Goal 1: Functions & Algebra

Systems of Linear Equations – Slope-Intercept Form

OBJECTIVE	CORE LEARNING GOALS
• Students will use the calculator to represent a situation as a table, graph, and equation. • Students will write systems of equations and find solutions to systems of equations. • Students will explain how they determined their solutions to a system of equations. Students will also justify their solutions.	1.1.2 The student will represent patterns and/or functional relationships in a table, as a graph, and/or by mathematical expression. 1.2.1 The student will determine the equation for a line, solve linear equations, and/or describe the solutions using numbers, symbols, and/or graphs. 1.2.3 The student will solve and describe if and where two straight lines intersect using numbers, symbols, and or graphs.
DRILL	MATERIALS • Graphing Calculator • Student Worksheet • Answer Key • Additional Problems
CALCULATOR SKILLS • Enter data into a list • Setting up appropriate viewing windows • Graphing systems of linear equations • Finding the point of intersection of two equations	
ACTIVITIES 1. **Drill**. 2. **Systems of Linear Equations – Farmers Market –** Incorporate group work and class discussions into the **Lesson** as students complete the **Student Worksheet.** 3. **Additional problems –** These problems are provided for you to use in any one of a variety of ways such as homework, an individual check for understanding, review, or quiz.	
ASSESSMENT Class discussion Group work	HOMEWORK

FARMERS MARKET
(Systems of Linear Equations – Slope-Intercept Form)

Lesson:

Engage students in the content.

A farmer wants to estimate the cost of transporting his produce to market. There are two trucking companies that he can choose from to transport his produce. The Long Haul trucking company charges $10.00 per mile and a flat fee of $1000. The Keep On trucking company charges $4.50 per mile and a flat fee of $1500.

1. For each trucking company, complete the tables that show the number of miles to market (*m*) and the total cost of transporting the produce (*T)* if the markets are 10, 20, 30, 40, and 50 miles away. (CLG: 1.1.2)

2. Enter your data into the list storage of your calculator. (CLG: 1.1.2)

> Teacher Tip:
> Discuss with students how to name their lists. This will help them save their lists for many different activities, so they can go back to them if they need to.

3. Set up an appropriate graphing window, and then graph the data. (CLG: 1.1.2)

> Teacher Tip:
> Discuss with your students what makes an appropriate window. Discuss the mathematics behind graphing data just as if you were graphing it on paper. Discuss the domain of the x values, and the range of the y values. Help students to see the data points in different windows and understand the need for an appropriate window.

4. What type of relationship exists among the data points for each trucking company?

> Teacher Tip:
> Discuss with the students linear and non-linear relationships.

5. For each trucking company, determine the equation that best describes the relationship between the miles to market (*m*) and the total cost of transporting the produce (*T*). Use mathematics to explain how you determined your equations. Use words, symbols, or both in your explanation. (CLG: 1.2.1)

Long Haul trucking company equation: _____

Keep On trucking company equation: _____

> Teacher Tip:
> Discuss with the students the meaning of the slope in the equation. Also discuss with them how to explain the steps they went through to get the equation.

6. Use your equations to determine how much each trucking company would charge to transport the produce to a market 100 miles away. Use mathematics to explain how you determined your answers. Use words, symbols or both in your explanation. (CLG: 1.2.1)

7. What does the y-intercept of each line mean in terms of the context of the problem?

8. Using your calculator, find the point of intersection of the two lines. (CLG: 1.2.3)

> Teacher Tip:
> - Enter both equations into the equation screen of the graphing calculator. Graph the equations with an appropriate window and use the functions of the calculator to find the point of intersection.
> - Discuss the meaning of the intersection of two equations.
> - Discuss systems of equations and their solutions.

9. For what distance would the cost of transporting the produce be the same for both trucking companies? Round your answer to the nearest mile.

10. What is the cost of transporting the crops this distance?

11. Use mathematics to justify your answers to numbers 9 and 10.

FARMERS MARKET

Student Worksheet:

A farmer wants to estimate the cost of transporting his produce to market. There are two trucking companies that he can choose from to transport his produce. The Long Haul trucking company charges $10.00 per mile and a flat fee of $1000. The Keep On trucking company charges $4.50 per mile and a flat fee of $1500.

1. For each trucking company, complete the tables that show the number of miles to market (m) and the total cost of transporting the produce (T) if the markets are 10, 20, 30, 40, and 50 miles away.

