



Drexel-SDP GK-12 ACTIVITY

LEGO Topo

Subject Area(s): measurement, earth & space

Associated Unit:

Activity Title: LEGO Topo

Grade Level: 6 (4-8)

Time Required: 45 minutes

Group Size: 3

Expendable Cost per Group:

\$0 to \$1 (if LEGO's can not be borrowed a large box can be purchased for approx. \$30)

Summary:

In this activity, students will learn how to create both a topographic map and a profile from a 3D LEGO model. LEGO bricks are less abstract and more uniform than foam models. As a result students can visualize and make the connection between 2D and 3D with relative ease. This lesson can be used in conjunction with the Full Option Science System (FOSS) Landform Unit as a preliminary step or alone.

Engineering Connection:

Understanding how to interpret topographic maps is essential to the planning, design and building of all major infrastructure projects. Engineers also use plans, profiles and cross sections to communicate their designs to the builder or construction manager.

Engineering Category

(1) relates science concept to engineering,

Keywords

LEGO, topography, plan, profile, cross section, top view, model

Pre-requisite knowledge

Students should be familiar with the concept of scale and graphing.

Educational Standards (PA Science)

3.2.7.B Use evidence, such as observations or experimental results, to support inferences about a relationship*

3.1.7.D Use space/time relationships, define concepts operationally, raise testable questions, or formulate hypotheses

Learning Objectives

After this activity, students should be able to:

1. Explain what contour lines represent on a topographic map and how their spacing is determined.
2. Identify a steep and a flat slope on a topographic map.
3. Develop a profile from a topographic map.

Materials List

Paper

LEGO Large Brick Box or Bucket (405 pieces) or MEGA Bloks

Introduction / Motivation

“A map is a way of representing on a two-dimensional surface, (a paper, a computer monitor, etc.) any real-world location or object. Many maps only deal with the two-dimensional location of an object without taking into account its elevation. Topographic maps on the other hand do deal with the third dimension by using contour lines to show elevation change on the surface of the earth, (or below the surface of the ocean). The concept of a topographic map is, on the surface, fairly simple. Contour lines placed on the map represent lines of equal elevation above (or below) a reference datum. To visualize what a contour line represents, picture a mountain (or any other topographic feature) and imagine slicing through it with a perfectly flat, horizontal piece of glass. The intersection of the mountain with the glass is a line of constant elevation on the surface of the mountain and could be put on a map as a contour line for the elevation of the slice above a reference datum.” (Riesterer 2010)

When might you use a map like this? What if you had to design a road from school to your house or across town? What if you were taking a hiking trip through the wilderness? Why do you think it would be helpful to know the elevation of a certain area in relation to another area?

Today we’re going to make a topographic map of a model pyramid. Then, we’ll take a slice through it and create a cross section which can be used to make a profile. Let’s go over a few vocabulary words first...

Vocabulary / Definitions

Word	Definition
Topography	the detailed mapping or charting of the surface features of a relatively small area, district, or locality
Datum	any level surface, line, or point used as a reference in measuring elevations
Contour Line	a line joining points of equal elevation on a surface
Elevation	the height to which something is elevated or to which it rises; the distance above a datum level
Plan view	a drawing made to scale to represent the top view or a horizontal section of a structure or a machine, as a floor layout of a building
Cross section	A section formed by a plane cutting through an object, usually at right angles to an axis
Profile	an outline of an object, as a molding, formed on a vertical plane passed through the object at right angles to one of its principal horizontal dimensions

Procedure

With the class

1. Break up into groups of 3.
2. Distribute different color LEGO bricks to each group.
3. Use the attached worksheet to guide construction of a pyramid and then a profile of the pyramid.
4. Allow students to build their own irregularly shaped model and a topographic map of the model as well as a profile.

Investigating Questions

1. What do the contour lines in your models represent?
2. Is the slope the same on all sides? How do you know from looking at the map you created?
3. In your own model, which side is steeper? How can you tell on the map of the model?

Assessment

Post-Activity Assessment

Have students document their responses to the investigating questions. Discuss as a class during the wrap up.

Activity Extensions

Full Option Science System (FOSS) Landform Unit

References

Jim Riesterer, Edited by Scott Hughes, Dan Narsavage & Diana Boyack, "What is a Topographic map?" Available at:http://geology.isu.edu/geostac/Field_Exercise/topomaps/topo_map.htm

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LEGO Topo Worksheet

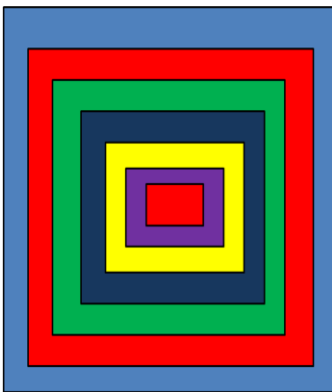


1. Build a LEGO pyramid like the one in the picture. It does not have to be mounted on a flat base like the green and yellow one in the picture.

