Linear and Non-Linear Relations: Unit Overview

MTH1W, Grade 9 Mathematics (De-streamed), Unit 4. 13 classes of 75 minutes, plus one class for the unit test (about three weeks).

The big question

How do tables, graphs and equations show the way one quantity changes with another, and how can we use them to predict?

Students compare growing and shrinking patterns, classify relations as linear or non-linear using first differences, graphs and equations, and represent linear relations four ways. They interpret rate of change and initial value, write equations from graphs, tables and models, graph special lines ($x = k$, $y = k$, $x + y = k$, $x - y = k$), lines in the form $ax + by = k$ and the curve $xy = k$, and shade regions for inequalities. They translate, reflect and rotate lines, find and interpret points of intersection, and use Python to build tables, test first differences and find meeting points. The summative asks students to plan a school dance: choose a DJ, compare linear and non-linear promotion plans, and model a snack budget with an inequality.

Lessons

#	Lesson	Classes	Question	Expectations	What's inside
1	**Growing and Shrinking Patterns**	1	Adding or multiplying?	C3.1	Savings, candles, doubling, bouncing ball
2	**Linear or Non-Linear?**	1	How can we tell?	C4.1, C3.1	First differences, graphs, equations
3	**Four Ways to Show a Relation**	1	How many ways can we see one relation?	C3.2	Toothpicks, tables, graphs, equations
4	**Rate of Change and Initial Value**	1	What do a and b mean?	C3.2	Taxis, candles, plants, proportional
5	**Equations from Graphs**	1	How do we read a line's equation?	C4.4	Rise over run, y-intercept, two points
6	**Equations from Tables and Models**	1	How do we find the hidden equation?	C4.4, C3.2	Unequal steps, working back, problems
7	**Special Lines**	1	Which lines can we graph instantly?	C4.2	$x = k$, $y = k$, $x + y = k$, $x - y = k$
8	**$ax + by = k$ and $xy = k$**	1	Line or curve?	C4.2, C4.1	Intercepts; fixed products
9	**Inequalities and Regions**	1	What's possible within a limit?	C4.2	Boundaries, test points, a snack budget

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#	Lesson	Classes	Question	Expectations	What's inside
10	**Transforming Lines**	1	How does moving a line change its equation?	C4.3	Translate, reflect, rotate y = ax
11	**Where Two Lines Meet**	1	When are two options equal?	C3.3	Rentals, phone plans, races, candles
12	**Coding Relations**	1	Can code test and compare relations?	C2.1–C2.3, C4.1	Python differences and meeting points
13	**Relations Review**	1	How does it all connect?	C3.1–C4.4	Relation sort; unit review

Assessment

Type	In this unit
Assessment for learning	Four Patterns, First Differences, Four Views, Find a and b, Read the Lines, Tables to Equations, Graph the Lines, Intercepts, Test and Shade, Transform It, Graph and Solve, Code A and B, quick checks and exit tickets
Assessment as learning	Self-checks, relation sort, unit review
Assessment of learning	Summative task (Which Is the Better Deal?) with a rubric, and a unit test with full solutions

Materials

Included:

- **Original problems and graphs:** every problem, data set, graph and grid was written or drawn for this unit
- **Code:** two short Python programs (any free Python editor, or trace on paper)
- **Start Here:** unit overview, summative task and rubric, unit test, and teacher solutions for both

Free tools only: graph paper or Desmos (sliders, inequalities and tables), and any board-approved Python editor. All companies, plans and prices are fictional.

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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