

Planning a Bowling Party
7th Grade Lesson Plan
Unit 4 (2005 – 2006)

LESSON OVERVIEW

Overview:

In this lesson, students analyze three plans for a group bowling party – one represented by a constant function, the other two represented by linear functions with different slopes and y-intercepts. Students represent each function using a table and a graph. They compare the three options using the representations focusing on issues related to slope and y-intercept, and select the plan with the lowest cost.

Mathematics in the Lesson:

To solve this task successfully, students must be able to find the constant rate of change for each of the plans, both by referring to the table, the graph, and the context. This will be identified as the SLOPE of the graph, which is the ratio of the change in y divided by the change in x. They must also be able to identify the initial value for each plan and explain how it is manifested in each of the representations. In selecting the plan with the least cost they must consider both the x and y values.

Goals of the Lesson:

- Develop/reinforce an understanding that for any linear function there is a constant rate of change between the two variables and that this rate of change has meaning in a variety of contexts and representations. That constant rate of change is called the Slope.
- Develop/reinforce the meaning of Slope in a table, a graph and a variety of real world contexts
- Develop/reinforce the understanding that the value of a linear function when $x = 0$ can be linked to a real world context, a table, and the y-intercept of a graph.

Mathematical Standards:

AF3.3 Graph linear functions, noting that the vertical change (change in y-value) per unit of horizontal change (change in x-value) is always the same and know that the ratio (“rise over run”) is called the slope of the graph.

AF3.4 Plot the values of quantities whose ratios are always the same (e.g. cost to the number of an item, feet to inches, circumference to diameter of a circle). Fit a line to the plot and understand that the slope of the line equals the quantities.

Academic Mathematical Language:

The following terms should be reinforced/developed/used through the lesson:

- Linear function (this lesson focuses on the meaning of “linear” and not “function”)
- Slope
- Ratio
- Y-intercept

Materials:

- Task (attached)
- Calculators
- Graph Paper, Chart paper or overheads for group share
- Rulers, Colored pencils (if plots will not be connected on the graph)

Assumption of prior knowledge/experience:

- Use a table to represent a function
- Use a graph to represent a function
- Evaluate an algebraic expression for a given situation

Note: Developing an understanding of the mathematical concepts and skills embedded in a standard requires having multiple opportunities over time to engage in solving a range of different types of problems which utilize the concepts or skills in question.

