VALENTINE'S DAY IDEA

Focus: Investigation of functional relationships for a given problem situation using tables, graphs, and algebraic representations.

Objective:

Alg I TEKS, Foundations for Functions #1
The student understands that a function represents a dependence of one quantity on another and can be described in a variety of ways.

Alg I TEKS, Foundations for Functions #3
The student understands algebra as the mathematics of generalization and recognizes the power of symbols to represent situations.

Terms: Function, independent variable, dependent variable, pattern

Set-Up: Whole group activity.

Materials: Transparencies #9-17, Activities #2-7, graphing calculators

Prerequisites: Identification of number patterns

Procedure:

Transparency #9: Valentine's Day Idea
Activity #2: Valentine's Day Idea

Introduce problem situation. Discuss which seems better: (a) 75 cents per rose vs. 50 cents per rose, (b) $20 fixed cost vs. $60 fixed cost, (c) 75 cents per rose plus $20 fixed cost vs. 50 cents per rose plus $60 fixed cost. Because students have a tendency to focus on certain parts of a problem situation while not attending to other parts, this line of questioning assists them in considering multiple variables at one time. The intent is also to get them to verbalize the algebraic rules that describe the functions.

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Transparency #10: Using Tables to Find the More Economical Offer
Activity #3: Using Tables to Find the More Economical Offer

When this activity is used with students, the teacher should assist them in creating the rules that describe the dependent relationship between the number of roses sold and the cost. Students should complete the chart.

Emphasize Alg I TEKS, Foundations for Functions #1
1.a. The student describes independent and dependent quantities in functional relationships.
Emphasize Alg I TEKS, Foundations for Functions #3
3.a. Given situations, the student looks for patterns and represents generalizations algebraically.

Table-building features of the graphing calculator need to be introduced (or revisited). In STAT, 1:Edit, enter in L1 values for x (30, 60, 90, 120, 150, 180, 210, 240, 270, 300). With cursor on L2 enter first function (.75*L1 + 20), ENTER and with cursor on L3 enter second function (.50*L1 + 60), ENTER.

An alternative approach is to enter the two functions into Y= and use the TABLE and TblSet features of the calculator.

Answers
1. Answers will vary.
2. The cost increases as the number of roses purchased increases. The graph is linear with a positive slope.
3. Roses-R-Red offers the better deal for n<160, there is not difference for n=160, and Flower Power offers the better deal for n>160.
4. The point of intersection is (160, 140). This point signifies that at n=160 roses, the cost ($140) is the same with either flower dealer.

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Transparencies #11-12: Using Graphs to Find the More Economical Offer
Activity #4: Using Graphs to Find the More Economical Offer

Note that the ways in which two variables are related is not always shown clearly by tables of input-output values. Patterns in the data may be lost amid all the specific numbers. However, when data are displayed in a *graph*, it is often much easier to see trends and therefore to make predictions and/or informed decisions.

Make connection between patterns seen in the tables of values and the graphs of the same ordered pairs. As the number of roses increases, the total cost increases.

Make connection between pattern seen in graph and interpretation. Note that to get from one point to another one, we must move to the right (increase in quantity) and then up (increase in cost) or we can move to the left (decrease in quantity) and then down (decrease in cost).

Emphasize Alg I TEKS, Foundations for Functions #1
1.d. The student represents relationships among quantities using concrete models, tables, graphs, diagrams, verbal descriptions, and algebraic representations.
1.e. The student interprets and makes inferences from functional relationships.
Emphasize Alg I TEKS, Foundations for Functions #2
2.c. The student interprets situations or creates situations that fit given graphs.

Discuss the meaning of slope and Y-intercept within the context of this problem. For example, the algebraic rule $Y_1=.75x + 20$ yields (a) y-intercept of 20 which indicates the fixed cost that has to be paid initially and (b) slope of .75 which indicates the constant rate of change or the constant increase in cost for the purchase of each rose.

