CPM Geometry Textbook to Curriculum Map Alignment for CC Geometry

High School Geometry – Unit 1

Develop the ideas of congruence through constructions and transformations

Critical Area: In this Unit the notion of two-dimensional shapes as part of a generic plane (the Euclidean Plane) and exploration of transformations of this plane as a way to determine whether two shapes are congruent or similar are formalized. Students use transformations to prove geometric theorems. The definition of congruence in terms of rigid motions provides a broad understanding of this notion, and students explore the consequences of this definition in terms of congruence criteria and proofs of geometric theorems. Students develop the ideas of congruence and similarity through transformations.

CLUSTERS	COMMON CORE STATE STANDARDS	CPM Geometry	Resources
Make geometric construction *Make a variety of formal geometric constructions using a variety of tools.*	**Geometry - Congruence** **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 give line through a point not on the line. **G.CO.13** Construct an equilateral triangle, a square, a regular hexagon inscribed in a circle.	3.1.1, 5.2.1, 6.2.5, 7.1.1,7.1.2, 7.1.4, 7.2.1,7.2.2,8.1.1, 9.2.1- 9.2.4, 10.1.1-10.1.5, 11.1.1-11.1.3 MN: 9.2.3 9-98, 9-104, 9-110, 9-113, 10-8 9.2.1, 9.2.3, 9.2.4 9-67, 9-104	**Materials:** **For Students:** compass, protractor, straight-edge, string, reflective devices, tracing paper, graph paper and geometric software. **For instruction:** Document camera, LCD projector, screen **Tulare County Office of Education** Hands-On Strategies for Transformational Geometry **Websites:** Math Open Reference http://mathopenref.com/tocs/constructionstoc.html (online resource that illustrates how to generate constructions) **Math is Fun** http://www.mathsisfun.com/geometry/constructions.html H-G.CO.12, 13 Engage New York Geometry-Module 1 pg 7 – 37 **Illustrative Mathematics**

CLUSTERS	COMMON CORE STATE STANDARDS	CPM Geometry	Resources
			Make Formal Constructions More Constructions
Experiment with transformations in the plan *Develop precise definitions of geometric figures based on the undefined notions of point, line, distance along a line and distance around a circular arc.* *Experiment with transformations in the plane.*	**Geometry - Congruence** **G.CO.1** Know precise definitions of angle, circle, perpendicular lines, parallel lines, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. **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.) **G.CO.3** Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. **G.CO.4** Develop definitions of rotations, reflections, and translations in terms of angles, circles perpendicular lines, parallel lines, and line segments. **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.	MN: 1.1.5, 1.2.5, 2.1.1, 2.1.2, 7.1.2, 7.1.4, 8.3.2, 10.1.1, 10.1.2 1.2.1–1.2.6, 3.1.1–3.1.3, 6.2.5 1-96, 1-102, 2-33, 3-17, 3-42, 5-90, 6-28, 9-23 1.2.4–1.2.6 1-64, 2-129, 6-16, 6-65 1.2.1–1.2.6 MN: 1.1.1, 1.2.2, 1.2.4 For applications in homework, see standard G-CO.5. 1.2.1–1.2.6, 6.2.5 1-85, 1-126, 2-20, 2-22, 2-64, 3-5, 3-69, 3-28, 6-52, 7-17	**Interactive** http://www.shodor.org/interactivate/activities/Transmographer/ **Illustrative Mathematics** Fixed Points of rigid Motion Dilations and Distances Horizontal Stretch of Plane **Mars Tasks:** Aaron's Designs Possible Triangle Constructions Transforming 2D Figures **Mathematics Vision Project:** Module 6: Congruence, Constructions and Proof Module 5: Geometric Figures **Illuminations** Security Camera Placement Placing a Fire Hydrant Pizza Delivery Regions Perplexing Parallelograms **California Mathematics Project** Transformational Geometry **Teaching Channel** Collaborative Work with Transformations

