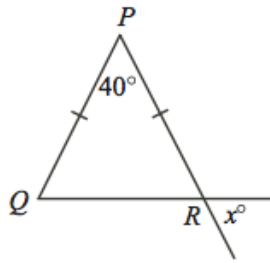# MC15G
Pre-MathCounts Geometry

Chapter 1:   Angles-1

- Angles and terminology

- Parallel, perpendicular, and transversal lines

- Sum of the degree measures in a triangle

- Types of triangles and their properties

Sample Problem:
(CEMC-2008-Gauss7-13) In the diagram, $\triangle PQR$ is isosceles. The value of x is

(A) 40   **(B)** 70   **(C)** 60   **(D)** 30   **(E)** 110

Chapter 2:   Angles-2

- Different types and names of polygons (by number of side lengths; regular polygons)

- Convex and concave polygons

- Sum of internal and external angles in an n-sided polygon

- Diagonals of a polygon

Sample Problem:
(Richard Spence) The interior angles of a convex pentagon form an arithmetic sequence. If the smallest angle measures $64°$, what is the measure of the second-smallest angle?

Chapter 3: Angles-3

- Properties of inscribed angles in circles

- Major/minor arcs, sectors, tangent lines to circles
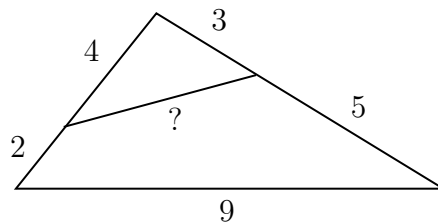
Sample Problem:
(Richard Spence) Points A and B are on circle O such that $\angle AOB = 48°$. Point P is on major arc AB such that $\triangle APB$ is isosceles. What is the degree measure of $\angle OAP$?

Chapter 4: Similarity

- Definition of similarity, congruence, stretch factor

- Congruence/similarity axioms (SSS, SAS, ASA, AA)

- Ratios of lengths between similar triangles

Sample Problem:
(Richard Spence) In the figure below, what is the length of the missing segment?

Chapter 5:   Length-1

- Perimeter of polygons

- Triangle inequality

Sample Problem:
(Jocelyn Zhu) A triangle has perimeter 14. What is the largest possible integer side length of the triangle?

Chapter 6:   Length-2

- Definition of legs, hypotenuse of a right triangle

- Pythagorean theorem

- Special right triangles (30-60-90 and 45-45-90 triangles)

- Pythagorean triples

Sample Problem:
(Hope Chen) What is the perimeter of a right triangle with legs 15 and 20?

Chapter 7:   Length-3

- Circumference of a circle

- Chords, power of a point

Sample Problem:
(Hope Chen) There are two chords BC and DE in a circle that intersect at point A. If $AB = 1$, $AC = 8$, and $AE = 2$, what is the length of chord DE?

Chapter 8:   Area-1

- Definition of area and square units

- Area formulas for squares, rectangles, parallelograms, rhombuses
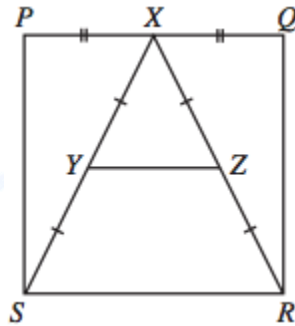
Sample Problem:
(Hope Chen) The area of a rectangle is 27. If the length is three times the length of the width, What is the length of the rectangle?

Chapter 9:   Area-2

- Area of a triangle (base × height/2)

- Area formula for a trapezoid

- Similar triangles and areas

Sample Problem:
(CEMC-2002-Gauss7-24) $PQRS$ is a square with side length 8. X is the midpoint of side PQ, and Y and Z are the midpoints of XS and XR, respectively, as shown. The area of trapezoid $YZRS$ is

(A) 24   **(B)** 16   **(C)** 20   **(D)** 28   **(E)** 32

Chapter 10:   Area-3

- Area of a circle

- Area of more complex shapes

- Review of area formulas

Sample Problem:
(Richard Spence) A circle is inscribed inside a square of side length 8. What is the total area of the region inside the square but outside the circle?

Chapter 11: Analytic Geometry

- Cartesian coordinate system, graphing points

- Definition of the slope of a line

- Slope-intercept form, point-slope form

- Midpoint and distance formulas

Sample Problem:
(Jennifer Zhu) What is the y-coordinate of the y-intercept of the line that passes through $(1, 5)$ and $(3, 9)$?

Chapter 12: 3D

- Applications of 3D geometry in the real world

- Volume and surface area of various 3D shapes (cubes, rectangular prisms, cylinders, pyramids)

Sample Problem:
(CEMC-2006-Gauss7-12) A rectangular pool is 6 m wide, 12 m long and 4 m deep. If the pool is half full of water, what is the volume of water in the pool?

(A) 100 m^3 **(B)** 288 m^3 **(C)** 36 m^3 **(D)** 22 m^3 **(E)** 144 m^3