

Contents

Acknowledgments xxiii

Letter to High School Mathematics Teachers xxv

Letter to High School Principals xxvii

Introduction

A Brief History of the Common Core	xxix
The Common Core State Standards for Mathematics	xxix
Instructional Shifts	xxx
Major Work of High School	xxx
Common Core Word Wall	xxxi
The Common Core Standards for Mathematical Practice	xxxii
Effective Mathematical Teaching Practices	xxxiv
How to Use This Book	xxxv
Reflection Questions	xxxvi

Part 1. Modeling

Conceptual Category Overview	2
Sample Planning Page	3
Reflection Questions: Modeling	7

Part 2. Number and Quantity

Conceptual Category Overview	10
Direct Connections to Number and Quantity in the Middle Grades	11
<i>Suggested Materials</i>	11
<i>Number and Quantity—Overarching Key Vocabulary</i>	11
Domain: The Real Number System (N.RN)	12
<i>N.RN—Key Vocabulary</i>	12
<i>Cluster A: Extend the properties of exponents to rational exponents.</i>	13
<i>Cluster B: Use properties of rational and irrational numbers.</i>	17
<i>Sample Planning Page</i>	19
<i>Reflection Questions: The Real Number System</i>	21
Domain: Quantities (N.Q)	22
<i>Cluster A: Reason quantitatively and use units to solve problems.</i>	22
<i>Sample Planning Page</i>	26
<i>Reflection Questions: Quantities</i>	28
Domain: The Complex Number System (N.CN)	29
<i>N.CN—Key Vocabulary</i>	29
<i>Cluster A: Perform arithmetic operations with complex numbers.</i>	30

Cluster B: Represent complex numbers and their operations on the complex plane.	34
Cluster C: Use complex numbers in polynomial identities and equations.	39
Sample Planning Page	44
Reflection Questions: The Complex Number System	46
Domain: Vector & Matrix Quantities (N.VM)	47
N.VM—Key Vocabulary	47
Cluster A: Represent and model with vector quantities.	48
Cluster B: Perform operations on vectors.	52
Cluster C: Perform operations on matrices and use matrices in applications.	56
Sample Planning Page	68
Reflection Questions: Vector and Matrix Quantities	73

Part 3. Algebra

Conceptual Category Overview	76
Direct Connections to Algebra in the Middle Grades	76
Suggested Materials	77
Algebra—Overarching Key Vocabulary	77
Domain: Seeing Structure in Expressions (A.SSE)	78
A.SSE—Key Vocabulary	79
Cluster A: Interpret the structure of expressions.	80
Cluster B: Write expressions in equivalent forms to solve problems.	83
Sample Planning Page	87
Reflection Questions: Seeing Structure in Expressions	88
Domain: Arithmetic With Polynomials and Rational Expressions (A.APR)	89
A.APR—Key Vocabulary	89
Cluster A: Perform arithmetic operations on polynomials.	90
Cluster B: Understand the relationship between zeros and factors of polynomials.	92
Cluster C: Use polynomial identities to solve problems.	96
Cluster D: Rewrite rational expressions.	100
Sample Planning Page	103
Reflection Questions: Arithmetic With Polynomials and Rational Expressions	104
Domain: Creating Equations (A.CED)	105
A.CED—Key Vocabulary	105
Cluster A: Create equations that describe numbers or relationships.	106
Sample Planning Page	112
Reflection Questions: Creating Equations	113
Domain: Reasoning With Equations and Inequalities (A.REI)	114
A.REI—Key Vocabulary	114
Cluster A: Understand solving equations as a process of reasoning and explain the reasoning.	115
Cluster B: Solve equations and inequalities in one variable.	120
Cluster C: Solve systems of equations.	126
Cluster D: Represent and solve equations and inequalities graphically.	133
Sample Planning Page	138
Reflection Questions: Reasoning With Equations and Inequalities	139

Part 4. Functions

Conceptual Category Overview	142
Direct Connections to Functions in the Middle Grades	143
<i>Suggested Materials</i>	143
<i>Functions—Overarching Key Vocabulary</i>	143
Domain: Interpreting Functions (F.IF)	144
<i>F.IF—Key Vocabulary</i>	144
<i>Cluster A: Understand the concept of a function and use function notation.</i>	145
<i>Cluster B: Interpret functions that arise in application in terms of the context.</i>	151
<i>Cluster C: Analyze functions using different representations.</i>	156
<i>Sample Planning Page</i>	171
<i>Reflection Questions: Interpreting Functions</i>	174
Domain: Building Functions (F.BF)	175
<i>F.BF—Key Vocabulary</i>	175
<i>Cluster A: Build a function that models a relationship between two quantities.</i>	176
<i>Cluster B: Build new functions from existing functions.</i>	182
<i>Sample Planning Page</i>	188
<i>Reflection Questions: Building Functions</i>	190
Domain: Linear, Quadratic, and Exponential Models (F.LE)	191
<i>F.LE—Key Vocabulary</i>	191
<i>Cluster A: Construct and compare linear, quadratic, and exponential models and solve problems.</i>	192
<i>Cluster B: Interpret expressions for functions in terms of the situation they model.</i>	203
<i>Sample Planning Page</i>	205
<i>Reflection Questions: Linear, Quadratic, and Exponential Models</i>	207
Domain: Trigonometric Functions (F.TF)	208
<i>F.TF—Key Vocabulary</i>	208
<i>Cluster A: Extend the domain of trigonometric functions using the unit circle.</i>	210
<i>Cluster B: Model periodic phenomena with trigonometric functions.</i>	219
<i>Cluster C: Students probe identities involving trigonometric functions and use them to solve problems.</i>	225
<i>Sample Planning Page</i>	228
<i>Reflection Questions: Trigonometric Functions</i>	230

