Performance Based Learning and Assessment Task

Finding Slope

I. ASSESSSMENT TASK OVERVIEW & PURPOSE:
This Performance Task is planned to give students an opportunity to practice finding slopes of various surfaces around the school building in order to solve real-world problems. The task is also designed to encourage students to make connections and to communicate their mathematical thinking clearly and accurately.

II. UNIT AUTHOR:
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III. COURSE:
Algebra I

IV. CONTENT STRAND:
Equations and Inequalities

V. OBJECTIVES:
The student will be able to find the slope of various surfaces around the school building.

VI. REFERENCE/RESOURCE MATERIALS:
Students will need access to class notes, a writing utensil, a graphing calculator, ruler and a "Slope" worksheet.

VII. PRIMARY ASSESSMENT STRATEGIES:
The task includes an assessment component that performs two functions: (1) for the student it will be a checklist and provide a self-assessment and (2) for the teacher it will be used as a rubric. Students will be assessed on their understanding of finding slope as it relates to real-life problems. Students will be evaluated on how clearly and accurately they explain their mathematical process and thinking. Students will also be assessed on the connections between their work and their reflection.

VIII. EVALUATION CRITERIA:
A self-assessment and a teacher assessment are attached below. The assessments are worth 34 points each for a total of 68 points. A benchmark is also included at the end of the document in order to demonstrate the level of quality that is expected from each group of students. The benchmark makes up the remaining 32 points for total possible score of 100 points.

IX. INSTRUCTIONAL TIME:
The Performance Task should take no longer than one ninety-minute block.

Finding Slope

Strand
Equations and Inequalities

Mathematical Objective(s)
The mathematical objective for this activity is to give students the opportunity to find slope of various surfaces in a real-world context.

Related SOL

A.6 The student will graph linear equations and linear inequalities in two variables, including
   a) Determining the slope of a line when given an equation of the line, the graph of the line, or two points on the line. Slope will be described as rate of change and will be positive, negative, zero, or undefined; and

NCTM Standards
- Build new mathematical knowledge through problem solving
- Analyze functions of one variable by investigating rates of change
- Approximate and interpret rates of change from graphical and numerical data.
- Apply and adapt a variety of appropriate strategies to solve problems
- Monitor and reflect on the process of mathematical problem solving
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others

Materials/Resources
Students will use class notes in order to validate how to find slope. The students will use a writing utensil to record answers on their "Slope" worksheet. A ruler will also be needed to measure the lengths. The student will use a graphing calculator as a tool for assistance if needed.

Assumption of Prior Knowledge
- Students should understand how to calculate slope of a line. Additionally, students must be able to communicate their mathematical processes in an organized and legible way.
- Students frequently mix up the direction rate of change run/rise versus rise/run. The teacher may need to give some additional prompts to help students recall their basic math skills when finding slope and reading rulers correctly.

Introduction: Setting Up the Mathematical Task

In this activity, you will investigate how to find slope of various surfaces in real-world scenarios. The Slope Activity should take no longer than one ninety-minute block.

For this activity, you will be finding slope of various surfaces around the school building. The teacher will need to be familiar with the school grounds to know how many ramps the school has and where the students can go to measure and complete their data. Each school should have multiple entrances and exits that should be complete with handicap accessible ramps in order to

be ADA compliant. The goal is to use your knowledge of finding slope to answer all of the questions listed on the "Slope" worksheet. Once the worksheet is completed, you will be expected to participate in a classroom reflective discussion about what you learned and also be expected to complete a self-assessment.

A recommendation for the teacher is to begin class with a bell ringer in which you review how to find slope and the different types of slope. This will create student awareness of what prior knowledge is expected to successfully complete the task at hand.

First, the teacher will take the class, as a whole, to various parts of the school to measure and collect their data. Next, the teacher will place students in pairs in order to produce workable, productive groups. The groups will then obtain the "Slope" worksheet and have thirty minutes to complete it with their partner. The teacher will be walking around to answer any and all questions. After the worksheet is completed, ten minutes of class will be spent in a reflective discussion. The students will be asked what challenges they faced, what problem-solving skills they used and developed, and what they enjoyed most about the task. Another question teachers could propose to their students is, "What other real-world scenarios can you think of that may require finding slope?" Within the discussion, students are expected to actively and respectfully participate. Students will also be expected to complete a self-assessment in the last ten minutes of class.

