

If you are comfortable with the below concepts and problems, you are ready for the Art of Problem Solving **Scholars Math 10.1: Olympiad Geometry** class.

You should have most of the following concepts mastered prior to enrollment:

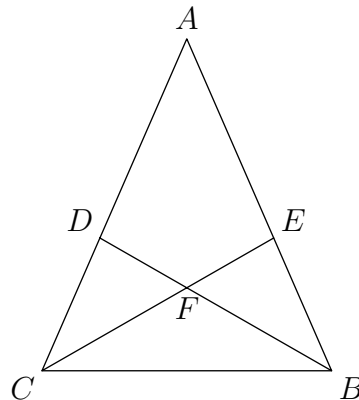
- Basic parts of a triangle (centroid, incircle, incenter, circumcircle, altitudes, etc.)
- You should be familiar with nearly all of the following expressions for the area of a triangle:

$$[ABC] = \frac{ah_a}{2} = rs = \sqrt{s(s-a)(s-b)(s-c)} = \frac{abc}{4R} = \frac{ab \sin C}{2}$$

- Ptolemy's Theorem
- Basic constructions. You should have no problem constructing the following: an equilateral triangle, the tangent to a circle given the circle and a point outside the circle through which the tangent passes, the circumcircle of a triangle.
- The relationships between angles and intercepted arcs.
- Law of Cosines, Extended Law of Sines

If you can solve 5–6 of the problems below without much trouble, you are definitely ready for this course. If you can solve 3–4 of them, you will still learn from the course, but will probably find it extremely challenging. If you cannot solve at least 3 of the problems, you should wait until you have more experience with geometry before taking this course.

1. Points A, B, C, D are on a circle such that $AB = 10$ and $CD = 7$. If AB and CD are extended past B and C , respectively, they meet at P outside the circle. Given that $BP = 8$ and $\angle APD = 60^\circ$, find the area of the circle.
2. In rectangle $ABCD$, $AB = 4$ and $BC = 3$. Find the side length of rhombus $AXYZ$, where X is on AB , Y is on BC , and Z is on BD .
3. In the diagram, $AB = AC = 20$, $AD = AE = 12$, and the area of $ADFE$ is 24. Find the area of BFC .



4. Point M is the midpoint of side BC of triangle ABC . Given that $AB = AC$, $AM = 11$, and that there is a point X on AM such that $AX = 10$ and $\angle BXC = 3\angle BAC$, find the perimeter of ABC .

5. $A'B'C'D'ABCD$ is a cube, where $ABCD$ is a face, and so is $A'B'C'D'$. AA' , BB' , CC' , and DD' are edges of the cube. Let X be the midpoint of BC and Y be on AA' such that $AY = 2A'Y$. Let m be the line where planes $B'XY$ and $A'B'C'D'$ intersect, and Z be the foot of the altitude from A' to m . Find $\tan \angle A'ZY$.
6. Given point A and parallel lines m and n , construct point B on m and C on n such that ABC is equilateral.

Don't look at the next page until you've attempted all the problems!

The answers are below. (The answers to problem sets and challenges given in the class will include full detailed solutions as opposed to the mere answers provided below.)

1. 73π
2. $\frac{64 - 16\sqrt{7}}{9}$
3. $40/3$
4. $11 + 11\sqrt{5}$
5. $\sqrt{37}/3$
6. Rotate line m 60° about A , and let this new line be m' . Point C is the intersection of m' and n . Point B is the point on m that corresponds to C on m' (i.e. rotate C 60° the other way about A to get B .)