Geometry
Learning Targets
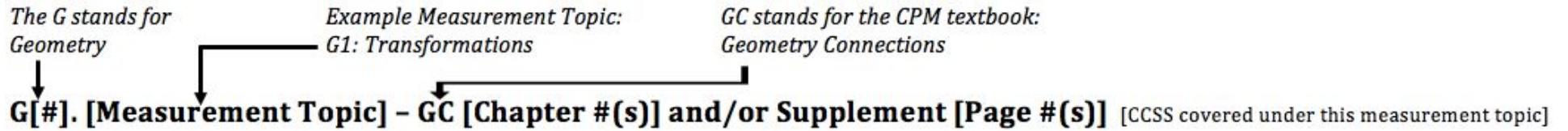## Proficiency Grading
2017-2018

This document is the product of a team of PPS teachers experienced in writing learning targets and using them in instruction. While it represents our best work, we know this document will act as a working draft, to be revisited and revised as we continue to hone our instruction around CCSS Geometry.

The intended audience of this document is teachers of mathematics. While this document will be especially helpful for teachers who are using proficiency-based grading, it should also be useful to all teachers of CCSS Geometry as a summary of the new content students are expected to master due to Oregon's adoption of the Common Core State Standards for Mathematics. The learning targets are written in student-friendly language. We chose to further call out aspects of the learning target being assessed for teachers in the "procedural" and "conceptual" columns.

Every student should be expected to show mastery of ALL of the learning targets at the proficient (PR) level. A higher grade reflects a higher level of mastery. Our desire when adding the grading rubric below each Learning Target is that there is some consistency of expectations amongst and within buildings for students in PPS.

Proficiency based grading can be a complex and difficult process. If you plan to use these Measurement Topics and Learning Targets to track student progress, one way to make tracking more manageable is to test at the Measurement Topic Level, in which case students would need to pass all Learning Targets at a proficient (PR) level in order to pass the Measurement Topic. Individual Learning Targets could still be assessed formatively and in cases of retesting.

We modeled our work after Robert J. Marzano's Measurement Topics (Formative Assessment & Standards-Based Grading, 2010). The following PPS Learning Target classification names are used in Synergy and may encompass one or more Common Core State Standards. The structure is as follows:

The G stands for Geometry	Example Measurement Topic: G1: Transformations	GC stands for the CPM textbook: Geometry Connections

G[#]. [Measurement Topic] – GC [Chapter #(s)] and/or Supplement [Page #(s)] [CCSS covered under this measurement topic]

Learning Targets	All of these items are to be covered under this learning target	
	Procedural	Conceptual
G [#][letter]. [Learning Target Text]	This detail goes deeper into the more algorithmic type of problems students should be able to complete to demonstrate proficiency on the learning target.	This detail goes deeper into types of problem solving skills a student should be able to complete to demonstrate proficiency on this learning target.

PR *Students can do….*	These questions are examples of the minimum level of knowledge of a standard(s) students need to demonstrate by the end of the course in order demonstrate understanding for this learning target. It is meant to help teachers calibrate their own assessments and student expectations.
HP *students can do…*	These questions are examples of a high level of mastery of standard(s) students demonstrate by the end of course. Often these questions require students to put multiple parts of learning together to solve a task or may reflect something that was never directly taught in the classroom. It is meant to help teachers calibrate their own assessments and student expectations.

+ Throughout this document this symbol (+) indicates an area that students do not need to master during this course. Teachers could use this as an extension or differentiation lesson.

The Standards

The following Common Core State Standards for Mathematics are covered in the PPS CCSS Geometry course, including the recommended calendar and timeline (https://sites.google.com/site/ppshighschoolmath/geometry/learning-targets-geometry) and the Measurement Topics and Learning Targets in this document. The standards covered are based on the recommendation in the CCSS Mathematics Appendix A Traditional Pathway. The complete set of standards and Appendix A are available for download at http://corestandards.org/the-standards

The following are the standards covered in CCSS Geometry:

- The Mathematical Practices
- Geometry

    o Congruence: G.CO.1-13

    o Similarity, Right Triangles, and Trigonometry: G.SRT.1-8

    o Circles: G.C.1-3, 5

    o Expressing Geometric Properties with Equations: G.GPE.1,2,4-7

    o Geometric Measurement and Dimension: G.GMD.1, 3, 4

    o Modeling with Geometry: G.MG.1-3

- Statistics & Probability
    o Conditional Probability and the Rules of Probability: S.CP.1-7

Contents

- G1a. I can draw rigid transformations.