Student Exploration

Student/Teacher Actions:
Students will be collaborating in pairs as determined by the teacher. The teacher will explicitly state the expectations for the day upfront and provide constructive feedback along the way. The teacher will also act as a mentor and coach as students begin answering the more difficult questions about Slope and graphing Linear Equations. Teachers will encourage students to draw on the group's knowledge first, prior to seeking out prompting from the teacher, class notes, and/or the Internet.

The teacher will also be available to facilitate the classroom reflective discussion. Students will communicate their mathematical knowledge by using appropriate vocabulary when presenting and making connections using the "Slope" worksheet.

Monitoring Student Responses

- Students are to communicate their thinking and their new knowledge by actively participating in the group discussion. Each classmate is expected to provide feedback at least once.
- Students are to communicate with each other actively, respectfully, and supportively.
- Students are encouraged to ask effective questions that do not require a yes or no answer.
- Teachers are to highlight and clarify frequently asked questions to the class as they emerge and provide problem-solving strategies to groups in order to resolve difficult situations.
- Teachers should encourage all students to be engaged within their group and therefore, discourage students from moving forward without their group members. If an entire group is ready to move on, encourage the group to begin brainstorming other ways to use operations on polynomials in the real world.

Again, in order to summarize the Slope Activity the teacher should plan to recap on the strengths and feedback from the classroom discussion. The teacher should also focus on how groups overcame difficult tasks and which problem-solving techniques to carry forward in the classroom setting. Lastly, the teacher should reflect on the content knowledge that was reviewed and applied.

Assessment List and Benchmarks

Students will complete the "Slope" worksheet with their group within one ninety-minute block. The teacher will then facilitate a discussion of the challenges, problem-solving strategies, and mathematical content knowledge gained from the "Slope" Activity. Unlike that of the group worksheet, students will individually complete a self-assessment at the end of the activity.

Polynomials Performance Task **Name:_____**
A.6a Finding Slope (32 points) **Date:_____Block:___**

1) Collect Data(Teacher will take students to various locations around the school) (2 points)

Location	Vertical Change(Rise)	Horizontal Change (Run)
A.		
B.		
C.		
D.		

2) Calculate the slope for Location A. Explain how you calculated your slope. (2 points)

3) Read the following and discuss if the Slope for Location A meets the ADA guidelines for ramps. (3 points)

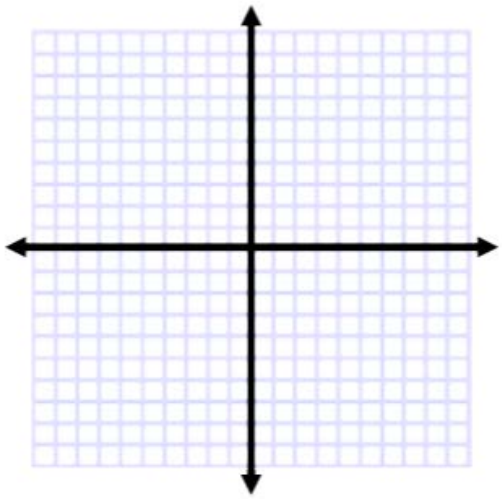
ADA Ramp Codes
RAMP CODES 4.8*

Stepless, by Guldman. Retrived September 28, 2014. http://www.guldmann.net/Files/Billeder/GuldmannProdukter/Stepless/Transportable%20ramper/Shared%20files/US/ADA%20Ramp%20Codes_US.pdf

4.8.1 General
Any part of an accessible route with a slope greater than 1:20 shall be considered a ramp and shall comply with 4.8.

