Roller Coaster Mania

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Real Life Slope Application

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Parts	Attributes
TEKS	111.32 (1) Foundations for functions. The student understands that a function represents a dependence of one quantity on another and can be described in a variety of ways. The student is expected to: (D) represent relationships among quantities using concrete models, tables, graphs, diagrams, verbal descriptions, equations, and inequalities; and (E) interpret and make decisions, predictions, and critical judgments from functional relationships. 111.32 (5) Linear functions. The student understands that linear functions can be represented in different ways and translates among their various representations. The student is expected to: (C) use, translate, and make connections among algebraic, tabular, graphical, or verbal descriptions of linear functions. 111.32 (6) Linear functions. The student understands the meaning of the slope and intercepts of the graphs of linear functions and zeros of linear functions and interprets and describes the effects of changes in parameters of linear functions in real-world and mathematical situations. The student is expected to: (A) develop the concept of slope as rate of change and determine slopes from graphs, tables, and algebraic representations; (B) interpret the meaning of slope and intercepts in situations using data, symbolic representations, or graphs; (C) investigate, describe, and predict the effects of changes in m and b on the graph of $y = mx + b$; (F) interpret and predict the effects of changing slope and y-intercept in applied situations.
Objectives (Bloom's Taxonomy)	• Given the opportunity to work in a group, the learner will make a kinesthetic representation of slope using their bodies by accurately modeling the direction and degree of incline. (application) • Given the other group's demonstrations, the learner will predict and estimate the slope by correctly determining whether it is a positive or negative slope and specifying the correct slope with in 2 units. (synthesis)

	• Given the experience of making a human slope, the learner will correctly identify real life applications of slope by drawing a detailed graphical representation and estimating the slope and equation of the real life application. (synthesis and evaluation)

Materials	• Roller coaster video clip using no sound
	  • http://www.youtube.com/watch?v=02rW3vaNj98
	• Roller coaster still picture
	  • http://open.salon.com/files/roller_coaster1249662567.jpg
	• Roller Coaster Mania Directions handout
	• Piece of notebook paper
	• Pencils
	• Straight edge
	• Roller Coaster Mania Demonstration worksheet
	• Real Life Slope Recognition homework

Anticipatory Set	1. The teacher will have a still picture of a roller coaster on the projector screen. 2. The teacher will ask, “Show of hands, who has ever SEEN a roller coaster?” 3. The teacher will ask, “Show of hands, who has ever RIDDEN a roller coaster?” 4. The teacher will say, “Thinking to yourself, what mathematical concepts can you find in a roller coaster? As you watch this video, look for those mathematical concepts.” 5. The teacher will show the video of a high-speed roller coaster. 6. The teacher will ask for 3 volunteers to share what concepts they saw. 7. The teacher will tell the students “You are going to get to create part of a roller coaster using the mathematical concept of slope that we have been studying the past few weeks.”
Instructional Input/ Teacher Explanation & Modeling	1. On the board, draw a (x, y) coordinate graph. 2. On the graph, draw the line $y=-{}^{2}/_{3}x + 4$, without writing the equation on the board. 3. The teacher will ask the students to silently identify the equation of the line, write it on a piece of scratch paper, and raise their hand when they have the answer. 4. The teacher will wait for 85% of the students to raise their hands and then tell them to get with 2 or 3 of their neighbors and share their answers with each other. 5. The teacher will say, “If you and your neighbors have different answers, discuss how you got your answers and come up with an answer together. If you and your neighbors have the same