- G2a. I can use theorems, postulates, or definitions about lines and angles.

- G3a. I can determine that two figures are similar.

- G4a. I can use appropriate tools to find missing sides and angles in right triangles.

- G5a. I can justify that two triangles are congruent and can use this to prove theorems about parallelograms.

- G6a. I can use coordinates of the vertices to compute perimeter and area.
- G6b. I can justify a claim about a figure using the coordinate grid.

- G7a. I can apply the properties of angles within circles.
- G7b. I can calculate the area of a sector and arc length.

- G7c. I can identify the center and radius of a circle given its equation.

G8. Geometric Modeling & Constructions
……..…………......15-16
- G8a. I can apply geometric concepts in modeling situations.
- G8b. I can use tools and methods to create constructions.

G9. Solids & Conics
…….……17-18
- G9a. I can calculate the volume of a prism, cylinder, cone, pyramid and sphere.
- G9b. I can identify the shapes of two-dimensional cross-sections of three-dimensional objects.
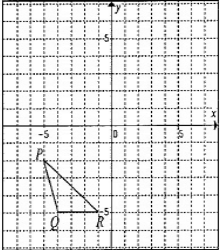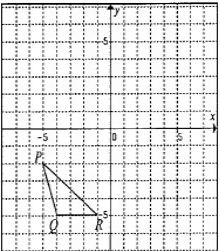
G10. Conditional Probability
…………………………………………………………………………………………………..……………………………………......19-20
- G10a. I can calculate probabilities with unions and intersections.
- G10b. I can calculate conditional & independent probabilities.

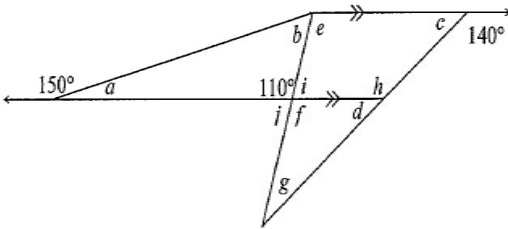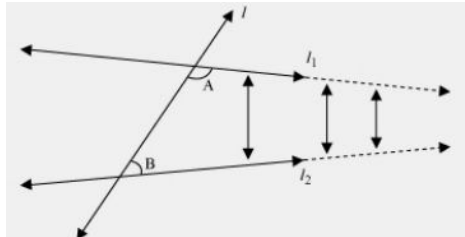# G1. Transformations – GC Ch. 1 and GC Supplement

G.CO. 2-6
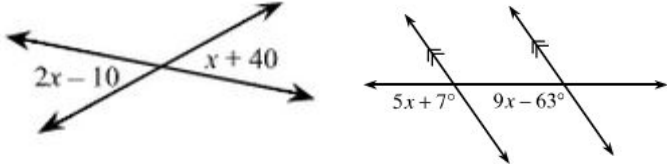
Learning Target	All of these items are to be covered under this learning target	
	Procedural	Conceptual
G1a. I can draw rigid transformations.	□ Reflections □ Rotations □ Translations □ Combinations of reflections, rotations, and translations □ Reflection and Rotation Symmetry	□ Predict the composition of transformation that will map a figure onto a congruent figure. □ Coordinate rules to transformations

