/TE:** 22, 132-139 **TE:** 132A-139B
MGSE9-12.S.ID.9 Distinguish between correlation and causation.	**Mathematics I** **SE:** 112-119, 120-128 **TE:** 112A-119B, 120A-128B **Mathematics II** **SE/TE:** 138 **TE:** 17B **Mathematics III** **SE/TE:** 253 **TE:** 257
Making Inferences and Justifying Conclusions S.IC	
Understand and evaluate random processes underlying statistical experiments	
MGSE9-12.S.IC.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	**Mathematics I** **SE/TE:** 432-433, 440-441, 447-448, 463 **TE:** 453B **Mathematics III** **SE:** 393-399, 400-406 **TE:** 393A-399B, 400A-406B

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MGSE9-12.S.IC.2 Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For example, a model says a spinning coin falls heads up with probability 0. 5. Would a result of 5 tails in a row cause you to question the model?	**Mathematics II** **SE/TE:** 476 **TE:** 483A **Mathematics III** **SE:** 393-399, 400-406 **TE:** 393A-399B, 400A-406B
Make inferences and justify conclusions from sample surveys, experiments, and observational studies	
MGSE9-12.S.IC.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	**Mathematics I** **SE/TE:** 125, 248, 430, 461-466 **TE:** 127, 461A-461B **Mathematics III** **SE:** 400-406 **TE:** 400A-406B
MGSE9-12.S.IC.4 Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.	**Mathematics I** **SE/TE:** 430, 446-452, 453-460 **TE:** 446A-452B, 453A-460B **Mathematics III** **SE:** 407-414, 415-422, 423-430 **TE:** 407A-414B, 415A-422B, 423A-430B
MGSE9-12.S.IC.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.	**Mathematics III** **SE:** 431-438 **TE:** 431A-438B
MGSE9-12.S.IC.6 Evaluate reports based on data. For example, determining quantitative or categorical data; collection methods; biases or flaws in data.	**Mathematics III** **SE:** 431-438 **TE:** 431A-438B

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Conditional Probability and the Rules of Probability S.CP	
Understand independence and conditional probability and use them to interpret data	
MGSE9-12.S.CP.1 Describe categories of events as subsets of a sample space using unions, intersections, or complements of other events (or, and, not).	**Mathematics II** **SE:** 483-490 **TE:** 483A-490B
MGSE9-12.S.CP.2 Understand that if two events A and B are independent, the probability of A and B occurring together is the product of their probabilities, and that if the probability of two events A and B occurring together is the product of their probabilities, the two events are independent.	**Mathematics II** **SE:** 483-490 **TE:** 483A-490B
MGSE9-12.S.CP.3 Understand the conditional probability of A given B as P (A and B)/P(B). Interpret independence of A and B in terms of conditional probability; that is, the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.	**Mathematics II** **SE:** 491-497 **TE:** 491A-497B
MGSE9-12.S.CP.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, use collected data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.	**Mathematics I** **SE:** 461-466 **TE:** 461A-466B **Mathematics II** **SE:** 477-482, 483-490, 491-497 **TE:** 477A-482B, 483A-490B, 491A-497B

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MGSE9-12.S.CP.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.	**Mathematics II** **SE:** 483-490, 491-497 **TE:** 483A-490B, 491A-497B
Use the rules of probability to compute probabilities of compound events in a uniform probability model	
MGSE9-12.S.CP.6 Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in context.	**Mathematics II** **SE:** 491-497 **TE:** 491A-497B
MGSE9-12.S.CP.7 Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answers in context.	**Mathematics II** **SE:** 483-490 **TE:** 483A-490B
MGSE9-12.S.CP.8 Apply the general Multiplication Rule in a uniform probability model, P(A and B) = [P(A)]x[P(B|A)] =[P(B)]x[P(A|B)], and interpret the answer in terms of the model.	**Mathematics II** **SE:** 483-490 **TE:** 483A-490B
MGSE9-12.S.CP.9 Use permutations and combinations to compute probabilities of compound events and solve problems.	**Mathematics II** **SE:** 499-505 **TE:** 499A-505B
Using Probability to Make Decisions S.MD	
Calculate expected values and use them to solve problems	
MGSE9-12.S.MD.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.	**Mathematics II** **SE:** 506-513 **TE:** 506A-513B
MGSE9-12.S.MD.2 Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.	**Mathematics II** **SE:** 514-520 **TE:** 514A-520B

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MGSE9-12.S.MD.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.	**Mathematics II** **SE:** 506-513, 514-520 **TE:** 506A-513B, 514A-520B
MGSE9-12.S.MD.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?	**Mathematics II** **SE:** 506-513, 514-520 **TE:** 506A-513B, 514A-520B
Use probability to evaluate outcomes of decisions	
MGSE9-12.S.MD.5 Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.	**Mathematics II** **SE:** 514-520, 521-527 **TE:** 514A-520B, 521A-527B **Mathematics III** **SE:** 440-446 **TE:** 440A-446B
MGSE9-12.S.MD.5a 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.	**Mathematics II** **SE:** 514-520, 521-527 **TE:** 514A-520B, 521A-527B **Mathematics III** **SE:** 440-446 **TE:** 440A-446B

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MGSE9-12.S.MD.5b 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.	**Mathematics II** **SE:** 514-520, 521-527 **TE:** 514A-520B, 521A-527B **Mathematics III** **SE:** 440-446 **TE:** 440A-446B
MGSE9-12.S.MD.6 Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).	**Mathematics II** **SE:** 521-527 **TE:** 521A-527B **Mathematics III** **SE:** 440-446 **TE:** 440A-446B
MGSE9-12.S.MD.7 Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).	**Mathematics II** **SE:** 521-527 **TE:** 521A-527B **Mathematics III** **SE:** 431-438, 440-446 **TE:** 431A-438B, 440A-446B