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## Midterm Exam 1

**Name:**

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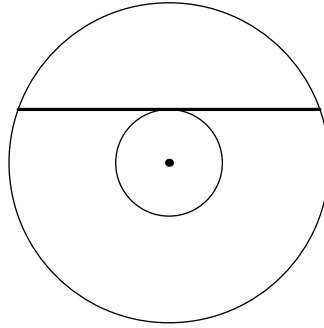
- Read the problems carefully and budget your time wisely.
- No calculators or other electronic devices, please. **Turn off your phone.**
- Please present your solutions in a clear manner. **Justify your steps.** A numerical answer without explanation cannot get credit. Cross out the writing that you do not wish to be graded on.

Problem	Points
1	/17
2	/17
3	/17
4	/17
5	/16
6	/16
<b>Total</b>	/100

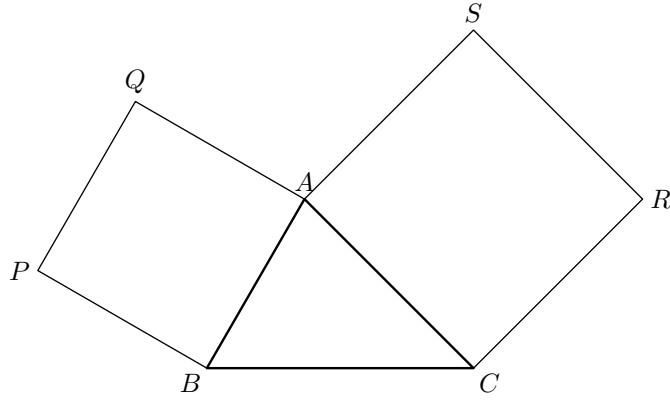
1. In quadrilateral  $ABCD$ , suppose that  $\angle A = \angle C$  and  $\angle B = \angle D$ . (We are referring to the interior angles, of course.) Show that  $ABCD$  is a parallelogram.

2. Let  $\triangle XYZ$  be any triangle with median equal to the half of opposite side. Show that  $\triangle XYZ$  is a right triangle.

3. A chord  $AB$  of a circle with center  $O$  is tangent to a smaller circle with center  $O$ . Assuming that  $AB = 12$ , determine the area of the annular region between two circles.

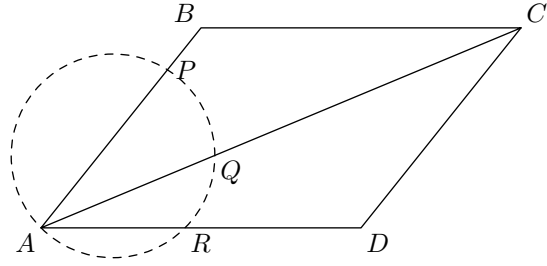


4. Given  $\triangle ABC$ , we construct squares  $ABPQ$  and  $ACRS$  outward from  $\triangle ABC$  as shown. Prove that  $CQ = BS$ . [**Hint:** There are different cases based on the measure of  $\angle A$ .]



5. A square is inscribed in the triangle  $\triangle ABC$  such that two vertices lie on side  $AC$  and 2 others lie on  $AB$  and  $BC$ . Find side of the square, if  $AC = a$  and the altitude from  $B$  is  $h$ .

6. Given parallelogram  $ABCD$ , suppose a circle through vertex  $A$  intersects side  $AB$  at  $P$ , diagonal  $AC$  at  $Q$ , and side  $AD$  at  $R$  as show in the figure below.



Show that  $\triangle PQR \sim \triangle CBA$ .