Transparency #13: New Rose Offer
Activity #5: New Rose Offer
Introduce the new offer made by the distributors.

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Transparency #14: Using Tables for New Rose Offer
Transparency #15: Making Comparisons
Activity #6: Using Tables for New Rose Offer

Encourage participants to complete the table so that comparisons between the table in activity #3 and this one can be made. Discuss changes from old deal to new deal. Ask participants to share ways to assist students in making the connection between the table values and the corresponding graphs.

Transparencies #16-17: Using Graphs for New Rose Offer
Activity #7: Using Graphs for New Rose Offer

A graph can be used in comparing the two dependent relations. We can see from the graphs that the two flower distributors charge the same amount when 160 roses are purchased. Roses-R-Red is less expensive when $n<160$ and Flower Power is less expensive when $n>160$.

Note that the slight modification made to the old deal is reflected in the function rules and their representations. For example,

$f(n) = .75x + 20$	old offer by Roses-R-Red
$r(n) = f(n) - 20 = .75x$	new offer by Roses-R-Red
$g(n) = .50x + 60$	old offer by Flower Power
$s(n) = g(n) - 20 = .50x + 40$	new offer by Flower Power.

Note the relationship between the graphical representation of $.75x + 20 = .50x + 60$ and the graphical representation of $.75x = .50x + 40$. Although both functions shift 20 units down the y-axis, the intersection of the transformed graphs has the same input value as the original graphs.

Emphasize Alg I TEKS, Foundations for Functions #1
1.c. The student describes functional relationships for given problem situations and writes equations or inequalities to answer questions arising from the situations.

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USING TABLES TO FIND THE MORE ECONOMICAL OFFER

From the description of each of the two offers, write an algebraic rule that will determine the cost of "n" roses. Complete the chart.

# Roses	Process Column	Cost at Roses-R-Red	Process Column	Cost at the Flower Power
30				
60				
90				
120				
150				
180				
210				
240				
270				
300				
n				

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USING GRAPHS TO FIND THE MORE ECONOMICAL OFFER

Roses-R-Red $f(x) = .75x + 20$

Flower Power $g(x) = .50x + 60$

Using your calculator, graph each of the cost functions and answer the following questions.

1. **What effect does the 75 cents per stem cost have on the graph of the Roses-R-Red function? What effect does the $20 have on the graph?**

2. **What effect does the 50 cents per stem cost have on the graph of the Flower Power function? What effect does the $60 have on the graph?**

3. **Which flower dealer offers the better deal?**

4. **What are the coordinates of the point where the two functions intersect? What is the significance of this point?**

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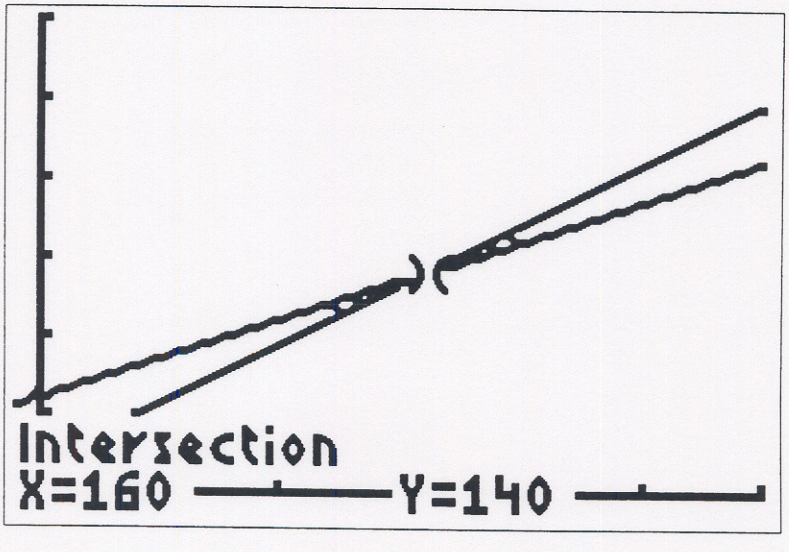
USING GRAPHS TO FIND THE MORE ECONOMICAL OFFER