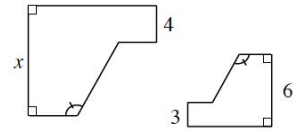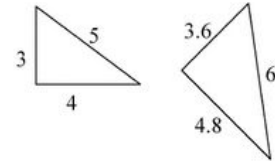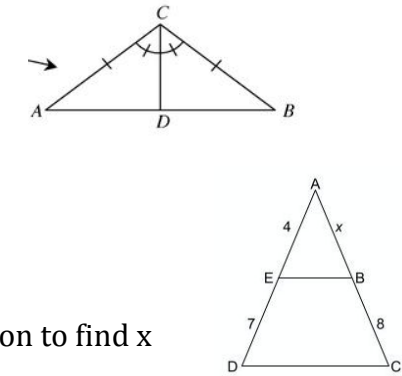| **PR** *students can do….*	For a given shape demonstrate a reflection For a given shape demonstrate a rotation For a given shape demonstrate a translation Reflect triangle PQR across the y-axis and label the image P'Q'R'. Reflect the image now across the x-axis. Label the new image P"Q"R".	
HP *students can do…*	A single transformation from PQR to P"Q"R" can be achieved by rotating the original figure. Where is the center of rotation and how many degrees was the triangle rotated? From the letter "E" create a new letter using transformations on the coordinate grid. Graph both letters and describe what transformations you used to move from the "E" to the new letter. Given two shapes on a coordinate grid, write the rule (y+5, x – 8) that transformed the first shape into the second. (Example should include multiple transformations).	

G2. Lines & Angles – GC Ch. 2

G.CO.1, 9

Learning Target	All of these items are to be covered under this learning target	
	Procedural	Conceptual
G2a. I can use theorems, postulates, or definitions about lines and angles.	□ Transversals, alternate interior, corresponding, same-side interior □ Linear angles/straight angles, vertical, complementary, and supplementary □ Triangle sum theorem	□ Given an angle relationship, prove that two lines are parallel

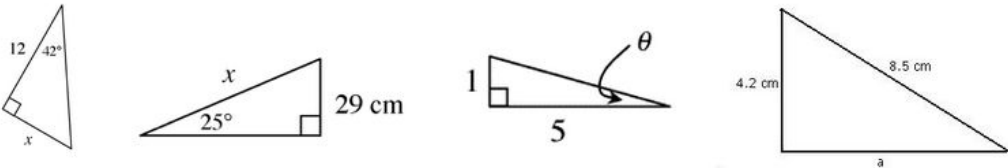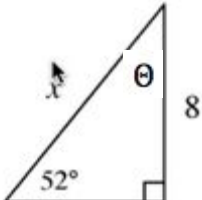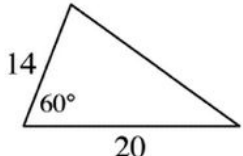| **PR** *students can do….*	Solve for X and name the relationship you used. $2x - 10$ $x + 40$ $5x + 7°$ $9x - 63°$
HP *students can do…*	In the diagram, find the measure of the following angles. Name any relationship you used to help you find each measure. $\angle$ a, $\angle$ e, $\angle$ f, $\angle$ g If A = 100° and B = 80°, can this diagram work? Justify your answer

G3. Similarity – GC Ch.3

G.SRT. 1-3, 5

Learning Target	All of these items are to be covered under this learning target	
	Procedural	Conceptual
G3a. I can determine that two figures are similar.	☐ AA~ ☐ SSS~ ☐ SAS~ ☐ Scale Factors ☐ Dilations	☐ Perform dilation with a given center and scale factor. ☐ To find missing parts of similar figures including right triangles ☐ Real world similar triangle problems ☐ Explain why SSA~ does not prove two triangle are similar

PR *students can do….*	*Triangles/shapes used are not touching* The two shapes are similar. Find the value of x. Show all work. Determine whether or not the two triangles are similar.
HP *students can do…*	*Triangles used are touching* Prove that the two triangles are similar. Use a structured argument or flow chart to justify your statements. Make sure you include a similarity statement in your proof/flowchart. *Triangles used are nested* In the diagram, side EB is parallel to side DC. Why are the two triangles similar? Write and solve a proportional equation to find x using the corresponding sides.