CLUSTERS	COMMON CORE STATE STANDARDS	CPM Geometry	Resources
Understand congruence in terms of rigid motions *Use rigid motion to map corresponding parts of congruent triangle onto each other.* *Explain triangle congruence in terms of rigid motions.*	**Geometry - Congruence** **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. **G.CO.7** Use 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. **G.CO.8** Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow the definition of congruence in terms of rigid motions.	***Reflect on Background Knowledge*** ***5.1 Angles of Triangles*** 1.2.1–1.2.6, 3-73, 6.1.1–6.1.3, 6.2.5 3-69, 3-76, 6-17, 6-26, 6-65. For applications of rigid motions in homework, see standard G-CO.5. 6.1.1–6.1.3 MN: 3.2.2 For applications in homework, see standard G-SRT.5. 6.1.1–6.1.3 MN: 6.1.4 For applications in homework, see standard G-SRT.5.	Illustrative Mathematics Understand Congruence in terms of Rigid Motion Is this a rectangle? **Illuminations** Triangle Classification **Teaching Channel** Formative Assessment: Understanding Congruence
Prove geometric theorems Prove theorems about lines and angles, triangles; and parallelograms.	**Geometry - Congruence** **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.	2.1.1–2.1.5, 9.2.1, 6.1.5 MN: 2.1.4, 2.1.5 Checkpoint 8 2-33, 6-62, 6-94, 7-67, 7-113, 7-124	**Illustrative Mathematics** https://www.illustrativemathematics.org/content-standards/HSG/CO/B **Mars Task:** Evaluating Statements About Length and Area **Illuminations**:

CLUSTERS	COMMON CORE STATE STANDARDS	CPM Geometry	Resources
	G.CO.10 Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; 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. **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.	1-84, 2.1.4, 2.1.5, 5.2.1, 6.1.4, 6.1.5, 7.2.6, 9.2.4 MN: 2.2.1, 5.3.1, 7.2.6, 9.2.4 Checkpoint 8 2-20, 4-70, 6-46, 7-69, 7-134, 8-8, 8-30, 8-134, 9-33, 12-53 7.2.1–7.2.6 MN: 7.2.3, 7.2.4, 8.1.2, 9.2.2 7-32, 7-35, 7-100, 7-108, 7-113, 7-124, 7-155, 8-87	Perplexing Parallelograms

Geometry – UNIT 2
Similarity, Right Triangles, and Trigonometry

Critical Area: Students investigate triangles and decide when they are similar. A more precise mathematical definition of similarity is given; the new definition taken for two objects being similar is that there is a sequence of similarity transformations that maps one exactly onto the other. Students explore the consequences of two triangles being similar: that they have congruent angles and that their side lengths are in the same proportion. Students prove the Pythagorean Theorem using triangle similarity.

CLUSTERS	COMMON CORE STATE STANDARDS	CPM Geometry	Resources
Understand similarity in terms of similarity transformations	**Geometry - Similarity, Right Triangles, and Trigonometry** **G-SRT.1**. Verify experimentally the properties of dilations given by a center and a scale factor: a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor. **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. **G-SRT.3**. Use the properties of similarity transformations to establish the Angle-Angle (AA) criterion for two triangles to be similar.	3.1.1, 3.1.2 MN: 3.1.1 3-5, 3-18, 3-46, 5-138, 9-113 3.1.2, 3.1.3 MN: 3.1.2, 3.1.1 3-5, 3-18, 3-29, 3-46, 3-80, 5-138, 9-113 3.1.2–3.1.4, 3.2.1, 3.2.4, 6.1.1, 6.1.2 MN: 3.1.4, 6.1.1 3-19, 3-42, 3-54, 3-55, 3-69, 3-113, 5-58, 7-60 3.2.1 3-54, 3-90, 3-99, 3-122, 4-7	**Mars Tasks :** Hopwell Geometry – G.SRT.5 Inscribing and Circumscribing Right Triangles – G.SRT: Analyzing Congruence Proofs CPALMS Dilation Transformation **Illustrative Mathematics** Similar Triangles : G-SRT.3 Pythagorean Theorem : G-SRT.4 Joining two midpoints of sides of a triangle : G-SRT.4 **Teaching Channel :** Challeging Students to Discover Pythagoras How tall is the Flagpole **Mathematics Vision Project** Module 6 : Similarity and Right Triangle Trigonometry
	Geometry - Similarity, Right		**Khan Academy**