Part 5. Geometry

Conceptual Category Overview	232
Direct Connections to Geometry in the Middle Grades	233
<i>Suggested Materials</i>	233
<i>Geometry—Overarching Key Vocabulary</i>	233
Domain: Congruence (G.CO)	235
<i>G.CO—Key Vocabulary</i>	236
<i>Cluster A: Experiment with transformations in the plane.</i>	237
<i>Cluster B: Understand congruence in terms of rigid motions.</i>	248
<i>Cluster C: Prove geometric theorems.</i>	253
<i>Cluster D: Make geometric constructions.</i>	257
<i>Sample Planning Page</i>	261
<i>Reflection Questions: Congruence</i>	263

Domain: Similarity, Right Triangles, and Trigonometry (G.SRT)	264
G.SRT—Key Vocabulary	265
Cluster A: Understand similarity in terms of similarity transformations.	266
Cluster B: Prove theorems involving similarity.	272
Cluster C: Define trigonometric ratios and solve problems involving right triangles.	276
Cluster D: Apply trigonometry to general triangles.	280
Sample Planning Page	285
Reflection Questions: Similarity, Right Triangles, and Trigonometry	288
Domain: Circles (G.C)	289
G.C—Key Vocabulary	289
Cluster A: Understand and apply theorems about circles.	290
Cluster B: Find arc lengths and areas of sectors of circles.	297
Sample Planning Page	300
Reflection Questions: Circles	303
Domain: Expressing Geometric Properties With Equations (G.GPE)	304
G.GPE—Key Vocabulary	304
Cluster A: Translate between the geometric description and the equation for a conic section.	305
Cluster B: Use coordinates to prove simple geometric theorems algebraically.	312
Sample Planning Page	317
Reflection Questions: Expressing Geometric Properties With Equations	319
Domain: Geometric Measurement and Dimension (G.GMD)	320
G.GMD – Key Vocabulary	320
Cluster A: Explain volume formulas and use them to solve problems.	321
Cluster B: Visualize relationships between two-dimensional and three-dimensional objects.	328
Sample Planning Page	330
Reflection Questions: Measurement and Dimension	332
Domain: Modeling With Geometry (G.MG)	333
G.MG—Key Vocabulary	333
Cluster A: Apply geometric concepts in modeling situations.	334
Reflection Questions: Modeling With Geometry	338
Sample Planning Page	339

Part 6. Statistics and Probability

Conceptual Category Overview	344
Direct Connections to Statistics and Probability in Middle Grades	344
Suggested Materials	345
Statistics and Probability—Overarching Key Vocabulary	345
Domain: Interpreting Categorical and Quantitative Data (S.ID)	346
S.ID—Key Vocabulary	346
Cluster A: Summarize, represent, and interpret data on a single count or measurement variable.	349
Cluster B: Summarize, represent, and interpret data on two categorical and quantitative variables.	358
Cluster C: Interpret linear models.	368
Sample Planning Page	376
Reflection Questions: Interpreting Categorical and Quantitative Data	379

Domain: Making Inferences and Justifying Conclusions (S.IC)	380
S.IC—Key Vocabulary	380
Cluster A: Understand and evaluate random processes underlying statistical experiments.	381
Cluster B: Make inferences and justify conclusions from sample surveys, experiments, and observational studies.	386
Sample Planning Page	395
Reflection Questions: Making Inferences and Justifying Conclusions	398
Domain: Conditional Probability and the Rules of Probability (S.CP)	399
S.CP—Key Vocabulary	399
Cluster A: Understand independence and conditional probability and use them to interpret data.	401
Cluster B: Use the rules of probability to compute probabilities of compound events in a uniform probability model.	411
Sample Planning Page	418
Reflection Questions: Conditional Probability and the Rules of Probability	420
Domain: Using Probability to Make Decisions (S.MD)	421
S.MD—Key Vocabulary	421
Cluster A: Calculate expected values and use them to solve problems.	422
Cluster B: Use probability to evaluate outcomes of decisions.	428
Sample Planning Page	433
Reflection Questions: Using Probability to Make Decisions	435

Resources

Table 1. Standards for Mathematical Practice	438
Table 2. Effective Teaching Practices	441

Reproducibles

Reproducible 1. Blank Sample Planning Page	444
Reproducible 2. The Real Number System	446
Reproducible 3: Seeing Structure in Expressions	447
Reproducible 4: Reasoning With Equalities and Inequalities	448
Reproducible 5: Interpreting Functions	450
Reproducible 6: Building Functions	451
Reproducible 7: Linear and Exponential Functions Cards	452
Reproducible 8: Trigonometric Functions	453
Reproducible 9: Exploring the Values of the Trigonometry Ratios	454
Reproducible 10: Real and Nonsense Words	456
Reproducible 11: Disjoint vs. Independent Activity	457

Additional Resources and References 459

About the Authors 461



For downloadable versions of the Quick Reference Guide, Reproducibles, and a Planning Page Template, visit the companion website at **resources.corwin.com/mathematicscanpanion9-12**.