Roses-R-Red $r(x) = .75x + 20$

Flower Power $f(x) = .50x + 60$



Viewing Window: (-10, 300, 50, -10, 300, 50)

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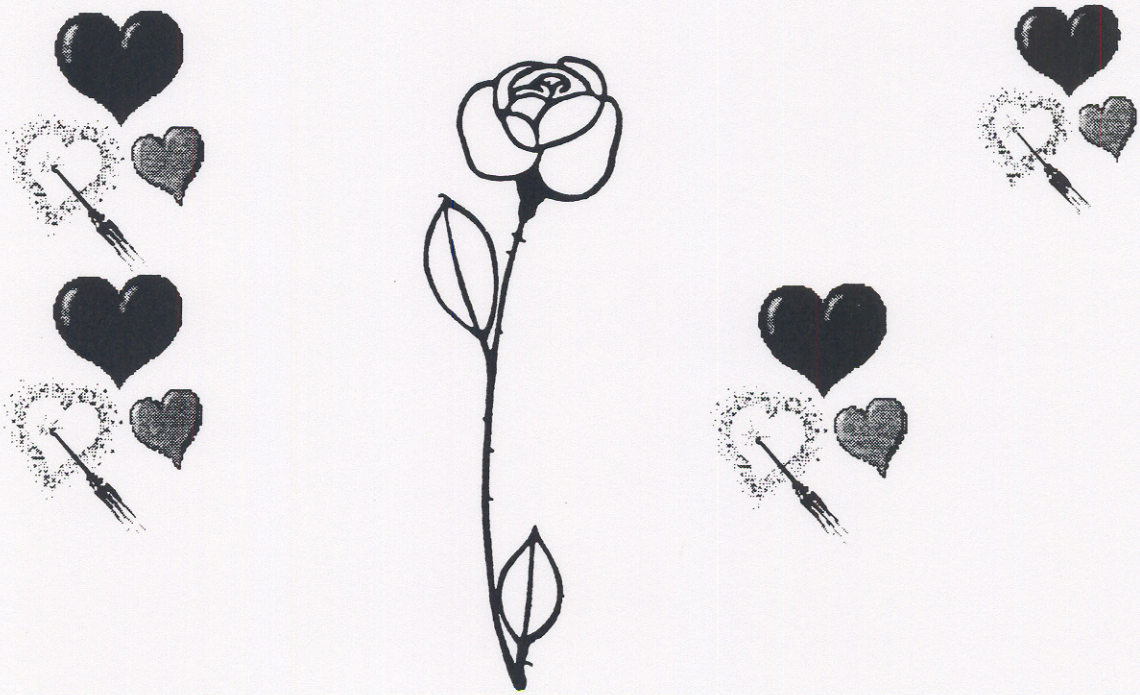
NEW ROSE OFFER

To entice these potential new customers, Roses-R-Red decides to eliminate its fixed charge of $20. According to its new offer, the drill team pays only for the roses they buy. When the Flower Power learns about the new offer by its competitor, it immediately enters the price war by reducing its fixed charge also by $20.

Which new deal is the better offer?

How does the new offer compare to the original offer?



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USING TABLES FOR NEW ROSE OFFER

From the description of the two new deals, adjust the old function rules for the new charging policies of the two flower dealers. Write an algebraic rule that will determine the cost of "n" roses. Complete the chart.

