CDs for the Band

Bryan and his band want to record and sell CDs. There will be an initial set-up fee of $250, and each CD will cost $5.50 to burn. The recording studio requires bands to make a minimum purchase of $850, which includes the set-up fee and cost of burning CDs.

1. Write a function relating the total cost and the number of CDs burned.

2. Write and solve an inequality to determine the minimum number of CDs the band can burn to meet the minimum purchase of $850.

3. If the initial set-up fee is reduced by 50%, will the total cost be less than, equal to, or more than 50% of the original total cost? Justify your answer.

Teacher Notes

Materials:
One graphing calculator per student.

Connections to Algebra I TEKS and Performance Descriptions:

(b.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:
(C) describes functional relationships for given problem situations and writes equations or inequalities to answer questions arising from the situations;

(D) represents relationships among quantities using concrete models, tables, graphs, diagrams, verbal descriptions, equations, and inequalities.

(b.3) Foundations for functions.
The student understands how algebra can be used to express generalizations and recognizes and uses the power of symbols to represent situations.

The student:
(A) uses symbols to represent unknowns and variables

(b.4) Foundations for functions.
The student understands the importance of the skills required to manipulate symbols in order to solve problems and uses the necessary algebraic skills required to simplify algebraic expressions and solve equations and inequalities in problem situations.

The student:
(B) uses the commutative, associative, and distributive properties to simplify algebraic expressions.

Scaffolding Questions:

- What will the cost be if they purchase only one CD? Two CDs? Ten CDs?
- What are the constants for this situation?
- What are the variables?
- Describe in words the dependency relationship between the variables.
- What does the $850 represent in this situation?

Sample Solution:

1. The total cost of recording CDs is a $250 set-up fee plus $5.50 times the number of CDs you want to purchase.

   $C = 250 + 5.50n$ where C represents the total cost and n represents the number of CDs

2. The total cost must be less than or equal to $850.
   Use the rule and put the values in a table.

Number of CDs	Total Cost
1	$255.50
10	$305.00
100	$800.00
110	$855.00

You know from the table that 110 CDs cost $855.00, which was just a little over the minimum fee of $850. Next calculate the cost of 109 CDs using the rule and find that the total cost equals

$250.00 + $5.50(109) = $849.50

109 CDs cost less than $850. They must purchase at least 110 CDs.

Another approach is to use the inequality to solve the problem.

$$250 + 5.50x \geq 850$$
$$5.50x \geq 850 - 250$$
$$5.50x \geq 600$$
$$x \geq 109.09$$

CDs must be purchased in whole number quantities. Therefore, the band can purchase 110 CDs.

3. If the set-up fee is reduced by 50%, it will be 0.50(250) or $125. The cost function becomes $C = 125 + 5.50n$. 50% of the original cost is

   $0.50(250 + 5.50n) = 0.50(250) + 0.50(5.50)n = 125 + 2.75n.$

   $125 + 2.75n \leq 125 + 5.50n$

   The new cost is more than 50% of the original cost.

Extension Questions:

- Suppose Bryan has found another company that charges a set-up fee of $200 and charges $6.00 per CD. Would this be a better company from which to purchase CDs if they have $850?

The cost function under these conditions is C = 200 + 6n

$$200 + 6x = 850$$
$$6x = 850 - 200$$
$$6x = 650$$
$$x = 108.33$$

They could purchase 108 CDs. This is not a better company to purchase from if they have $850.

(c.1) Linear functions.
The student understands that linear functions can be represented in different ways and translates among their various representations.

The student:
(B) determines the domain and range values for which linear functions make sense for given situations.

(c.3) Linear functions.
The student formulates equations and inequalities based on linear functions, uses a variety of methods to solve them, and analyzes the solutions in terms of the situation.

The student:
(A) analyzes situations involving linear functions and formulates linear equations or inequalities to solve problems;

(B) investigates methods for solving linear equations and inequalities using concrete models, graphs, and the properties of equality, selects a method, and solves the equations and inequalities; and

(C) for given contexts, interprets and determines the reasonableness of solutions to linear equations and inequalities.

- Under what circumstances would the second company be a better choice for the band to use for producing their CDs?

Texas Assessment of Knowledge and Skills:

Objective 4:
The student will formulate and use linear equations and inequalities.

Connections to Algebra I: 2000 and Beyond Institute:

I. Foundations for Functions
1 Developing Mathematical Models
1.2 Valentine's Day Idea

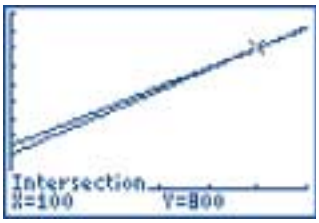
II. Linear Functions
1 Linear Functions
1.2 The Y-Intercept

Connections to Algebra End-of-Course Exam:

Objective 4:
The student will formulate or solve linear equations/inequalities and systems of linear equations that describe real-world and mathematical situations.

Objective 5:
The student will formulate or solve quadratic equations that describe real-world and mathematical situations.

The tables and graphs of the two functions may be compared to determine when they are equal in cost.



The functions have the same value when x is 100. The first company's cost is greater for values of x less than 100. The second company's cost is more for values of x more than 100.

If they are going to purchase less than 100 CDs, they should buy from the second company. If they are going to purchase more than 100 CDs, they should buy from the first company.