

## Review for Exam 2

Geometry, MTH 329 Spring 2026

Instructor: Abhijit Champanerkar

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- Exam 2 will be held on **Monday March 30th** and will be 100 minutes long.
  - **Syllabus:** Sections 5.1, 5.3, 7.1, 7.3, 7.4, 7.6, 8.2, 9.2, 10.2, 10.3.
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**Straight edge and compass constructions:** (1) Squaring a given triangle or rectangle, (2) Subdividing a given line segment in  $n$  equal parts, (3) Constructing a circle through 3 given points (i.e. circumcircle given a triangle), (4) Constructing an incircle given a triangle, (5) subdividing a given line segment into equal parts, (6) Construct a tangent line from a given point to a given circle.

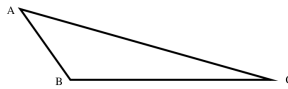
- Given line segment  $AB$ , construct an equilateral triangle with perimeter equal to  $|AB|$ .

$A$  \_\_\_\_\_  $B$

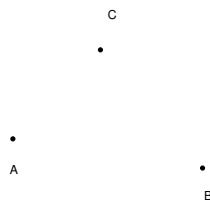
- Given line segment  $AB$ , construct a right angled triangle with hypotenuse equal to  $|AB|$ .

$A$  \_\_\_\_\_  $B$

- Construct a rectangle with the same area as the triangle below.



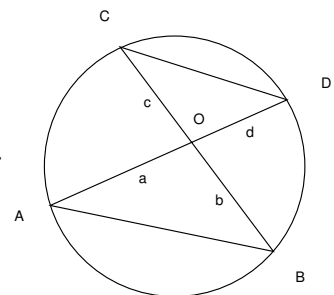
- Find the point equidistant from the given points  $A$ ,  $B$  and  $C$ .



## Proofs

1. State and prove the Pythagorean theorem. You can use any proof you like with proper justification.
2. Taxicab Geometry
  - (a) Draw different shortest paths between 2 given points.
  - (b) Computing side lengths of triangles.
  - (c) Draw a circle of given radius with given center e.g. of radius 2 with center  $(1, 2)$ .
  - (d) Find counterexamples to SSS and ASA.
3.
  - (a) State Euclid's 5th postulate and Playfair's Axiom.
  - (b) Prove that Euclid's 5th postulate implies that alternated angles for line falling on parallel lines are equal.
  - (c) Prove that Playfair's Axiom implies Euclid's 5th postulate.
4. Prove that the sum of interior angles of a triangle is  $\pi$ .
5.
  - (a) Prove that a quadrilateral whose opposite sides are equal and parallel is a parallelogram.
  - (b) Prove that in a parallelogram the opposite sides and angles are equal.
  - (c) Prove that parallelograms which have same base and are in same parallel lines are equal.
6. Prove Thales theorem (VI.2): If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.

7. Prove the Intersecting Chord Theorem i.e. prove that  $ad = bc$ .



8. (a) (Star Trek Theorem) III.20 - Central angles is double the inscribed angle.
- (b) III.22 If a quadrilateral has all its four vertices on a circle, prove that any pair of opposite angles sum to  $\pi$ .
- (c) Prove that if  $A$ ,  $B$ , and  $C$  are distinct points on a circle where the line  $AC$  is a diameter, then the angle  $\angle ABC$  is a right angle.
9. Chapter 10: III.3, III.18,
10. (a) A quadrilateral is called *orthodiagonal* if its diagonals intersect at right angles. Prove that the area of an orthodiagonal quadrilateral is half the product of the lengths of its diagonals.
- (b) Give a counterexample of show that this is false for general quadrilaterals (Hint: Use rectangles).