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Fun With Limited Funds

8th Grade

Objectives:

M8A4. Students will graph and analyze graphs of linear equations and inequalitites.

    a. Interpret slope as a rate of change.

    b. Determine the meaning of the slope and *y*-intercept in a given situation.

    c. Graph equations of the form $y = mx + b$.

    f. Determine the equation of a line given a graph, numerical information that defines the line or a context involving a linear relationship.

    g. Solve problems involving linear relationships.

M8D4. Students will organize, interpret, and make inferences from statistical data

    a. Gather data that can be modeled with a linear function.

M8P1. Students will solve problems (using appropriate technology).

    a. Build new mathematical knowledge through problem solving.

    b. Solve problems that arise in mathematics and in other contexts.

    c. Apply and adapt a variety of appropriate strategies to solve problems.

    d. Monitor and reflect on the process of mathematical problem solving.

M8P3. Students will communicate mathematically.

    a. Organize and consolidate their mathematical thinking through communication.

    b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

M8P4. Students will make connections among mathematical ideas and to other disciplines.

    a. Recognize and use connections among mathematical ideas.

    b. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.

    c. Recognize and apply mathematics in contexts outside of mathematics.

M8P5. Students will represent mathematics in multiple ways.

    a. Create and use representations to organize, record, and communicate mathematical ideas.

    b. Select, apply, and translate among mathematical representations to solve problems.

    c. Use representations to model and interpret physical, social, and mathematical phenomena.

Materials:

TI-83 or TI-84, color pencils

Fun With Limited Funds ($$$)

Overview:
While the launch is a review of mean and students ability to determine if it is the best representation for a set of data, the actual lesson focuses on linear relationships. In the lesson students will collect data that occurs as a result of relationships between varying quantities. They will organize that data into tables and graph the data on a coordinate plane. They will analyze the graphs, tables and equations to determine the relationship between the varying quantities. Students will also interpret slope as how the rate of change in one variable affects the other and determine the meaning of slope and y-intercept in a given situation. Finally, they will utilize technology to further explore that relationship.

Essential Questions:
- What does the data tell me?
- How does a change in one variable affect the other variable in a given situation?
- Which tells me more about the relationship I am investigating – a table, a graph, or an equation?
- What does the slope and y-intercept of a linear equation tell me?

Launch:
There are 20 rides in an amusement park that you would like to ride if time and money permits. Below is a table showing the wait time for the rides from least to greatest.

Ride	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Wait Time (minutes)	5	5	5	10	10	10	10	15	15	15	15	20	25	25	25	30	30	45	45	60

a) Find the mean amount of wait time for the twenty rides. Show how you arrived at your answer.

b) Is this mean wait time a good representation for the waits above? Why or Why not?

c) How can you show the difference between the wait times numerically?

d) If you plan to spend one hour eating at the park, how long will you need to stay at the park to ride all 20 rides? Show how you arrived at you answer.

Investigation:

You and your friends are making plans to go to an amusement park. Since you have a limited amount of money, you want the best deal. Study the plans below. Decide which plan is the better deal.

Plan A   **Plan B**   **Plan C**
$ 5.00 admission $10.00 admission $ 25.00 admission
$ 2.00 per ride $ 1.00 per ride   Unlimited Rides

1. Calculate the <u>total cost</u> under each plan for riding from 0 to 15 rides.

Plan A		Plan B		Plan C	
Rides (X)	Total Cost (Y)	Rides (X)	Total Cost (Y)	Rides (X)	Total Cost (Y)
0		0		0	
1		1		1	
2		2		2	
3		3		3	
4		4		4	
5		5		5	
6		6		6	
7		7		7	
8		8		8	
9		9		9	
10		10		10	
11		11		11	
12		12		12	
13		13		13	
14		14		14	
15		15		15	

2. Tell how you can determine the cost of riding *x* amount of rides under Plan A, Plan B, and Plan C.

The slope is a constant rate of change.