Long Haul Trucking

Number of Miles (m)	Total Cost (T)
10	
20	
30	
40	
50	

Keep On Trucking

Number of Miles (m)	Total Cost (T)
10	
20	
30	
40	
50	

2. Enter your data into the list storage of your calculator.

3. Set up an appropriate graphing window, and then graph the data.

4. What type of relationship exists among the data points for each trucking company?

5. For each trucking company, determine the equation that best describes the relationship between the miles to market (*m*) and the total cost of transporting the produce (*T*). Use mathematics to explain how you determined your equations. Use words, symbols, or both in your explanation. (CLG: 1.2.1)

Long Haul trucking company equation: _____

Keep On trucking company equation: _____

Explanation:

6. Use your equations to determine how much each trucking company would charge to transport the produce to a market 100 miles away. Use mathematics to explain how you determined your answers. Use words, symbols or both in your explanation. (CLG: 1.2.1)

7. What does the y-intercept of each line mean in terms of the context of the problem?

8. Using your calculator, find the point of intersection of the two lines.

9. For what distance would the cost of transporting the produce be the same for both trucking companies? Round your answer to the nearest mile.

10. What is the cost of transporting the crops this distance?

11. Use mathematics to justify your answers to numbers 9 and 10.

FARMERS MARKET
Answer Key

A farmer wants to estimate the cost of transporting his produce to market. There are two trucking companies that he can choose from to transport his produce. The Long Haul trucking company charges $10.00 per mile and a flat fee of $1000. The Keep On trucking company charges $4.50 per mile and a flat fee of $1500.

2. For each trucking company, complete the tables that show the number of miles to market (m) and the total cost of transporting the produce (T) if the markets are 10, 20, 30, 40, and 50 miles away.

Long Haul Trucking

Number of Miles (m)	Total Cost (T)
10	1100
20	1200
30	1300
40	1400
50	1500

Keep On Trucking

Number of Miles (m)	Total Cost (T)
10	1545
20	1590
30	1635
40	1680
50	1725

2. Enter your data into the list storage of your calculator.

3. Set up an appropriate graphing window, and then graph the data.

4. What type of relationship exists among the data points for each trucking company?

Linear

5. For each trucking company, determine the equation that best describes the relationship between the miles to market (*m*) and the total cost of transporting the produce (*T*). Use mathematics to explain how you determined your equations. Use words, symbols, or both in your explanation. (CLG: 1.2.1)

Long Haul trucking company equation: *T = 10m +1000*
Keep On trucking company equation: *T = 4.5m + 1500*

Explanation: (example)
Using y = mx + b, I knew the slope (m) for each equations would be the rate of change per mile and the y-intercept (b) would be the flat fee because it is the cost when the mileage is 0.

6. Use your equations to determine how much each trucking company would charge to transport the produce to a market 100 miles away. Use mathematics to explain how you determined your answers. Use words, symbols or both in your explanation.

Long Haul trucking company: 10(100) + 1000 = $2000

Keep On trucking company: 4.5(100) + 1500 = $1950

7. What does the y-intercept of each line mean in terms of the context of the problem?

The y-intercept is the flat fee for each of the trucking companies.

8. Using your calculator, find the point of intersection of the two lines.

(90.91, 1909.09)

9. For what distance would the cost of transporting the produce be the same for both trucking companies? Round your answer to the nearest mile.

91 miles

10. What is the cost of transporting the crops this distance? *$1909.09*

11. Use mathematics to justify your answers to numbers 9 and 10.

The point of intersection of a graph is the point that makes both equations true.

Or

10(91) + 1000 1909
4.5(91) + 1500 1909 (because of rounding)

Systems of Linear Equations
Additional Problems

1. You are going to a baseball game at Camden yards. A parking garage down the street from the ballpark charges a flat fee of $10 and $0.50 per hour for parking. A parking garage across the street from the ballpark charges a flat fee of $5 and $1.50 per hour for parking.
   - For each parking garage, write an equation that represents the total costs for parking.
   - Graph the two equations.
   - Determine after how many hours the cost would be the same for both parking garages. What is the cost for this amount of time? Use mathematics to explain how you determined your answers. Use words, symbols or both in your explanation.

2. Jack and Jill both mow lawns on weekends. Jack bought a new mower this year and determined that his profit equation for mowing lawns this year is $P = 15N – 300$ where P is his total profit and N is the number of lawns he has mowed. Jill also bought a new mower this year and determined that her profit equation for mowing lawns this year is $P = 20N – 450$.
   - Interpret the meaning of the –300 and the –450 in the equations in the context of the problem.
   - Solve the system of profit equations. What does this point mean in the context of the problem? Use mathematics to justify your answer.

3. Writing a check without having enough money in the bank is called bouncing a check. One store in the mall charges a 6% penalty on the amount of the check and a $5 fee for bouncing a check. Another store in the mall charges only a $15 fee for bouncing a check.
   - When will the total cost of bouncing a check be the same for both stores? Use mathematics to justify your answer.
   - What is the total cost at both stores for bouncing a $55.00 check? Use mathematics to explain how you determined your answers. Use words, symbols, or both in your explanation.

4. Mary's two favorite aunts send her money every year on her birthday. Mary's parents put the money into a savings account for Mary. Aunt Cleo decided to give Mary $50 for her first birthday and $5 every birthday after that. Aunt Cheryl decided to give Mary $10 for every birthday.
   - Determine when Mary has received the same amount of money from both aunts. Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.