THE LESSON

Phase	TEACHER PEDAGOGY	STUDENT RESPONSES AND RATIONALE FOR PEDAGOGY
S E T U P	<u>HOW DO YOU SET UP THE TASK?</u> Prior to teaching the task, solve it yourself in as many ways as possible. Possible solutions to the task are included throughout the lesson plan.	<u>HOW DO YOU SET UP THE TASK?</u> It is critical that you solve the problem in as many ways as possible so that you become familiar with strategies students may use. This will allow you to better understand students' thinking. As you read through this lesson plan, different questions the teacher may ask students about the problem will be given.
	<u>SETTING THE CONTEXT FOR THE TASK</u> Begin by asking: "Have you ever been bowling? What do you have to pay for when you go bowling?" Then ask students to follow along as you read the problem: The 7th grade is planning a bowling party to celebrate the end of the school year. Juan and Camilla decided to call different companies to find their group rates for an afternoon of unlimited bowling. They found three different plans: • <i>Bowling Bonanza</i> charges \$150 for the afternoon, plus a charge of 50¢ per person for the bowling shoes. • <i>Ten Pin Haven</i> charges \$60 to reserve the lanes for the afternoon plus \$2 per person for both shoes and bowling. • <i>Lucky Lanes</i> charges a flat rate of \$200 -- this includes both shoes and bowling for everyone. Represent the total cost for each of the plans using a table and a graph.	<u>SETTING THE CONTEXT FOR THE TASK</u> It is important that students have access to solving the problem from the beginning. • Finding out if students are familiar with bowling will help you set the stage, and will indicate whether you have to provide background information about the need to rent bowling shoes in addition to paying to bowl. Ask if they understand what is meant by "unlimited bowling" • Have the problem displayed on an overhead projector or chart paper so that it can be referred to as you read the problem. • Check on students' understanding of the task by asking several students what they know and what they are trying to find when solving the problem. You may need to explain what is meant by "flat fee" and "per person".
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Phase	TEACHER PEDAGOGY	STUDENT RESPONSES AND RATIONALE FOR PEDAGOGY
S E T U P	<u>SETTING THE CONTEXT FOR THE TASK (Cont'd.)</u> Explore: 1. What do you notice about each of the plans? How are they the same? How are they different? 2. Describe how the flat fee and cost per person of each plan are represented in the table and in the graph.	<u>SETTING THE CONTEXT FOR THE TASK (Cont'd.)</u> • Be careful not to tell students how to solve the task, or to set up a procedure for solving the task, because your goal is for students to do the problem solving.
	Choose the company that you think gives the best deal and justify to Juan and Camilla why you chose that plan.	
	<u>SETTING UP EXPECTATIONS FOR DOING THE TASK</u> Remind students that they will be expected to: • justify their solutions in the context of the problem. • explain their thinking and reasoning to others. • make sense of other students' explanations. • ask questions of the teacher or other students when they do not understand. • use correct mathematical vocabulary, language, and symbols.	<u>SETTING UP EXPECTATIONS FOR DOING THE TASK</u> Setting up and reinforcing these expectations on a continual basis will result in them becoming a norm for the mathematics classroom. Eventually, students will incorporate these expectations into their habits of practice for the mathematics classroom.
	Tell students that their groups will be expected to share their solutions with the whole group using the board, the overhead projector, etc.	

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E X P L O R E	<u>INDEPENDENT PROBLEM-SOLVING TIME</u> • Tell students to work on the problem by themselves for a few minutes. • Circulate around the class as students work individually. Clarify any confusions they may have but do not tell them how to solve the problem.	<u>INDEPENDENT PROBLEM-SOLVING TIME</u> It is important that students be given private think time to understand and make sense of the problem for themselves and to begin to solve the problem in a way that makes sense to them.
	<u>FACILITATING SMALL-GROUP EXPLORATION</u> Tell students they may now work with their partners. As students continue working, circulate around the classroom. <u>What do I do if students have difficulty getting started?</u> Ask questions such as: • What are you trying to find? • What do you know about each plan? • How much would each of the plans cost for 1 person? 10 people?	<u>FACILITATING SMALL-GROUP EXPLORATION</u> <u>What do I do if students have difficulty getting started?</u> It is important to ask questions that do not give away the answer or that do not explicitly suggest a solution method.

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E X P L O R E	<u>FACILITATING SMALL-GROUP EXLORATION (Cont'd.)</u> <u>Possible misconceptions or errors:</u> Confusing the flat fee and the per-person fee. If we are trying to find the cost at Ten Pin Haven, what does the 25 represent? What does the 2 represent? What would be the total cost if 1 person bowled? 2 people?	<u>FACILITATING SMALL-GROUP EXLORATION (Cont'd.)</u> <u>Possible misconceptions or errors:</u> It is important to have students explain their thinking before assuming they are making an error or have a misconception. After listening to their thinking, ask questions that will move them toward understanding their misconception or error.
E X P L O R E	- Mixing dollars and cents notation for the Bowling Bonanza plan. How much would be the total cost if 1 person bowled at Bowling Bonanza? [This may be sufficient]. What does the 150 represent? What does the 50 represent? How would you write each in dollars notation? In cents notation? - Forgetting to indicate units: What does your answer mean in terms of the problem?	- The \$25 represents the flat fee – the fee you pay for reserving the lanes; the \$2 is how much you have to pay on top of this for each bowler. So, if only 1 person bowled it would cost \$27, if two people bowled, it would cost \$29. - A student may add 150 and 50 and say that it costs \$200 for one person to bowl. If this does not prompt them to correct their mistake, leave them to ponder. - Students should be able to explain that their answer is dollars, not people
E X P L O R E	- Excluding the flat fee when calculating total cost. Explain your answer. What about the \$150? Does that need to be considered when you calculate the total cost?	It is important that students understand that Juan and Camilla are concerned about the total cost for each plan. They must combine the flat fee and the fee for the bowlers.

