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Architectural Design – Roofs and Ramps

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Slope of a Line
Architectural Design – Roofs and Ramps
TI Technology
Maria Huot

Objectives:

- To have students design and calculate ramps and roofs controlling slope, as a major constraint in the design process.
- To impose a grid on a line to quantify the steepness of a line
- To introduce slope as the ratio of the vertical change divided by the horizontal change.
- To illustrate the slope characteristic of lines a positive, zero, negative, or undefined (no slope)
- To associate the terms with the appropriate graph of a line: increasing, horizontal, decreasing, or vertical.
- To observe that the slope of a straight line is constant
- To apply these mathematical concepts in the solution of roof and ramp design following architectural and anthropometric limitations.

NY Standards or Key ideas

Standard 3: Mathematics

Students will understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in **real-world settings**, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

- Key idea 1: Mathematical Reasoning
- Key idea 3: Operations
- Key idea 4: Modeling/ Multiple Representations
- Key idea 5: Measurement
- Key idea 7: Patterns and function

5 E's Lesson Plan

This lesson plan follows a model for lesson plans called 5 E's (Engagement, Exploration, Explanation, Elaboration and Evaluation). This is a constructivist model where students have to build their own knowledge and the teacher's function consists in assisting his/her students to succeed through the process. The lesson is planned for a 2 blocks session.

1. Engagement (Making connections with prior-knowledge)

- Discuss with your students their understanding of the word slope. Have them develop the sectional drawing (students are using a CAD system to design their own house) to make analyze and modify the slope of roofs and ramps when required. The study of slopes will help them to make the necessary modifications.

Samples:

- Ski slope
- The slope of a roof
- Ask them why it might be important to assign a specific number to a slope.

2. Exploration (Overview): *Encourages the students to work without direct instruction*

- Students will explore the concept of slope through the use of the TI-84:
 - Students will answer the questions provided in a worksheet, making use of the **Overview** from the menu Slope with a Grid which is found in the Section 3: titled Linear Functions, inside the application ALG1PART1.
 - Students will need read each screen carefully and look for new terms, definitions, and concepts



Questions that the student need to answer

- Define the concept of slope
- Which letter do we use to name the slope of a line?
- Define slope as a ration
- Explain the four cases of slope

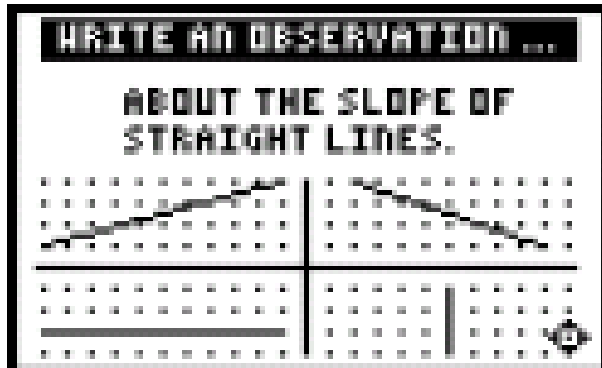
* **These questions are in Worksheet No 2 at the end of the lesson plan**

3. Explanations (Observation): *Encourages students to explain concepts in their own words*

- Using **Observations** from the menu Slope with a Grid which is found in the Section 3: titled Linear Functions, inside the application ALG1PART1. Students will answer the question:

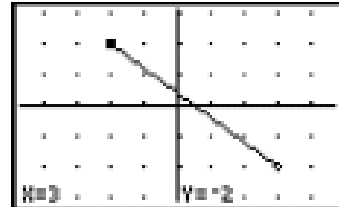
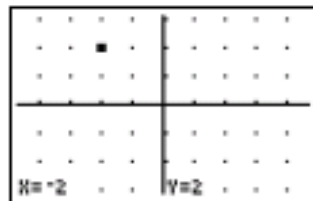
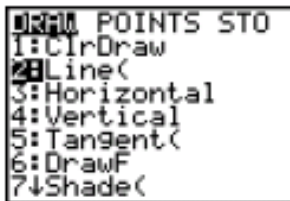
What do you notice about the slope of straight lines?

* **These questions are in Worksheet No 1 at the end of the lesson plan.**



4. Elaboration (Try it! On Your TI-83): *Encourages students to apply or extend concepts and skills*

- Students will draw lines with different slopes, using their graphing calculators and the worksheet provided
- Instructions are given in the students worksheets



5. Evaluation (Activities): *Assesses students' knowledge or skills, and allows students to assess their own learning.*

- Using **Activities** from the menu Slope with a grid which is found in the Section 3: titled Linear Functions, inside the application ALG1PART1.
- Students can select two activities:
 - Screen Cross: students need to find the slope between the given points, and pick the right slope using the arrow keys. (Students can keep their scores while play and practice).
 - Linked Calculators Screen Cross.

Final Project: Students would present CAD drawings of floor plans and sections with structural details showing slope ratios of ramps and roofs.

Activities (continued)



Scoring: You get two attempts to solve each problem. You earn 2 points for a correct answer on the first try, 1 point for a correct answer on the second try.

You can earn up to 10 points.

Assessment of the Lesson

Scoring guide

Category	Score	Description
No Response	0	Work not attempted or the work is incorrect.
Minimal	1-3	Response demonstrates only a minimal understanding of the concept.
Partial	4-6	Response contains evidence of an understanding of the concept.
Satisfactory	7-8	Response demonstrates a clear understanding of the concept.
Excellent	9-10	Response show complete understanding of the concept.

Name _____ **Date** _____

Use the Overview from the menu Slope with a Grid which is found in the Section 3: titled Linear Functions, inside the application ALG1PART1 and answer the following questions.

- Define the concept of slope

- Which letter do we use to name the slope of a line?

- Define slope as a ration

- Explain the four cases of slope



Worksheet No 2

Name _____ Date _____



Linear Functions: Slope with Grid

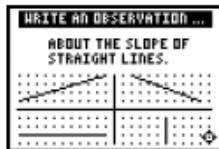
Student Worksheet

Overview

The **Overview** introduces the topics covered in **Observations** and **Activities**. Scroll through the **Overview** using  ( to review, if necessary). Read each screen carefully. Look for new terms, definitions, and concepts.

Observations

The **Observations** illustrate the slope of a straight line. Scroll through the **Observations** using  ( to review, if necessary). Read each screen carefully. When you come to a **Write an Observation** screen, stop and write the answers to the questions on your worksheet.



Observation 1

What do you notice about the slope of straight lines? Write your thoughts.

Write your thoughts

Worksheet No 3

Name _____ Date _____

Activities

The **Activities** help you practice determining the slope of a line using a grid. You can select from two activities—**Screen Cross** or **Linked Calculators Screen Cross**. Follow these steps to play the activity and complete your worksheet.

1. Make sure you are in the **Activities** for this section.
2. Highlight an activity using \uparrow or \downarrow , and press **ENTER**.

Activities (continued)



Scoring: You get two attempts to solve each problem. You earn 2 points for a correct answer on the first try, 1 point for a correct answer on the second try.

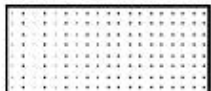
You can earn up to 10 points.

Screen Cross

1. Read the directions on the screen, and then press any key to continue.

Note: Repeat steps 2 and 3 for line segments 2 through 5.

2. Calculate the slope between the two points. Record your work below.
3. Press \uparrow or \downarrow to view the choices for the slope (**UNDEF** = undefined slope). When you think the correct slope is displayed, press **ENTER**.



segment 1: _____

segment 2: _____

segment 3: _____

segment 4: _____

segment 5: _____

4. What was your score? _____