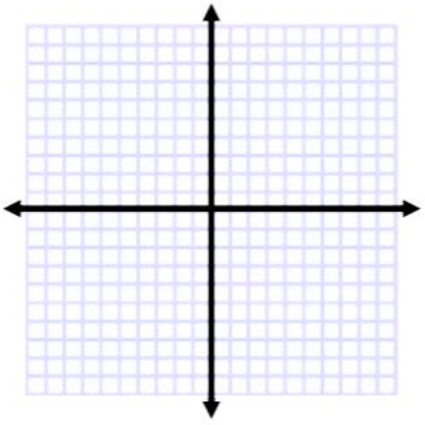
4.8.2 Slope and Rise
The least possible slope shall be used for any ramp. The maximum slope of a ramp in new construction shall be 1:12. The maximum rise for any ramp run shall be 30 inches. Curb ramps and ramps to be constructed on existing sites or in existing buildings or facilities may have slopes and rises, if space limitations prohibit the use of a 1:12 slope or less.

4) Plot two points on a graph that would represent the same slope as location A. (2 points)



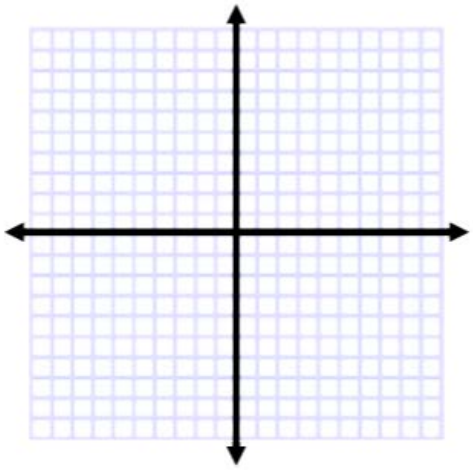
5) Calculate the slope for Location B. Explain how you calculated your slope. (2 points)

6) Plot two points on a graph that would represent the same slope as location B. (2 points)



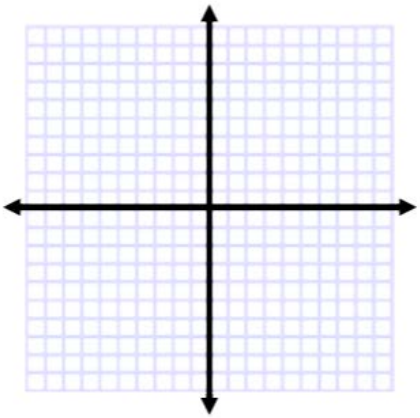
7) Calculate the slope for Location C. Explain how you calculated your slope. (2 points)

8) Plot two points on a graph that would represent the same slope as location C. (2 points)



9) Calculate the slope for Location D. Explain how you calculated your slope. (2 points)

10) Plot two points on the graph that would represent the same slope as location D. (2 points)



11) Write a paragraph explaining why you think the ADA has explicit regulations on slopes of ramps. (6 points)

12) Research and create two other real world examples that use slope. (5 points)

Performance Assessment Task
A.6a Finding Slope
Self-Assessment/Teacher Assessment

Name: _____
Date: _____Block: _____

			Earned Assessment	
Num	**Element**	**Point Value**	**Self**	**Teacher**
1	The data was collected	2		
2	The slope for location A was provided	2		
3	An explanation was given for the slope of location A.	2		
4	A discussion was provided on whether the slope of Location A met ADA guidelines.	2		
5	The slope for location B was provided	2		
6	An explanation was given for the slope of location B.	2		
7	Two points were plotted on the graph that would represent the same slope as location B.	2		
8	The slope for location C was provided	2		
9	An explanation was given for the slope of location C.	2		
10	Two points were plotted on the graph that would represent the same slope as location C.	2		
11	The slope for location D was provided	2		
12	An explanation was given for the slope of location D	2		
13	Two points were plotted on the graph that would represent the same slope as location D.	2		
14	The "Slope" worksheet is completed on time.	2		
15	The student actively and respectfully participated in the reflective discussion.	2		
16	All written work is legible.	2		
17	The mathematical responses are well organized.	2		
	Total	34		