G4. Trigonometry – GC Ch. 4, 5 and GC Supplement   G.SRT.4
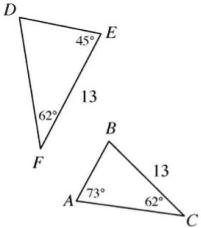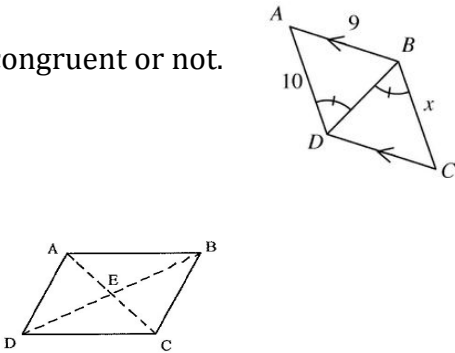
Learning Target	All of these items are to be covered under this learning target	
	Procedural	Conceptual
G4a. I can use appropriate tools to find missing sides and angles in right triangles.	□ Sine □ Cosine □ Tangent □ Pythagorean Theorem □ Inverse Trigonometric Functions	□ Real world right triangle problems □ The use of slope triangles to identify slope triangles, sides and angles □ The relationship between the sin and cos of complementary angles □ (+) Law of Sin, Law of Cos

PR *students can do….*	To paint a house, Travis leans a ladder against the wall. If the ladder is 16 feet long and it makes contact with the house 14 feet above the ground, what angle does the ladder make with the ground? Draw a diagram of this situation and show all work. Find all of the missing sides and angles in this triangle. Show all work.
HP *students can do…*	Find the area and perimeter of the triangle. Use any method you like, show all work.

G5. Triangles & Parallelograms: Application & Proof – GC Ch. 6, 7 & GC Supp.   G.CO.7, 8, 10, 11

Learning Target	All of these items are to be covered under this learning target	
	Procedural	Conceptual

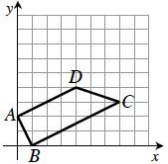| G5a. I can justify that two triangles are congruent and can use this to prove theorems about parallelograms.	☐ SSS/SAS/ASA/AAS/HL ☐ CPCTC ☐ 2 column proof, flowcharts	☐ I can identify and explain that in a pair of congruent triangles, corresponding sides are congruent and corresponding angles are congruent. ☐ I can use theorems, postulates, or definitions to prove theorems about parallelograms ☐ Opposite sides and angles of a parallelogram are congruent, ☐ Diagonals of a parallelogram bisect each other; rectangles have congruent diagonals ☐ (+) Base angles of isosceles triangles; triangle midsegment; and medians in triangles.

PR *students can do….*	*Triangles used are not touching* In the diagram, determine whether the triangles are congruent or not. Make a flowchart/proof justifying your answer.	
HP *students can do…*	*Triangles used are not touching* In the diagram, determine whether the triangles are congruent or not. Make a flowchart/proof justifying your answer. Prove that side AD is congruent to side B If the diagonals of a quadrilateral bisect each other, must the quadrilateral be a parallelogram? Explain completely.	

G6. Coordinate Geometry – GC Ch. 7 and GC Supp.

G.GPE.7

Learning Target	All of these items are to be covered under this learning target	
	Procedural	Conceptual

G6a. I can use coordinates of the vertices to compute perimeter and area.	□ Distance formula □ Pythagorean theorem □ Perimeter and Area formulas	□ Using coordinates of vertices from real world situations to compute the perimeter and area.

PR *students can do….*	Plot and connect the points A (-3, 4), B (1, 7), C (10, -5) and D (6, -8). Find the length of AB: _____ Find the length of BC: _____ Find the area of ABCD: _____ Find the perimeter of ABCD: _____ Plot and connect the points A (-3, 4), B (1, 7), C (10, -5) and D (6, -8). Find its area and perimeter.
HP *students can do…*	Plot and connect the points of ABCDEF if A(- 5, 5), B (- 1, 1), C (2, 1), D (2, -1), E (-1, -1) and F(- 5, -5). Find its area and perimeter.

G6. Coordinate Geometry – GC Ch. 7 and GC Supp.

