Analytic Geometry: Unit Overview

MPM2D, Grade 10 Principles of Mathematics (Academic), Unit 2. 10 classes of 75 minutes, plus one class for the unit test (about two weeks).

The big question

How can coordinates prove what a shape looks like it is?

Students develop the midpoint and length formulas, then use the length formula to develop the equation of a circle centred at the origin, $x^2 + y^2 = r^2$. They find radii, sketch circles and test whether points lie inside, on or outside them. Combining these with Unit 1 skills, they write equations of right bisectors and medians, and find the shortest distance from a point to a line. They investigate properties of triangles and quadrilaterals by folding and in GeoGebra, classify figures using lengths and slopes, and plan and carry out multi-step verifications such as midsegment and diagonal properties. A design lesson applies every tool to a park plan. The summative, Town Planner, places a library equidistant from three neighbourhoods, checks cell coverage, plans a driveway and verifies a park is a rectangle.

Lessons

#	Lesson	Classes	Question	Expectations	What's inside
1	**Midpoints**	1	Where is halfway?	AG2.1	The midpoint formula; missing endpoints; triangle midpoints
2	**Length of a Line Segment**	1	How far apart?	AG2.2	From Pythagoras to the length formula; maps and drones
3	**Circles Centred at the Origin**	1	What makes a circle?	AG2.3, AG2.4	$x^2 + y^2 = r^2$; sketching; coverage zones
4	**Right Bisectors and Medians**	1	What's special about these lines?	AG2.5, AG3.1	Equations; equidistant points; centroid
5	**Shortest Distance to a Line**	1	What's the shortest path?	AG2.5	Perpendicular, system, length; cabin to road
6	**Investigating Properties of Figures**	1	What patterns hold every time?	AG3.1	Folding and GeoGebra; midsegments; conjectures
7	**Classifying Triangles and Quadrilaterals**	1	What shape is it really?	AG3.2	Lengths and slopes as evidence
8	**Verifying Properties: Multi-Step Proofs**	1	How do we prove it?	AG3.3	Plan, calculate, conclude

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9	**Analytic Geometry in Design**	1	Which tool fits?	AG2.1–AG2.5	A park plan; equidistant first-aid station
10	**Analytic Geometry Review**	1	How do the tools connect?	AG2.1–AG3.3	Mixed review and a proof workshop

Assessment

Type	In this unit
Assessment for learning	Find the Midpoint, How Long?, Circle Equations, Right Bisectors, Three Steps, Midsegments, Classify the Triangle, Plan and Verify, Riverside Park, Mixed Review, quick checks and exit tickets
Assessment as learning	Self-checks, More Conjectures, Prove It, The Right Tool, Proof Workshop
Assessment of learning	Summative task (Town Planner) with a rubric, and a unit test with full solutions

Materials

Included:

- **Original problems and diagrams:** every problem, map and diagram was written for this unit
- **Investigations:** paper folding and GeoGebra activities with no special equipment
- **Start Here:** unit overview, summative task and rubric, unit test, and teacher solutions for both

Free tools only: graph paper, rulers, compasses, calculators and GeoGebra or Desmos (free).

What's in each lesson

- Teacher lesson plan with expectations, timed sequence, differentiation, look-fors and answer guides
- Slides with speaker notes
- Student handouts and organizers
- Editable Word and PowerPoint files, plus PDFs

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