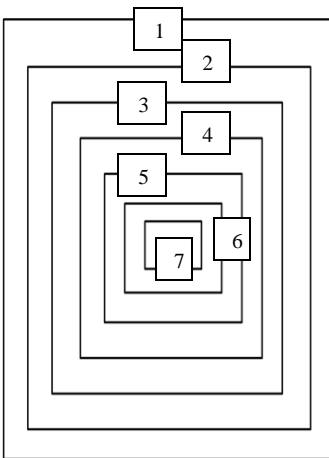
The pyramid is a 3 dimensional model with length, width, and height (elevation).



2. Take a few moments to view your pyramid from the top and side. Your topographic map will be a plan view (top view) created on a 2 dimensional piece of paper.) Your profile will be a side view or cross section through the middle of the model.



3. On your paper, trace each layer of the pyramid, one at a time by taking it apart. Try your best to keep it to scale by maintaining the same distance between layers as in the original model. In the example, this space is the equivalent of one raised LEGO circle. Identify the colors. Each color represents a different elevation.



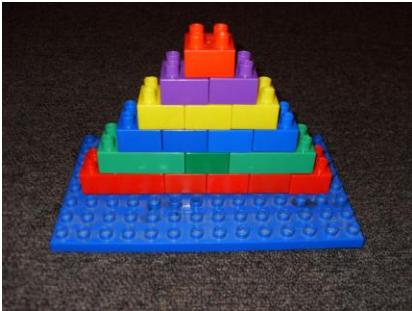
4. Looking only at lines, label the elevation of each layer of the pyramid starting with 1.

This is a complete contour map of your 3D pyramid.

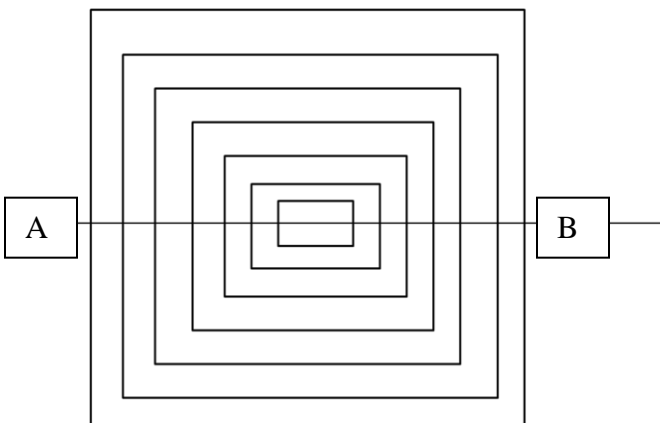


5. Rebuild your 3-D pyramid and look at it from the side. Build another 3-D model of a slice taken out of the middle of your pyramid (see the picture.)

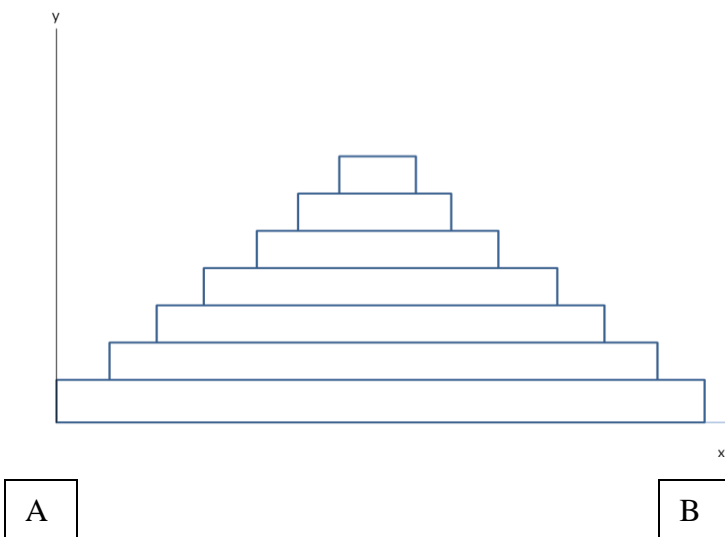
Compare the slice with the entire model. Notice how the elevation is the same as are the number of LEGO raised circles between each step up the model. This space is the distance between your contour lines on the topographic model above. How would the slope change if there were more circles between these lines?



Note: You could trace the outline of your slice to create a profile on a 2D piece of paper, but we're going to do it another way.



6. Because of the similarities noted above you can use your topographic map to create a profile (another way of showing elevation on a 2D drawing). Start by drawing a line through the middle of the topographic map. Label one side A and the other side B. Then, fold the paper in half along this line so that you can see the lines and labels on each half of the paper.



7. Set up an x and y axis on graph paper. Line up the folded topographic map with the x axis. Label A and B on the axis to match the points labeled A and B on the folded map. On the y axis label the lines consecutively starting at 1 and going as high as the greatest elevation in your model (1-7 for the example). Make tick marks on the line labeled 1 to indicate where the topographic map contour line 1 crosses the line. Move up to the line labeled 2 and do the same for the contour lines labeled 2. Continue until all elevations have tick marks. Draw lines to connect the tick marks. Your plot should resemble the example. This is a profile of your model.

8. Try some other configurations with models that are not perfectly symmetrical. Practice making topographic maps and profiles of these models.