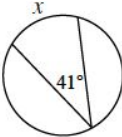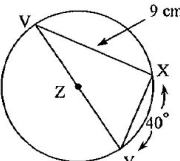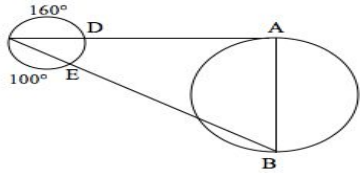| Learning Target	All of these items are to be covered under this learning target	
	Procedural	Conceptual
G6b. I can justify a claim about a figure using the coordinate grid.	☐ Distance formula, midpoint formula, Pythagorean theorem ☐ Parallel lines, perpendicular lines, negative reciprocals ☐ Properties of quadrilaterals	☐ I can calculate the point(s) on a directed line segment that partitions the line segment into a given ratio.

PR *students can do….*	Plot and connect the points: *N* (-5, 7), *O* (-1, 13) and *D* (4, 7) What kind of triangle is *NOD*? Justify your answer. Plot and connect the points M(-9, 3), A (- 8, 7), T (-5, 9) and H (- 6, 5) to make quadrilateral MATH. Explain why it is a parallelogram.
HP *students can do…*	Plot and connect the points *M* (1,7), N (-2,2), P (3, -1) and *Q* (6, 4) to make quadrilateral MNPQ. What is the best name for *MNPQ*? Justify your answer.

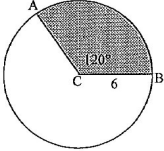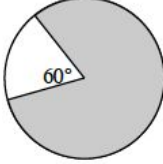# G7. Circles – GC Ch. 8, 10, AC and GC Supp.

<div align="right">G.C.2; G.MG.1</div>

Learning Target	All of these items are to be covered under this learning target	
	Procedural	Conceptual
G7a. I can apply the properties of angles within circles.	☐ Central angles, inscribed and circumscribed angles ☐ Tangents, arcs and intersecting chords	☐ Properties of geometric figures to comparable real-world objects. ☐ (+) I can prove that opposite angles in an inscribed quadrilateral are supplementary ☐ (+) I can use pictures to explain that a regular polygon with many sides is nearly a circle and its perimeter is nearly the circumference of a circle.

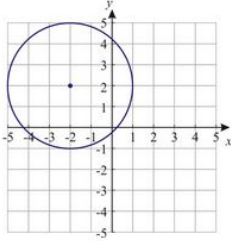|	
PR *students can do….*	Find x. If QS is a diameter and PO is a chord of the circle at right, find the measure of the geometric parts listed below. Arc PS_____ Angle PQS_____ Arc SPO_____ http://map.mathshell.org/lessons.php?collection=8&unit=9300 - Geo figures real world objects.
HP *students can do…*	The radius of the large circle is 3 inches and $\overline{AB}$ is its diameter. Also, $\overline{AC}$ is tangent to the large circle at point A. If $m\widehat{CD} = 160°$ and $m\widehat{CE} = 100°$, find the area of triangle AB Find the area of circle Z.

G7. Circles – GC Ch. 8, 10, AC and GC Supp.

Learning Target	All of these items are to be covered under this learning target	
	Procedural	Conceptual
G7b. I can calculate the area of a sector and arc length.	☐ Using the ratio of the intercepted arc (central angle) measure and 360°.	☐ Using the ratio of the intercepted arc measure and 360° in real world examples.

PR *students can do….*	Find the area of sector ACB in circle C. Find the length of the arc AB. Find the area of the shaded region of the circle. Find the length of the arc of the shaded region.
HP *students can do…*	A 14.75 inch long windshield wiper blade starts at a horizontal resting position and swipes upward on a arc at an angle of 132 degrees. How many square inches of the windshield's surfaces does the blade cover on any given swipe? <Create concentric circle here with a shaded region to determine its area> Find the area of the shaded region.

G7. Circles – GC Ch. 8, 10, AC and GC Supp. G.GPE.1

Learning Target	All of these items are to be covered under this learning target	
	Procedural	Conceptual
G7c. I can identify the center and radius of a circle given its equation.	☐ Convert equation from general to standard ☐ Completing the square	☐ Identify the center and radius of a circle given its equation in a real world model.