Performance Assessment Task
A.6a Finding Slope
Category Descriptions

Name: _____
Date: _____Block: _____

#	Element	0	1	2
1	The data was collected	The data was not collected	The data was somewhat collected	The data was collected
2	The slope for location A was provided	The slope for location A was not provided	The slope for location A was somewhat provided	The slope for location A was provided
3	An explanation was given for the slope of location A.	An explanation for the slope of location A was not provided	An explanation for the slope of location A was somewhat provided	An explanation for the slope of location A was provided
4	A discussion was provided on whether the slope of Location A met ADA guidelines.	The ramp versus the ADA guidelines were not discussed	The ramp versus the ADA guidelines were somewhat discussed	The ramp versus the ADA guidelines were discussed
5	The slope for location B was provided	The slope for location B was not provided	The slope for location B was somewhat provided	The slope for location B was provided
6	An explanation was given for the slope of location B.	An explanation for the slope of location A was not provided	An explanation for the slope of location A was somewhat provided	An explanation for the slope of location A was provided
7	Two points were plotted on the graph that would represent the same slope as location B.	Two points that represent the same slope as location B were not plotted	Two points that represent the same slope as location B were somewhat plotted	Two points that represent the same slope as location B were plotted
8	The slope for location C was provided	The slope for location C was not provided	The slope for location C was somewhat provided	The slope for location C was provided
9	An explanation was given for the slope of location C.	An explanation for the slope of location A was not provided	An explanation for the slope of location A was somewhat provided	An explanation for the slope of location A was provided
10	Two points were plotted on the graph that would represent the same slope as location C.	Two points that represent the same slope as location C were not plotted	Two points that represent the same slope as location C were somewhat plotted	Two points that represent the same slope as location C were plotted
11	The slope for location D was provided	The slope for location D was not provided	The slope for location D was somewhat provided	The slope for location D was provided
12	An explanation was given for the slope of location D	An explanation for the slope of location A was not provided	An explanation for the slope of location A was somewhat provided	An explanation for the slope of location A was provided

13	Two points were plotted on the graph that would represent the same slope as location D.	Two points that represent the same slope as location D were not plotted	Two points that represent the same slope as location D were somewhat plotted	Two points that represent the same slope as location D were plotted
14	The "Slope" worksheet is completed on time.	No worksheet	Worksheet is incomplete or not provided on time	Worksheet completed on time
15	The student actively and respectfully participated in the reflective discussion.	Does not actively or respectfully participate	Does not fully participate	Actively and respectfully participates
16	All written work is legible.	Written work illegible	Written work partially legible	Written work legible
17	The mathematical responses are well organized.	No evidence of organization	Not fully organized	Well organized

Polynomials Performance Task
A.6a Finding Slope

Name: Example
Date:_____ **Block:**__

1) Collect Data(Teacher will take students to various locations around the school)

Location	Vertical Change(Rise)	Horizontal Change (Run)
A. Guidance office entrance ramp	5"	116"
B. Library entrance ramp	14"	196"
C. Front office entrance ramp	5"	60"
D. Classroom Tile	0"	12"

2) Calculate the slope for Location A. Explain how you calculated your slope.

$\frac{5}{116}$ To find slope, we divided the vertical change (rise) by the horizontal change (run)

3) Read the following and discuss if the Slope for Location A meets the ADA guidelines for ramps.

ADA Ramp Codes
RAMP CODES 4.8*

Stepless, by Guldman. Retrived September 28, 2014. http://www.guldmann.net/Files/Billeder/GuldmannProdukter/Stepless/Transportable%20ramper/Shared%20files/US/ADA%20Ramp%20Codes_US.pdf

4.8.1 General
Any part of an accessible route with a slope greater than 1:20 shall be considered a ramp and shall comply with 4.8.

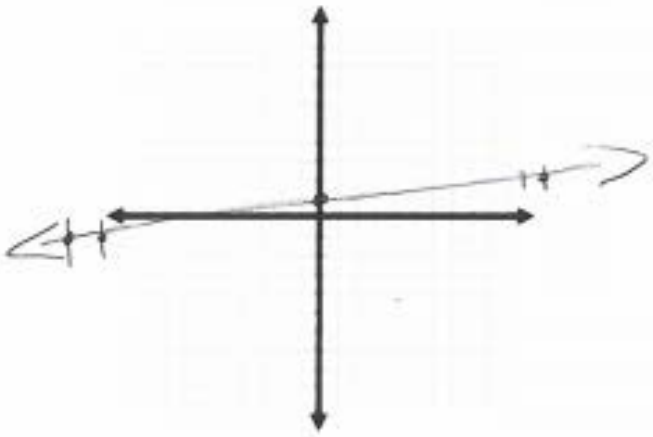
4.8.2 Slope and Rise
The least possible slope shall be used for any ramp. The maximum slope of a ramp in new construction shall be 1:12. The maximum rise for any ramp run shall be 30 inches. Curb ramps and ramps to be constructed on existing sites or in existing buildings or facilities may have slopes and rises, if space limitations prohibit the use of a 1:12 slope or less.