Prove theorems involving similarity **Apply geometric concepts in modeling situations**	**Triangles, and Trigonometry** **G-SRT.4**. Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity. **G-SRT.5**. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures Supporting clusters: **G-MG 1-3**: Modeling with Geometry: Apply geometric concepts in modeling situations	3-39, 3-74, 3-107 3.1.4, 3.2.1–3.2.6, 6.1.1–6.1.5, 7.2.6, 8.2.1, 8.2.2 MN: 3.2.1, 3.2.5, 6.1.4, 7.1.3, 7.2.1, 8.2.1 Checkpoint 6 3-99, 3-122, 4-70, 4-118, 5-23, 5-65, 6-47, 6-58, 7-6, 7-31, 7-102, 8-22, 8-30, 8-63, 8-87, 8-118, 9-20, 9-71, 11-101 6.2.1, 6.2.3, 8.3.3, 9.1.3–9.1.5, 10.1.1, 10.1.2, 11.1.2–11.1.5, 11.2.1, 11.2.2 11-72, 12-21, 12-112 9-69 9-40, 9-57, 9-93, 9-114 6.2.1, 6.2.3, 7.1.3, 8.3.3, 12.2.2–12.2.4 7-84, 8-52, 8-115	https://www.khanacademy.org/math/geometry/right_triangles_topic/pythagorean_proofs/e/pythagorean-theorem-proofs **Math is Fun** http://www.mathsisfun.com/geometry/pythagorean-theorem-proof.html **NCTM Illuminations** Understanding the Pythagorean Relationship **Mars Task:** Solving Geometry Problems: Floodlights Proofs of Pythagorean Theorem The Pythagorean Theorem: Square Areas Finding Shortest Routes: The Schoolyard Problem **Modeling Task:** **Mars Task**: Estimating: Counting Trees **Inside Mathematics** William's Polygon

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High School Geometry – Unit 3

Express Geometric Properties with Equations; Extend Similarity to Circles

Critical Area: Students investigate triangles and decide when they are similar; with this newfound knowledge and their prior understanding of proportional relationships, they define trigonometric ratios and solve problems using right triangles. They investigate circles and prove theorems about them. Connecting to their prior experience with the coordinate plane, they prove geometric theorems using coordinates and describe shapes with equations. Students extend their knowledge of area and volume formulas to those for circles, cylinders and other rounded shapes. They prove theorems, both with and without the use of coordinates.

CLUSTERS	COMMON CORE STATE STANDARDS	CPM Geometry	Resources
Use coordinates to prove simple geometric theorems algebraically	**Geometry - Expressing Geometric Properties with Equations** **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, $\sqrt{3}$) lies on the circle centered at the origin and containing the point (0, 2).* **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). **G.GPE.6**. Find the point on a dire cted line segment between two given points that partitions the segment in a given ratio. **G.GPE.7**. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. ★	7.3.1–7.3.3, 12.2.1 7-35, 7-153, 8-119, 12-23, 12-31, 12-45 1.2.3, 7.3.1 MN: 1.2.6, 7.3.2 1-105, 2-42, 2-45, 2-69, 3-89, 5-132, 7-131, 10-37 7.3.2 MN: 7.3.3 8-32, 7-140, 8-98 6.2.2, 7.3.1–7.3.3 2-32, 2-106, 4-119, 5-147, 7-35, 8-71, 8-131	**Materials**: • Compass, straight-edge, graph paper, reflective surface, protractor, tracing paper, scissors, tape. • Geometer's Sketchpad or other software. Geogebra Software **Mathematics Vision Project** Module 7: Connecting Algebra and Geometry **Mars Task:** Finding Equations of Parallel and Perpendicular Lines
Understand and apply theorems about circles	**Geometry - Circles** **G.C.1**. Prove that all circles are	3-55	**Illustrative Mathematics** Right triangles inscribed in circles II:

Find arc lengths and areas of sectors of circles	similar. **G.C.2.** Identify and describe relationships among inscribed angles, radii, and chords. *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.* **G.C.3.** Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle. **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. **Convert between degrees and radians. CA**	10.1.1–10.1.5, 11.2.2, 11.2.3 MN: 10.1.3, 10.1.4, 11.2.3 10-18, 10-20, 11-29, 11-111, 11-117, 12-11, 12-52, 12-93, 12-115 9.2.1, 9.2.4, 10.1.5, 10-28, 10-42 MN: 10.1.5 10-78 8.3.2, 10.1.2, 10-55 MN: 8.3.3 10-32, 10-83, 10-104	G.C.2a Inscribing a triangle in a circle : G.C.**3a** Two Wheels and a Belt : G.C. B Equal Area Triangles on the Same Base II : G.GPE.5b **Mars Tasks:** Sectors of Circles **Inside Mathematics:** What's My Angle?
Translate between the geometric description and the equation for a conic section	**Geometry - Expressing Geometric Properties with Equations** **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. **G.GPE.2**. Derive the equation of a parabola given a focus and directrix.	12.1.1, 12.1.2 MN: 12.1.3 12-24, 12-51, 12-105, 12-10 12.1.4	**Illustrative Mathematics** Explaining the equation for a Circle Slopes and Circles Defining Parabolas Geometrically **Mars Task:** Equations of Circles 1 Equations of Circles 2

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High School Geometry – UNIT 4
Trigonometry; Measurement and Dimensions; Statistics and Probability

Critical Area: Students explore probability concepts and use probability in real-world situations. They continue their development of statistics and probability, students investigate probability concepts in precise terms, including the independence of events and conditional probability. They explore right triangle trigonometry, and circles and parabolas. Throughout the course, Mathematical Practice 3, "Construct viable arguments and critique the reasoning of others," plays a predominant role. Students advance their knowledge of right triangle trigonometry by applying trigonometric ratios in non-right triangles.

CLUSTERS	COMMON CORE STATE STANDARDS	CPM Geometry	Resources
Define trigonometric ratios and solve problems involving right triangles.	**Geometry - Similarity, Right Triangles, and Trigonometry** **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. **G.SRT.7** Explain and use the relationship between the sine and cosine of complementary angles. **G.SRT.8** Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. **G.SRT.8.1** Derive and use the trigonometric ratios for special right triangles (30°,60°,90°and 45°,45°,90°). CA	4.1.1–4.1.4, 5.1.1–5.1.3 MN: 4.1.2, 4.1.4, 5.1.2, 5.1.4 For applications in homework, see standards G-SRT.7 and G-SRT.8. 5.1.2 5-14, 5-46, 8-110 2.3.2, 4.1.4, 4.1.5, 5.1.1–5.1.4, 5.2.1, 5.2.2, 5.3.1, 5.3.5 MN: 2.3.2 Checkpoint 7 4-43, 4-50, 4-124, 5-18, 5-137, 7-78, 8-77, 12-10	**Illustrative Mathematics** Defining Trigonometric Ratios: G.SRT.6 Sine and Cosine of Complementary Angles: G.SRT.7 Shortest line segment from a point P to a line L: G.SRT.8 **Mars Task**: Modeling Rolling Cups **Inside Mathematics:** Circular Reasoning
Explain volume formulas and use them to solve problems	**Geometric Measurement and Dimension** **G.GMD.1** Give an informal argument for the formulas for the circumference	8.1.2–8.1.5, 8.3.1, 8.3.2, 9.1.1–9.1.3, 11.1.2–11.1.5	**Illustrative Mathematics** Doctor's Appointment: G.GMD.3 Centerpiece: G.GMD.3