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E X P L O R E	<u>FACILITATING SMALL-GROUP EXPLORATION (Cont'd.)</u>	<u>FACILITATING SMALL-GROUP EXPLORATION (Cont'd.)</u>
	<u>Possible Solution Paths</u> Strategies will be discussed as well as the questions that you might ask students. Representations of these solutions are included at the end of this document. ** Indicates important questions in terms of getting at the mathematical goals of the lesson.	<u>Possible Solution Paths</u> Questions should be asked based on where the learners are in their understanding of the concept. It is important that student responses are given both in terms of the context of the problem and in correct mathematical language. ** Indicates key mathematical ideas in terms of the goals of the lesson.
	<i>Making a table:</i> have each group make its table on a large piece of paper so that it can be visibly displayed at the beginning of the Share Phase. Ask questions such as: What are the variables for each plan? - Students may begin their table with increments of 1 bowler. If you see this, you can say: What are we trying to find? How long do you think it will take you to find this using the numbers you have selected for your table? Can you think of another way to select the rest of the numbers so that it won't take so long?	<i>Making a table:</i> Possible student responses: - Students should state that for the variables for each plan are number of bowlers and total cost. - Students should soon see that it would take them too long to find when the plans cost the same amount if they use an increment of 1. Asking them to refer to the overarching question will help them see that the table is just a means to answer the question, not an end in itself. They will find that Ten Pin Haven becomes as expensive as Bowling Bonanza (\$180) for 60 people while Bowling Bonanza costs as much as Lucky Lanes for 100 people.

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E X P L O R E E X P L O R E	<u>FACILITATING SMALL-GROUP EXPLORATION (Cont'd.)</u> <i>Constructing a graph:</i> have each group make its graph on a large piece of paper so that it can be visibly displayed during the Share Phase. Ask questions such as: • What are the variables for each plan? • What goes on the x-axis? What goes on the y-axis? Why? • If you notice any scales numbered incorrectly, ask team members to comment: Do you think it is OK to number the axes this way? [Leave them to ponder over this. If they still do not correct their axes, they will understand their error during the Share Phase.]	<u>FACILITATING SMALL-GROUP EXPLORATION (Cont'd.)</u> <i>Constructing a graph:</i> The independent variable (number of bowlers) is discrete, not continuous, therefore it is misleading to connect the points [a continuous line implies that you can determine the cost for a fractional number of bowlers]. Nonetheless, connecting the points for each plan helps students to visualize whether or not they fall along a straight line. If you choose for students to plot their points without connecting them, use a different colored point for each plan so that the linear arrangement is apparent. • Students should state that for the variables for each plan are number of bowlers and total cost. • Students should state that the number of bowlers should go on the x-axis and the total cost should go on the y-axis. Though “independent and dependent variable” are not terms that are indicated in the 7th grade Standards, students should indicate that they need to know the number of bowlers in order to calculate the cost. The convention that since cost “depends on” # of bowlers, the number of bowlers must go on the x-axis. • It is important for students to use consistent scales on the x- and y-axis. Although they do not have to use the same increments on both axes, each axis has to be numbered using a fixed increment (e.g., Cost could increase by \$20's while number of bowlers increases by 10's). If students do not use fixed increments, the points will not fall on a straight line and they will not be able to see that these are linear functions.