Yes, the slope for location A does meet the criteria for the ADA guidelines for a handicap ramp.

$\frac{1}{12} > \frac{5}{116}$ 5

$\frac{1}{12} \neq \frac{5}{60} > \frac{5}{116}$

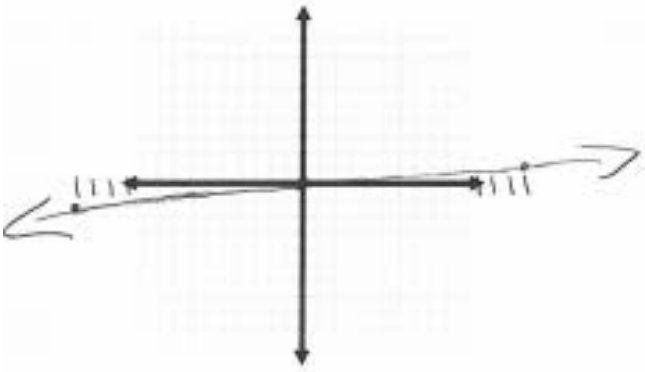
4) Plot two points on a graph that would represent the same slope as location A.



5) Calculate the slope for Location B. Explain how you calculated your slope.

$\frac{14}{196} = \frac{1}{14}$ To find the slope, we divided the vertical change by the horizontal change and simplified our fraction.

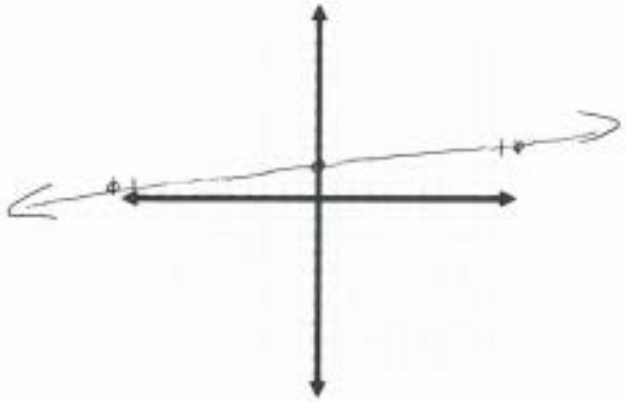
6) Plot two points on a graph that would represent the same slope as location B.



7) Calculate the slope for Location C. Explain how you calculated your slope.

$\frac{5}{60} = \frac{1}{12}$ To find the slope, we divided the vertical change by the horizontal change and simplified our fraction.

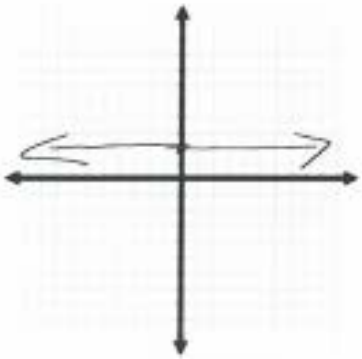
8) Plot two points on a graph that would represent the same slope as location C.



9) Calculate the slope for Location D. Explain how you calculated your slope.

$\frac{0}{12} = 0$ slope We divided the vertical change by the horizontal change and simplified our fraction.

10) Plot two points on the graph that would represent the same slope as location D.



11) Write a paragraph explaining why you think the ADA has explicit regulations on slopes of ramps. Answers may vary. ADA guidelines are written for the safety of all people. If there were no guidelines to follow, the the slopes of handicap ramps could be dangerous. If the slope is too steep, the accidents could occur. The Americans with Disabilities Act is designed to aid in the safety and accessibility of all

12) Research and create two other real world examples that use slope.

Answers may vary. other examples of real facilities, would slopes that can be measured are highway grades going up & down Mountains and stairs in a building.