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The following lessons were created by **Jonathan Halabi**, a teacher participating in the National Endowment for the Humanities Summer Institute for Teachers entitled Touch the Past: Archaeology of the Upper Mississippi River Region.

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### Three Dimensional Coordinates

Grade Level	9
Subjects	Algebra
Duration	1 enrichment lesson
Unit	Graphing on the Cartesian Plane
Vocabulary	Origin, x-axis, y-axis, north, south, east, west, up, down, below
Background 1	Students have studied archaeology in conjunction with 1) the development of man (in Global History), 2) river societies (in Global History) and 3) the first peoples of the Americas (in United States History), all earlier in the term
Background 2	Students have completed all the required components of the unit. They can graph lines on the coordinate plane. They can locate coordinates. They know the associated vocabulary (see above)
Setting the Stage	Distribute photo of two adjacent pits with visible artifacts/features at different depths. How are we going to record the position of each feature so that we know where they are 1) relative to each other and 2) relative to the other artifacts and features at the site?
Directed Discussion	Elicit from class that we need some sort of coordinate system. Challenge the class to use an x-y system (they will fail). Allow students to propose a third axis - if they are unable to do so, the teacher will propose it.

Development	Explain that in archaeology, one point is identified called the datum (vocabulary digression, include other plurals from Latin formed without -s). The ground is gridded (elicit from students the analogy to the cartesian plane), and each grid is labeled with the coordinates of its southwest corner. (Project or draw coordinate grid, practice with 3 examples). The locations are also identified by their distance below the ground. This gives us a third dimension. In a 3-dimensional coordinate system, the analogy would be a new, z-axis.
Activity 1	Teacher places an object in the front of the class, at a height of about 4 feet. This works best in a classroom with 1 foot square tiles. This is our datum. Teacher elicits cardinal directions from students, then calls out several "squares" based on their position in relation to the datum (e.g., 3 feet west, 6 feet south, 1 foot below the datum) and calls on students to identify what is at that location (call coordinates for student's heads, or doorknobs, book bags, an object outside the window, etc.)
Activity 2	Group students. They have an "archaeology fieldwork" problem: to assign the proper coordinates to an object in another part of the school, or near the school (examples: the back right leg of the principal's desk, the trophy case, the bus stop, the top of the flag pole, the door to a basement lavatory in the building across the street, etc) Share answers on the board, and let groups check each other.
Closure	Discuss the question: "In what situations might a 3-dimensional coordinate system be necessary?"
Evaluation	Include a two part "bonus question" on the unit test, asking students to explain why having a 3 dimensional coordinate system can be important, and then asking them to identify what information would be missing if they were asked to supply 3 dimensional coordinates for the lock on their locker (no datum or no origin or no reference point)