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E X P L O R E E X P L O R E E X P L O R E	<u>FACILITATING SMALL-GROUP EXPLORATION (Cont'd.)</u> ** What do you notice about the three graphs? How are they the same and how are they different? Listen for student responses that can be linked to the concepts of slope as constant rate of change and the “initial cost” (which will be linked to y-intercept below). ** Why is Ten Pin Haven’s graph steeper than Bowling Bonanza’s? ** Why do the graphs start at different places on the y-axis? Which plan would you choose? How can you use the graph to help you make your choice?	<u>FACILITATING SMALL-GROUP EXPLORATION (Cont'd.)</u> ** They all form straight lines [if they did not connect their points they should see that the points fall along a straight line nonetheless]. Bowling Bonanza and Ten Pin Haven both slant up, but Lucky Lanes is flat. Ten Pin Haven’s graph is steeper than Bowling Bonanza’s. The three plans start at different places on the y-axis. [These ideas will be developed further in the Share Phase.] ** Each person only costs an extra 50¢ at Bowling Bonanza but they cost \$2 at Ten Pin Haven, so the line goes up faster. It goes up \$2 every time you add another person at Ten Pin Haven. The graph hits the y-axis when there are zero bowlers. Even before anyone starts bowling, it will cost \$60 for Ten Pin Haven, \$150 for Bowling Bonanza, and \$200 for Lucky Lanes. That’s where they start on the y-axis. Students should indicate that they want to select the plan that is the least expensive, but their choice will depend upon the number of bowlers. They should be able to indicate the two points where the graphs cross (creating three different regions), and to realize that they would select the plan that is “on the bottom” depending on the number of bowlers that they expect to have. This question is used to provide a motivation for this task, though Systems of Equations is not one of our mathematical goals at this time. It is also not necessary for students to use the terminology “Point of intersection”. Accept any expression that makes sense to the students.

Phase	TEACHER PEDAGOGY	STUDENT RESPONSES AND RATIONALE FOR PEDAGOGY
S H A R E D I S C U S A N D A N A L Y Z E	<u>FACILITATING THE SHARE, DISCUSS, AND ANALYZE PHASE OF THE LESSON</u> <u>What solution paths will be shared, in what order, and why?</u> To facilitate the discussion, have all the groups post their tables in front of the room. ** Indicates responses that get at the key mathematical ideas in terms of the goals of the lesson. Possible Solutions to be Shared <i>Comparing and analyzing the tables:</i> Have all groups display their tables around the room. In crafting the discussion, look for a variety of approaches – (i.e., a separate table for each plan and all three plans in one table to compare efficiency; groups that selected different increments for the independent variable to illustrate that there is more than one way to do this, etc.)	<u>FACILITATING THE SHARE, DISCUSS, AND ANALYZE PHASE OF THE LESSON</u> <u>What solution paths will be shared, in what order, and why?</u> The purpose of the discussion is to assist the teacher in making certain that the goals of the lesson are achieved by students. Questions and discussions should focus on the important mathematics and processes that were identified for the lesson. ** Indicates responses that get at the key mathematical ideas in terms of the goals of the lesson. Possible Solutions to be Shared <i>Comparing and analyzing the tables:</i> By looking across the tables it will be clear that there is more than one way that a table can be helpful. The tables should remain visible for the remainder of the discussion, so that links can be made between the various representations.