3. What is the slope of Plan A? _____ Plan B? _____ Plan C? _____

The y-intercept is the starting point of the dependant variable when the independent variable is at 0.

4. In this scenario which variable is independent and which variable is dependent?   Explain how you know?

5. What is the y-intercept of Plan A? _____ Plan B? _____ Plan C? _____

The equation y = mx + b is called slope-intercept form. In the equation, m represents the slope and b represents the y-intercept. In the equation y = 3x + 7, the slope is 3 and the y-intercept is 7.

6. Write and equation in slope-intercept form for each of the Plan's.

Plan A _____ Plan B _____ Plan C _____

7. Using the completed table for the plans, graph Plan A, B, and C below. Be sure to label and number each axis. Use a different color for the graph of each plan.
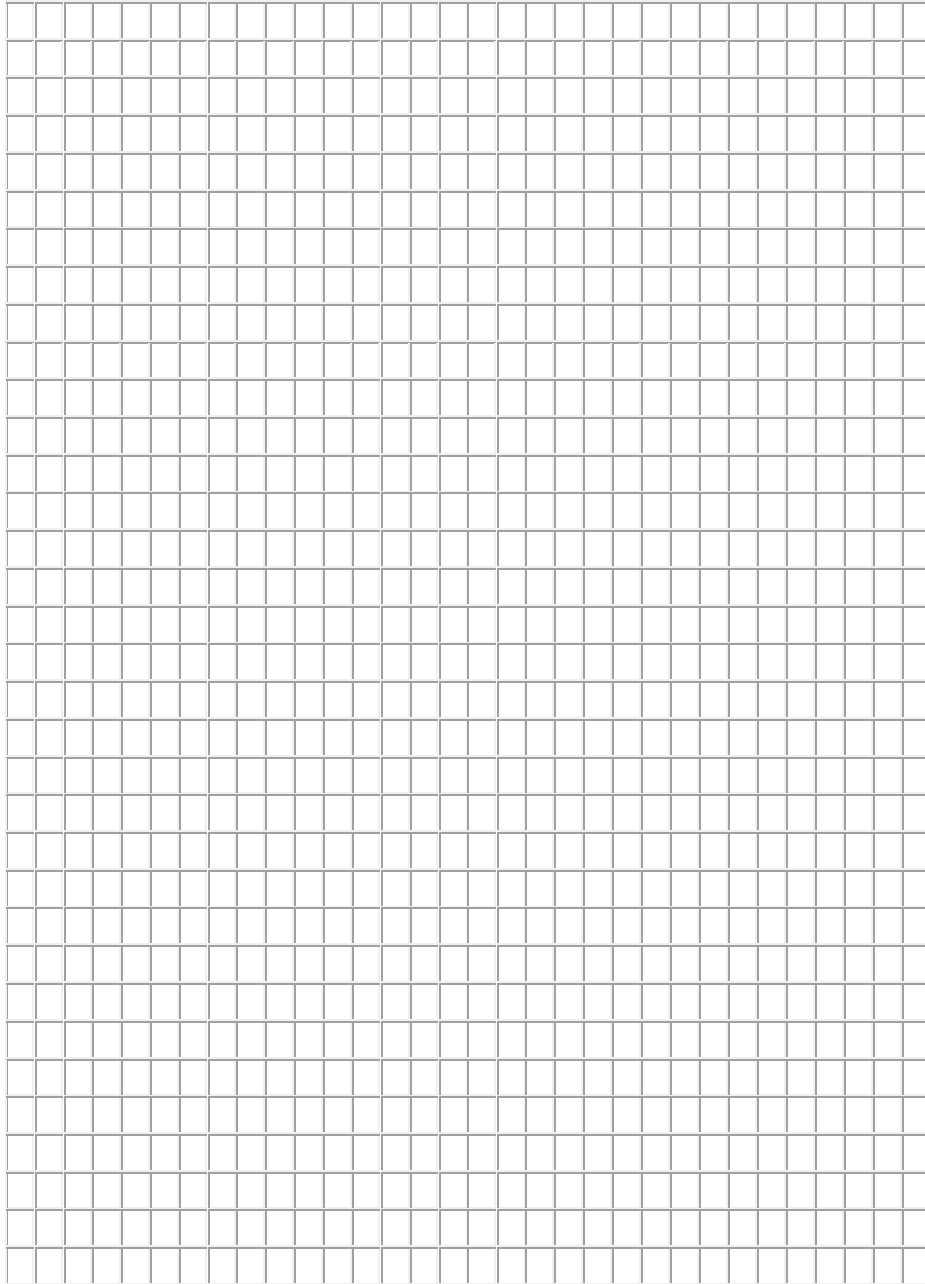
8. Describe the pattern you see with the coordinates of Plan A. (Be specific and write in complete sentences.)