	answer, discuss how you came up with that answer." 6. The teacher will write the correct equation on the board and ask the students to compare their answers with the correct answer. 7. The teacher will review how to come up with that answer and ask if there are any questions. 8. The teacher will ask students to think to themselves, "Could this equation work as the slope on a roller coaster? Why or why not?" 9. The teacher will have the students briefly share with their neighbors why or why not. 10. The teacher will walk around the room listening briefly to each group as they discuss their reasoning. 11. The teacher will put the picture of the roller coaster back on the projector screen as the groups wrap up their discussions. 12. The teacher will come back to the front of the room and ask for 2 or 3 groups to share what they discussed. 13. The teacher will say, "Yes, this slope will work for a roller coaster, although what KIND of roller coaster would it be? Would this be on a high-thrill roller coaster? A kiddie roller coaster? Or your 'run-of-the-mill roller coaster?" 14. The teacher will excitedly ask, "Now, are you ready to design your roller coasters?" 15. The teacher will say, "In just a minute, you and your group will have about 10 minutes to design part of a roller coaster. During this time, you will come up with what kind of roller coaster you want, an equation for the slope of your coaster, and last, your group will demonstrate for the class what your coaster looks like." 16. The teacher will hand out the Group Roller Coaster Design instructions to each group. Each group will be assigned a group number by the teacher. 17. The teacher will ask, "Are there any questions for steps one thru five?" 18. If there are any questions, teacher will clarify instructions. 19. Teacher will say, "Ok, for steps six thru 8, may I have 2 volunteers?" 20. Teacher will physically model with the 2 volunteers how the groups will demonstrate their coasters to the rest of the class. 21. During the model, the teacher will give detailed instructions in relation to what each member of the group will do. 22. Teacher will ask, "Are there any questions about steps six thru eight?" 23. If there are any questions, teacher will re-model if necessary and clarify instructions. 24. Teacher will say, "I am looking forward to seeing what kind of roller coaster you come up with. Time starts now!" 25. As the groups work on their coasters, the teacher will walk around and observe the groups, answering any questions as necessary. 26. At the 8 minute mark, the teacher will tell them they have 2 minutes and to start wrapping it up.

	27. At the 10-minute mark the teacher will say, “Groups, please raise your hands if you need more time?” 28. If a group raises their hands, the teacher will ask, “How much time do you need?” 29. The teacher will grant up to 2 more minutes to finish the in class assignment. 30. If no groups raise their hands, the teacher will announce, “Here in an minute, I will draw a group number from the bowl. When I draw your group number, your group gets to demonstrate your coaster slope to the class. As your group comes to the front of the class, please hand me your group paper.” 31. The teacher gives out the Class Roller Coaster Demonstrations worksheet to each student as she explains, “As each group goes, watch carefully as you fill out this sheet. You will estimate the slope of each group’s demonstration and turn it in with your group assignment at the end of class.” 32. The teacher will announce which group gets to go first and stands to the side of the front of the room to observe and assist with safety as necessary as the group demonstrates. 33. As each group goes, the teacher will remind the rest of the class to estimate their slope and write down their answers silently. 34. After every group has demonstrated their roller coaster, the teacher will ask, “Who would like to share what they learned today?” 35. The teacher will take a few answers and allow time for a brief class discussion over the lesson. 36. The teacher will pose questions for the class to think about silently, such as, “Could a roller coaster have a zero slope? What other things in our world are designed using slope?” 37. The teacher will say, “Thinking about what you learned today, your homework will be to find other real world objects or situations that involve slope.” 38. The teacher will assign the homework (assuming a block schedule, the homework will be due next class period, see homework sheet) and ask if there are any questions. 39. The teacher will instruct the class to turn in their estimates before leaving class.
Checking for Understanding	During whole class discussion: • The teacher will make a visual check of the percentage of students that came up with the correct equation for the slope of the line demonstrated when they raise their hands. • If less than 75% of the class responds accurately, do another review with greater teacher involvement. During group activity: • As they are discussing whether or not the review slope could work as the slope on a roller coaster, the teacher is walking the room and listening for which students have an understanding of slope. • When they are designing their roller coasters, the teacher is