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S H A R E D I S C U S A N D A N A L Y Z E	<u>FACILITATING THE SHARE, DISCUSS, AND ANALYZE PHASE OF THE LESSON (Cont'd.)</u> Ask 2-3 groups (identify groups that made different choices): • How did your group create your table(s)? What are your variables? How did you decide your choice of values in the “bowlers” column? Ask the class: • ** How are the plans the same and how are they different? Can we see any of these differences by just looking at the tables? This question will help to focus students on the details of each plan. Ideas that emerge from this discussion should be listed so that they can be referred to later in the discussion. Allow plenty of wait time to encourage reluctant students to participate. • ** How can we find the starting cost of each plan by using only the information in the table(s)? Why is it easier to see this information in some of the tables than in other tables?	<u>FACILITATING THE SHARE, DISCUSS, AND ANALYZE PHASE OF THE LESSON (Cont'd.)</u> • If possible, call on groups that didn't seem to take the goals of the task into account when selecting their increments (either increments that are unnecessarily small, extremely large, or inconsistent). Also, highlight groups that created 3 separate tables. Also include a group that used trial-and-error to determine that increments of 10 or 20 worked well, if possible. Multiple strategies of different levels of efficiency should help the idea of efficient strategies to emerge. <u>Indicate that we will call the number of bowlers “x” and the total cost “y”.</u> • Listen for student responses that you will be able to link to slope (the cost for Bonanza goes up faster than the cost for Ten Pin Haven. At Lucky Lanes it doesn't matter how many people come – the cost is the same) or y-intercept (Bonanza starts out more expensive than Ten Pin Haven; Lucky Lanes starts out the most but ends up the least). • By looking across tables they should identify those tables that start with 0 bowlers. It will be apparent that starting cost can be read directly from such tables.

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S H A R E D I S C U S S A N D A N A L Y Z E	<u>FACILITATING THE SHARE, DISCUSS, AND ANALYZE PHASE OF THE LESSON (Cont'd.)</u> ** How could we figure out how much a plan charged for each bowler if you just had the information contained in the table(s)? Does it matter which values you used to figure this out? Once they have identified that there is a constant rate of change for each plan, ask: Why do we get a constant rate for each plan? Which plan did you choose? Why? How did you use your table to make your choice?	<u>FACILITATING THE SHARE, DISCUSS, AND ANALYZE PHASE OF THE LESSON (Cont'd.)</u> ** Have different groups use their tables to show how they could figure out the per-person charge – each group can focus on a specific plan. Select a group that has increments of one (if possible), as well as groups that have only larger increments. Have them indicate the intervals on their tables that they are using to determine the change in number of bowlers and change in cost – they should also write their calculations on the board. Have each group use at least two different intervals on their table to show that the ratio is always the same. Indicate that this ratio will be referred to as a <u>ratio of the change in y to the change in x</u>, and write it in ratio form: $\frac{\text{change} - \text{in} - y}{\text{change} - \text{in} - x}$ - Call on groups whose tables include the “points of intersection” (60, 180) and (100, 200), as well as those whose tables do not include these points. This will highlight the need to find where the plans are the same in order to make sure that you are making the most accurate assessment. Also include groups that reached different conclusions, if possible, to highlight the fact that the answer depends upon the number of bowlers that you expect. There is no RIGHT ANSWER, however, answers that do not also indicate the number of bowlers must be challenged -- “What does the rest of the class think? Are you satisfied with their explanation?”

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S H A R E D I S C U S S A N D A N A L Y Z E	<u>FACILITATING THE SHARE, DISCUSS, AND ANALYZE PHASE OF THE LESSON (Cont'd.)</u> <i>Comparing and analyzing the graphs:</i> Have all groups display their graphs. When selecting graphs to highlight, look for a variety of approaches – (i.e., graphs that used different sized increments for the independent variable to illustrate that there is more than one way to do this, but they must be consistent for each axis; groups that used different increments on the x- and y-axis; again to show that this is acceptable. If there is a group that did not use fixed increments, and thus don't produce straight lines, this will provide an excellent opportunity to highlight the importance of consistent increments. You might want to prepare such a graph to share if none emerges from the class.) Ask 2-3 groups: • How did your group create your graph? What are your variables? How did you decide your choice of increments for the x-axis? The y-axis? Did they have to be the same? How did you label your axes? Ask the class: • ** What do you notice about the graphs? How are the plans the same and how are they different? Can we see any of these differences by just looking at the graphs? This question will help to focus students on the details of each plan. Ideas which emerge from this discussion should link to those mentioned when they compared the tables. Allow plenty of wait time to encourage reluctant students to participate. These ideas will be unpacked separately below.	<u>FACILITATING THE SHARE, DISCUSS, AND ANALYZE PHASE OF THE LESSON (Cont'd.)</u> <i>Comparing and analyzing the graphs:</i> Comparing a variety of correct and incorrect examples of student work helps students understand what are acceptable norms for creating graphs. By having the work available for open comparison, the ideas can be discussed without putting individual students “on the spot”. • Student explanations should include the need for equal increments on each axis; it is not necessary for the x- and y-axes to use the same increments; are on the x-axis and cost on the y-axis; axes need to be labeled clearly, the \$ unit should be indicated on the y-axis. • ** The points fall along a straight line; two of the graphs slant up, Lucky Lanes is flat; Ten Pin Haven is steeper than Bowling Bonanza; the ones that start out the highest end up the lowest;