PR *students can do….*	Identify the center and radius of the following circle: $(x + 5)^2 + (y – 7)^2 = 25$ Identify the center and radius of the following circle: $x^2 + (y – 5)^2 = 20$ Given the graph at the right, write the equation for the circle:
HP *students can do…*	Given the equation: $x^2 + 6x + y^2 – 6y = -9$, find four (4) points on the circle. Find the equation of the circle described based on the information provided. Drawing a picture will help. "It is tangent to the y-axis with a radius of 2 and the center is on the line y = 2x" The beam of a lighthouse can be seen from all points that satisfy the equation: $x^2 + y^2 = 20^2$. How far Northeast (in miles) are you from the lighthouse if you are right at the outskirts of the beam?

G8. Geometric Modeling and Constructions – GC Ch. 9

G.MG.1-3

Learning Target	All of these items are to be covered under this learning target	
	Procedural	Conceptual
G8a. I can apply geometric concepts in modeling situations.	☐ Apply concepts of density based on area and volume, including converting units of measure	☐ Solve design problems using a geometric model. (CPM 7-19 speaker problem, 7-73)

PR *students can do….*	Alaska is much less crowded than New Jersey. It has an approximate population of 698,000 and an area of 570,374 square miles. What is the density of people per square mile? The Butterfly House at the animal park contains 625 butterflies. If the dimensions of the house are 15 feet by 20 feet by 10 feet, what is the density of butterflies per cubic foot? Calculate and rank the 10 most densely populated countries in the world. (http://www.worldatlas.com/aatlas/populations/ctypopls.htm)
HP *students can do…*	Given race data from several Portland neighborhood from 2000 and 2010, be able to compare the change in density of racial groups and draw some conclusions. *This data is available on the Portland Police Bureau website:* *http://www.portlandoregon.gov/police/29793* Alaska is much less crowded than New Jersey. It has an approximate population of 698,000 and an area of 570,374 square miles. New Jersey has an approximate population of 8,791,000 and an area of 7,420 square miles. How many people need to move from New Jersey to Alaska in order to equalize their population densities?

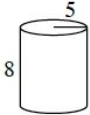# G8. Geometric Modeling and Constructions – GC Ch. 9 and GC Supp.   G.CO.12, 13; G.C.3
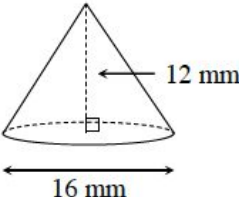
Learning Target	All of these items are to be covered under this learning target	
	Procedural	Conceptual
G8b. I can use tools and methods to create constructions.	□ Precisely copy an angle, □ Bisect a segment, □ Bisect an angle, □ Construct perpendicular lines and bisectors □ Construct a line parallel to a given line through a point not on the line. *great teaching resource at mathopenref.com	□ Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle. □ Construct the inscribed and circumscribed circles of a triangle.

PR *students can do….*	Draw a perpendicular bisector to a given line. Bisect an angle. Draw a line that is parallel to the given line. Copy an angle. Construct an isosceles right triangle.
HP *students can do…*	Circumscribe a triangle. Construct a line segment that is $\sqrt{5}$ units long.

G9. Solids & Conics – GC Ch. 9, 11, 12 and GC Supp.

G.GMD. 1, 3

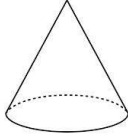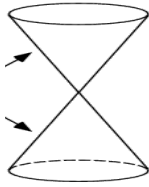| Learning Target	All of these items are to be covered under this learning target	
	Procedural	Conceptual
G9a. I can calculate the volume of a prism, cylinder, cone, pyramid and sphere.	□ Using the given formula $v = B \cdot h$ and the volume of a cylinder $V = \pi r^2 h$.	□ Explain that the volume of a pyramid is 1/3 the volume of a prism with the same base area and height. □ Use volume formula for cylinders, pyramids, cones and spheres to solve real life problems

PR *students can do….*	Find the volume: Find the radius of a cylinder that has a volume of $200\,\pi$ square units and a height of 21 units.
HP *students can do…*	The height of a cone is 4 inches and the radius of the top is 2 inches. If a perfectly spherical scoop of snow cone melted would the cone be able to hold the liquid with given dimension and no spillage?

