

Sample questions for Midterm

Geometry for Teachers, MTH 623, Fall 2019
Instructor: Abhijit Champanerkar



Postulates and Common Notions

1. State Euclid's five postulate and five common notions.
2. Explain what is neutral geometry.

Constructions with proofs.

(Numbers refer to the book)

1. (2.3.1) To construct an equilateral triangle on a given finite straight line.
2. (2.3.9) To bisect a given rectilinear angle.
3. (2.3.10, 2.3.11) To draw the perpendicular bisector to a given finite straight line. on it.
4. (2.3.12) To draw a straight line perpendicular to a given infinite straight line from a given point not on it.
5. (3.1.4) To draw a straight line through a given point parallel to a given straight line.
6. (3.4.4) To construct a square equal to a given rectangle.
7. (4.2.7, 4.2.8) About a given triangle to circumscribe a circle.
8. (4.2.9, 4.2.10) In a given triangle to inscribe a circle.
9. (4.3.1) In a given circle to inscribe a regular hexagon.
10. (Pg 154 # 1) Prove that the regular octagon is constructible.

Prove the following statements

1. (2.3.4 SAS) If two triangles have two sides equal to two sides respectively, and have the angles contained by the equal straight lines equal, then they also have the base equal to the base, the triangle equals the triangle, and the remaining angles equal the remaining angles respectively, namely those opposite the equal sides.
2. (2.3.8 SSS) If two triangles have the two sides equal to two sides respectively, and also have the base equal to the base, then they also have the angles equal which are contained by the equal straight lines.
3. (2.3.14, Perpendicular bisector) The locus of all the points that are equidistant from two distinct points is the perpendicular bisector to the line segment determined by these points.
4. (2.3.24) Of all the line segments joining a point to a straight line, the shortest is the one that is perpendicular to the given line segment.
5. (2.3.25) In any triangle the sum of any two sides is greater than the remaining one.

6. (2.3.34, Angle bisector) The locus of all the points that are equidistant from two intersecting lines are the two straight lines that bisect the four angles formed by them.
7. (2.3.35) If a straight line falling on two straight lines makes the alternate angles equal to one another, then the straight lines are parallel to one another.
8. (3.1.1) A straight line falling on parallel straight lines makes the alternate angles equal to one another, the exterior angle equal to the interior and opposite angle, and the sum of the interior angles on the same side equal to two right angles.
9. (3.1.5, Playfair Postulate) Prove that Playfair's postulate is equivalent to the Parallel Postulate in the context of neutral geometry
10. (3.1.6) In any triangle the three interior angles of the triangle are equal to two right angles.
11. (3.2.6) Triangles which are on the same base and in the same parallels equal one another.
12. (4.1.1) In equal circles, the following are equivalent: equal arcs, equal central angles, equal chords.
13. (4.2.1) In a circle, the angle at the center is double of the angle at the circumference, when the angles have the same arc as base.
14. (4.2.6) The opposite angles of a cyclic quadrilateral are equal to two right angles.
15. State and prove the Pythagoras theorem (with any proof you like).