Visualize relationships between two-dimensional and three-dimensional objects.	of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.* **G.GMD.3** Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. **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. **G.GMD.5** Know that the effect of a scale factor k greater than zero on length, area, and volume is to multiply each by k, k^2, and k^3, respectively; determine length, area and volume measures using scale factors. CA **G.GMD.6** Verify experimentally that in a triangle, angles opposite longer sides are larger, sides opposite larger angles are longer, and the sum of any two side lengths is greater than the remaining side length; apply these relationships to solve real-world and mathematical problems. CA	MN: 9.1.3, 9.1.5 9.1.3–9.1.5, 11.1.3–11.1.5 MN: 11.1.4, 11.1.5, 11.2.2 Checkpoint 11 9-83, 9-103, 11-100, 11-102, 11-118, 11-128, 12-40, 12-54 1.2.1, 11.1.3, 12.1.3, 12.1.4 MN: 11.1.3, 12.1.4 1-58, 11-13, 11-39, 11-42, 11-61, 12-42 n/a n/a	Area of a circle: G.GMD.1 Global Positioning System: G.GMD.4, A.CED.2 Circumference of a Circle Volume formulas for Cylinder and prims **Illuminations** Trigonometry for Solving Problems **Mathematics Vision Project:** Circles a Geometric Perspective **Mars Task**: Evaluating Statements About Enlargements (2D & 3D) 2D Representations of 3D Objects Calculating Volume of Compound Objects Modeling: Making Matchsticks Estimating and Sampling: Jellybeans

Understand independence and conditional probability and use them to interpret data (Link to data from simulations or experiments.)	**Statistics and Probability - Conditional Probability and the Rules of Probability** **S.CP.1** Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). **S.CP.2** Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent. **S.CP.3** Understand the conditional probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and interpret independence of *A* and *B* as saying that 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*. **S.CP.4** Construct and interpret two-way frequency tables of data	4.2.1–4.2.4 MN: 1.2.1, 4.2.3, 4.2.4 Checkpoint 9A 5-45, 5-145, 5-149, 10-190, 11-129 10.2.3 MN: 10.2.3 10-131, 10-142, 10-176, 11-112 10.2.1–10.2.3 MN: 4.1.5, 10.2.3 10-116, 10-117, 10-130, 10-176, 10-188, 10-190, 11-112, 11-126 10.2.2, 10.2.3 10-101, 10-102, 10-117, 10-130,	**Illustrative Mathematics** Statistics and Probability- Conditional Probability and the rules of Probability Rain and Lightning:S.CP.2,3,5, and 7 Lucky Envelopes: S.CP.3 Random Walk: S.CP.9 **Mathematics Vision Project:** Module 9: Probability Mars Task: Probability Games Modeling Conditional Probabilities 1: Lucky Dip Georgia Standards: Unit 7: Applications on Probability Inside Mathematics: Friends You Can Count On Got Your Number

	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, collect 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.* **S.CP.5** Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.	10-176, 11-88 10.2.1–10.2.3 10-85, 10-101, 10-102, 10-116, 10-117, 10-176, 10-188, 10-190, 11-88	
Use the rules of probability to compute probabilities of compound events in a uniform probability model	**Statistics and Probability - Conditional Probability and the Rules of Probability** **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	10.2.1–10.2.3 MN: 10.2.3 10-85, 10-101, 10-117, 10-188,	

	the answer in terms of the model.	10-190	
	S.CP.7 Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) – P(A \text{ and } B)$, and interpret the answer in terms of the model.	4.2.3, 10.2.3 4-116, 5-10, 5-32, 5-55, 5-151, 11-129	**Inside Mathematics:** Rod Trains
	S.CP.8 (+) Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B\|A) = P(B)P(A\|B)$, and interpret the answer in terms of the model.	10.2.3 See S-CP.2 and S-CP.3 for applications of the Multiplication Rule.	
	S.CP.9 (+) Use permutations and combinations to compute probabilities of compound events and solve problems.	10.3.1–10.3.5 MN: 10.3.1, 10.3.2, 10.3.3, 10.3.5 10-129, 10-1453, 10-155, 10-159, 10-179, 10-180, 10-187, 10-189, 11-59, 11-119, 11-127, 12-90	