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S H A R E D I S C U S S A N D A N A L Y Z E	<u>FACILITATING THE SHARE, DISCUSS, AND ANALYZE PHASE OF THE LESSON (Cont'd.)</u> • Why do you think the points for each plan fall along a straight line? Why are the lines on this graph crooked [referring to the graph you provided, if students did not produce one]? • ** How can we find the cost per bowler for each plan by using only the information in the graphs? Does it matter which points we use? Let's see. Have students use different graphs – selecting a single plan (e.g., Ten Pin Haven). Once they have identified that there is a constant rate of change for each plan, ask: How does this compare to the constant rate we found in our tables? How does this relate to the plan? We call this constant ratio the SLOPE of the graph. How does the SLOPE relate to the ratios we found in the tables? Can we see these ratios in the plans? [referring to the original problem] • ** Why is Ten Pin Haven's graph steeper than Bowling Bonanza's? Why is Lucky Lanes' graph a flat line? • ** How can we find the starting cost of each plan by using only the graphs?	<u>FACILITATING THE SHARE, DISCUSS, AND ANALYZE PHASE OF THE LESSON (Cont'd.)</u> • The points fall along a straight line because there is a constant increase in y for each constant increase in x. You may want to show the "slope triangles" or "stair steps" that are formed. <u>Indicate that these are called LINEAR FUNCTIONS</u> because the points form a straight line. The crooked line results when the increments are not consistent on each axis. Students should be able to identify the mistake in numbering. • Students should select two points on the graph for a given plan and interpret their meaning in terms of the difference in cost between the two points and the difference in number of bowlers (i.e., 10 bowlers will cost \$20, so one bowler will cost $20/10 = \\$2$ per bowler.) Select two other points that are further apart – again the ratio will be \$2 per bowler. Reiterate the ratio form: $\frac{\text{change} - \text{in} - y}{\text{change} - \text{in} - x}$. WE CALL THIS RATIO THE SLOPE OF THE FUNCTION. Have students find the slope for Bowling Bonanza and Lucky Lanes in the same way. • The SLOPE is larger for Ten Pin Haven, is less for Bowling Bonanza, and is zero for Lucky Lanes. • The starting cost is the cost for zero bowlers. It is the point where each graph crosses the y-axis, or is the y value when $x = 0$. These points are called the Y-INTERCEPTS.