9. Describe the pattern you see with the coordinates of Plan B. (Be specific and write in complete sentences.)

10. Describe the pattern you see with the coordinates of Plan C. (Be specific and write in complete sentences.)

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11. Now use the graphing calculator to see the graphs of the equations that you have written and verify that your table is correct. Press [Y=] and type in your equation for Plan A next to Y1 =. Press [ENTER] and type in your Plan B equation next to Y2 =. Press [ENTER] and type in your Plan C equation next to Y3 =. Press [2nd][GRAPH] to see the table for the equations. Press [ZOOM] 0 to see the graphs of the equations.

12. Which points if any on the line graph are not relevant? Why?

In Class Problems:

Answer the following questions concerning the three options for park admission. For you convenience, the ticket options are listed below.

Plan A	Plan B	Plan C
$ 5.00 admission	$10.00 admission	$ 25.00 admission
$ 2.00 per ride	$ 1.00 per ride	Unlimited Rides

1. If I ride 9 rides under Plan A, it will cost _____ .

2. If I ride 9 rides under Plan B, it will cost _____ .

3. If I ride 9 rides under Plan C, it will cost _____ .

4. If I ride 30 rides under Plan A, it will cost _____ .

5. If I ride 30 rides under Plan B, it will cost _____ _____.

6. If I ride 30 rides under Plan C, it will cost _____ _____.

7. If I spent $15 under plan A, how many rides did I ride? _____

8. If I spent $20 under plan B, how many rides did I ride? _____

9. Will there ever be a time when admission is the same for the plans?

10. Explain your response for question 9.

11. When would it cost more under Plan A?

12. Explain your response for question 11.

13. When would it cost less under Plan A?

14. Explain what you see on the graph that helps you to determine this.

15. Comparing the graphs of Plan A and B, which of the lines is steeper and what does this mean as it relates to the total cost?

16. Which plan will you recommend? _____Why? (be specific and write complete sentences)

Conclusion:

1. Predict what the line would look like if you graphed the following situations:

   a. a plan that has no admission price and each ride is $3.00

   b. a plan that has $25 admission price and no charge for the rides

   c. a plan that has $5 admission price for 3 free rides, then $1 for each additional ride

2. How does the admission price affect the line?

3. How does the cost per ride affect the line?

4. What doe they y-intercept and slope tell you about any given scenario?

5. In the amusement park problems which variable represented the slope and which variable represented the y-intercept? How do you know?

6. Give another scenario in which the change in one variable affects the other. Identify the independent and dependent variable in your scenario.

Homework:

Plan A	Plan B	Plan C
$ 5.00 admission	$10.00 admission	$ 30.00 admission
$ 2.00 per ride	$ 1.00 per ride	Unlimited Rides

What if Plan C consisted of an admission of $30.00 and unlimited rides, how would this change the problem? Write about the changes that would take place.

With the new $30.00 admission price for Plan C, when would each plan be optimal?

Critique the "Fun With Limited Funds" lesson.