Problem Based Lesson - Gumball Machine

G9. Solids & Conics – GC Ch. 9, 11, 12 and GC Supp. G.GPE. 2; G.GMD.4

Learning Target	All of these items are to be covered under this learning target	
	Procedural	Conceptual
G9b. I can identify the shapes of two-dimensional cross-sections of three-dimensional objects.	□ Identify shapes as ellipse, arc, circle, oval	□ Identify the focus and directrix of a parabola when given its equation.

PR
 	
students can do….
	If a cone were sliced horizontally, what shape would the cross section be?
	   a. a circle
	   b. an oval
	   c. a parabola
	   d. a cone
	
	If a cylinder is sliced vertically, what is the shape of the cross-section? Show your understanding with a diagram.

HP *students can do…*	On the double cone solid, for each of the conic sections, draw the cross section that produces each one.

G10. Conditional Probability – GC Supplement

Learning Target	All of these items are to be covered under this learning target	
	Procedural	Conceptual
G10a. I can calculate probabilities with unions and intersections.	□ Establish events as subsets of a sample space based on the union, intersection □ Complement of other events □ "And" "or" "not" □ Area models, tree diagrams	□ Calculating probabilities with unions and intersections of real world models.

PR *students can do….*	Susannah has a stack of cards numbered 1 through 50. What is the probability that the card chosen at random is less than 23? What is the probability that the card chosen at random is a multiple of 5 or even? In a standard deck of 52 cards, shown at right, what is the probability of drawing one card that is: A club or a face card? A club and a face card? Not a club and not a face card?
HP *students can do…*	In a random sample of 10,000 college students, a research company found that 35.7% were involved in a club and 27.8% studied 4 or more hours per day. When they reported their findings, the research company indicated that 53.4% of college students were either involved in a club or they studied 4 or more hours per day. Given this information, what is the probability that a college student is involved in a club and studies 4 or more hours a day?

G10. Conditional Probability – GC Supplement

S.CP.2-5

Learning Target	All of these items are to be covered under this learning target	
	Procedural	Conceptual
G10b. I can calculate conditional & independent probabilities.	□ How to identify the difference between conditional and independent events □ Area model for conditional probability □ Two-way frequency table	□ Explain that conditional probability is the probability of an event occurring given the occurrence of some other event and give examples that illustrate conditional probabilities

PR *students can do….*	If Letitia studies for her math test tonight, she has an 80% chance of getting an A. If she does not study, she only has a 10% chance. Whether she can study or not depends on whether she has to work at her parent's store. If she has to work, she can't study. Earlier in the day, her father said there is a 50% chance that Letitia would have to work. Find the probability that Letitia gets an A There are 30 students in Mr. Cooper's class; 18 boys and 12 girls. 4 of the boys and 3 of the girls earned As for their first semester. Create a two-way table to display this data. If a student is chosen at random, what is the probability that they are a girl or an A student?
HP *students can do…*	If Letitia studies for her math test tonight, she has an 80% chance of getting an A. If she does not study, she only has a 10% chance. Whether she can study or not depends on whether she has to work at her parent's store. If she has to work, she can't study. Earlier in the day, her father said there is a 50% chance that Letitia would have to work. What are the chances that Letitia studied, given that she got an A? There are 30 students in Mr. Cooper's class; 18 boys and 12 girls. 4 of the boys and 3 of the girls earned As for their first semester. Create a two-way table to display this data. If a student earned an A, what is the probability the he/she was a girl? At a small East Coast college, the following data is collected: |	Engr major	Other major	| |---|---|---|---| | Male | 30 | 170 | 200 | | Female | 6 | 34 | 40 | | | 36 | 204 | 240 | Are the P(female) and P(engineering) independent events? Show how you know. Are the P(female) and P(engineering) mutually exclusive? Show how you know.