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S H A R E D I S C U S S A N D A N A L Y Z E	<u>FACILITATING THE SHARE, DISCUSS, AND ANALYZE PHASE OF THE LESSON (Cont'd.)</u> ** Why does Ten Pin Haven's plan eventually catch up with the other two plans even though it starts out the least expensive? ** Which plan did you choose? Show us how you can use the graphs to explain your choice. Is it easier to use the graph or the table to explain your choice? Summary: ** Why are the graphs of the plans straight lines? ** What is the slope of the Lucky Lanes' graph? Where can we find the slope in the table? What does it mean in the plan? ** What is the y-intercept of the Bowling Bonanza graph? Where can we find the y-intercept in the table? What does it mean in the plan?	<u>FACILITATING THE SHARE, DISCUSS, AND ANALYZE PHASE OF THE LESSON (Cont'd.)</u> - Since Ten Pin Haven's plan costs more per person, the SLOPE is steeper and it increases faster. Therefore, even though it starts out less expensive, it will catch up with the other plans. - Again, call on students who reached different conclusions; they must refer to the number of bowlers – and the graph that is on the bottom – to justify their choice. The graph helps you to see where your choices should change – the places where the “lines” would cross. Summary: It is important to return to the goals of the lesson to help students focus on the BIG IDEAS that they are supposed to take away from the activity.

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S H A R E D I S C U S S A N D A N A L Y Z E	<u>FACILITATING THE SHARE, DISCUSS, AND ANALYZE PHASE OF THE LESSON (Cont'd.)</u> <u>EXTENSION:</u> <i>Writing an equation:</i> If students wrote equations, have them share them with the class. Then ask the entire class: Where do we see the slope in the equations? Where do we see the y-intercept? What does x [whatever variable is used] represent? Why do we multiply x by the slope? Why do we add the y-intercept?	<u>FACILITATING THE SHARE, DISCUSS, AND ANALYZE PHASE OF THE LESSON (Cont'd.)</u> <u>EXTENSION:</u> <i>Writing an equation:</i> - Some students will be ready to link this problem to their work with variables and expressions. Give them a chance to share their work with the class if time permits. - The equations will be: - Lucky Lanes $c = 200$ or $c = 200 + 0b$ - Bowling Bonanza $c = 150 + .5b$ - Ten Pin Haven $c = 60 + 2b$ Where c = total cost and b = number of bowlers Students should be able to identify the variable as the # of bowlers. They should see that the coefficient of the variable is the slope that is the cost per bowler; and the constant is the y-intercept, which is the initial cost. They multiply the number of bowlers by the slope because that's how much each bowler will cost; they add the y-intercept because that's the flat fee that gets added on no matter how many bowlers you have.

7th Grade Unit 4 Task
2005 – 2006

Planning a Bowling Party



The 7th grade is planning a bowling party to celebrate the end of the school year. Juan and Camilla decided to call different companies to find their group rates for an afternoon of unlimited bowling. They found three different plans:

- *Bowling Bonanza* charges \$150 to reserve the lanes for the afternoon plus a charge 50¢ per person for both bowling and shoes. (The initial fee is nonrefundable.)
- *Ten Pin Haven* charges \$60 to reserve the lanes for the afternoon plus \$2 per person for both shoes and bowling. (The initial fee is nonrefundable.)
- *Lucky Lanes* charges a flat non-refundable rate of \$200 -- this includes both shoes and bowling for everyone.

Represent the total cost for each of the plans using a table and a graph.

Explore:

1. What do you notice about each of the plans? How are they the same? How are they different?
2. Describe how the initial fee and additional cost per person of each plan are represented in the table and in the graph.

Choose the company that you think would be the best deal and explain to Juan and Camilla why you chose that plan.

EXTENSION: Represent each plan by writing an equation. How are the details of each plan represented in the equations? Also, you may want to have students create their own plan that would be a better deal than any of these three. This would continue to challenge them to think about what slope or rate of change is and how it relates to the context.

A Possible Table

# of Bowlers	Lucky Lanes	Bowling Bonanza	Ten Pin Haven
0	200	150	60
10	200	155	80
20	200	160	100
30	200	165	120
40	200	170	140
50	200	175	160
60	200	180	180
70	200	185	200
80	200	190	220
90	200	195	240
100	200	200	260
110	200	205	280
120	200	210	300
130	200	215	320
140	200	220	340
150	200	225	360
160	200	230	380
170	200	235	400
180	200	240	420
190	200	245	440
200	200	250	460

A Graphical Representation