	walking the room silently looking at their papers, making a visual check for understanding and suggesting adjustments as necessary.
Guided Practice	Whole class discussion: • Teacher will draw a graph and line on the board to review how to form the equation of a line and find its slope. • Teacher will actively model how to make a human slope using 2 volunteers.
Closure	• After all the groups have demonstrated their human roller coaster slope, the teacher opens the room for discussion by asking, "Who would like to share what they learned today?" • The teacher asks more questions to prompt further discussion, "Could a roller coaster have a zero slope? What other things in our world are designed using slope?"
Independent Practice	• Students work in their groups to design a slope for a roller coaster. • Students will demonstrate with their group what the slope of their roller coaster looks like using the human slope. • Students will complete homework assignment independently.
Assessment	• During the group demonstration, the teacher will make a visual check to see if their human slope is representative of the slope on their graphs. • The teacher will evaluate the accuracy of each student's estimates of other group demonstrations. • The teacher will evaluate the homework assignment turned in to see if the student can accurately identify where slope is used in 3 real world applications and make a detailed graph to estimate the slope of each real life application.
Extensions	1. Have each group make a detailed, scale model of their initial roller coaster slope. 2. Have students predict what impact their roller coaster slope will have on the human body. 3. From the homework, take one of the real life applications where they noticed slope to have them find the actual slope of that object. 4. Have the students find places in nature where slope is naturally occurring.

Roller Coaster Mania Instructions

1. In your group, choose what kind of roller coaster you want to design.
2. On a single piece of paper, put your group number, name of each group member, date, and class period at the top of the page.
3. Draw a large x,y coordinate graph.
4. On the graph, draw the slope of your roller coaster going through the point (0,0).
5. Determine the equation for your line and write it on the graph.
6. Below the graph, answer the following questions:
   a. What is the slope of your roller coaster?
   b. Is this the slope of the 'climb' or the 'fall' on your roller coaster?
   c. What kind of roller coaster did you design?
7. Turn in your group assignment page at the end of class

Group Roller Coaster Demonstration

8. Choose which group member will be the "slope" of your coaster demonstration.
9. Think about how you will accurately model the slope of your coaster.
10. Practice in your groups modeling your coaster and be ready to show the class when time is up.
11. Good luck and have fun!

Roller Coaster Mania Demonstrations

As other groups are demonstrating their coasters, closely watch and estimate the slope of their roller coasters. Write your answers below:

- Group 1 _____
- Group 2 _____
- Group 3 _____
- Group 4 _____
- Group 5 _____
- Group 6 _____
- Group 7 _____
- Group 8 _____

What do you think?

Real Life Slope Homework

Over the next two days you will accurately identify and document at least 3 real life designs or applications in which slope is present.

Please attach a separate piece of paper for each application. You will need to do each step for all 3 designs or applications:

1. Describe in detail the real life slope. What does the slope look like? Where is it located? How is this slope used in real life?

2. Draw a (x.y) coordinate graph using correct labels for each axis. (If the x-axis is the ground, you will label it "ground"; if the y-axis is a flagpole, you will label it "flag pole").

3. Drawing a life like representation, correctly estimate and draw the slope on your graph.

4. Correctly write the equation of the line.

Real Life Slope Homework Rubric
(applies to each application identified)

	6.5	4	2.5	0
Recognition of slope	Student correctly identifies a real life application of slope.	Student identifies a real life application showing understanding of slope but does not correctly identify the application of slope.	Student inaccurately identifies a real life application of slope.	Student does not correctly identify a real life application of slope.
Description of application	Student provides a thorough and detailed description of the applications of slope.	Student provides a partially detailed description of the applications of slope.	Student provides a minimally detailed description of the applications of slope.	Student does not provide a description of the application of slope.
Graph drawing	Student accurately draws and labels a (x,y) coordinate graph according to the use of slope of the application making no errors.	Student draws and labels a (x,y) coordinate graph according to the use of slope of the application making 1 or 2 errors.	Student draws and labels a (x,y) coordinate graph according to the use of slope of the application making 3 or 4 errors.	Student does not draw and label a (x,y) coordinate graph according to the use of slope of the application.
Graphical representation (counts as double points)	Student draws a detailed, life like representation of the slope on the graph and correctly identifies the equation of the line.	Student draws a detailed, life like representation of the slope on the graph but incorrectly identifies the equation of the line.	Student does not draw a detailed, life like representation of the slope on the graph, yet correctly identifies the equation of the line.	Student does not draw a detailed, life like representation of the slope on the graph and incorrectly identifies the equation of the line.