# Roses	Process Column	Cost at Roses-R-Red	Process Column	Cost at Flower Power
30				
60				
90				
120				
150				
180				
210				
240				
270				
300				
n				

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MAKING COMPARISONS

Original Offer

# Roses (old)	Process Column	Cost at Roses-R-Red	Process Column	Cost at Flower Power
30		$42.50		$75.00
60		$65.00		$90.00
90		$87.50		$105.00
120		$110.00		$120.00
150		$132.50		$135.00
180		$155.00		$150.00
210		$177.50		$165.00
240		$200.00		$180.00
n		.75x + 20		.50x + 60

New Offer

# Roses	Process Column	Cost at Roses-R-Red	Process Column	Cost at Flower Power
30		$22.50		$55.00
60		$45.00		$70.00
90		$67.50		$85.00
120		$90.00		$100.00
150		$112.50		$115.00
180		$135.00		$130.00
210		$157.50		$145.00
240		$180.00		$160.00
n		.75x		.50x + 40

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USING GRAPHS FOR NEW ROSE OFFER

Roses-R-Red $r(x) = .75x$

Flower Power $s(x) = .50x + 40$

Using your calculator, graph each of the cost functions and answer the following questions.

1. **What effect does subtracting $20 from the old rule have on the new graph of the Roses-R-Red function?**

2. **What effect does subtracting $20 from the old rule have on the new graph of Flower Power function?**

3. **Which flower dealer offers the better new deal?**

4. **What are the coordinates of the point where the two functions intersect? What is the significance of this point?**

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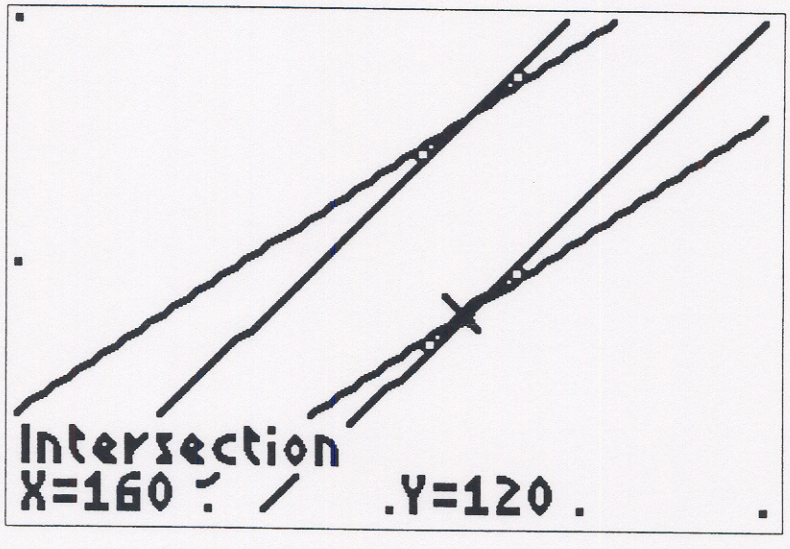
USING GRAPHS FOR NEW ROSE OFFER

Roses-R-Red $r(x) = .75x$

Flower Power $f(x) = .50x + 40$



Viewing Window: (100, 200, 25, 100, 150, 25)

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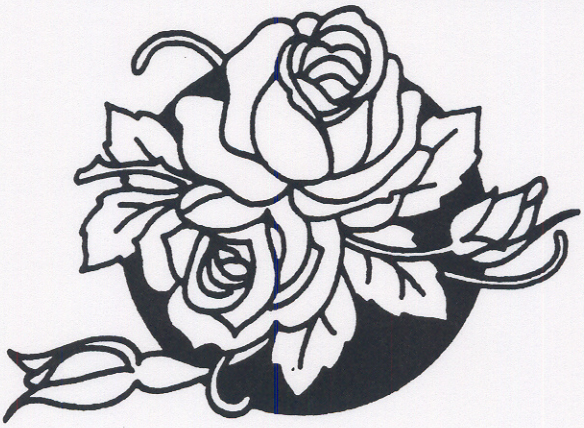
VALENTINE'S DAY IDEA

The school's student council **has contacted several flower distributors and has narrowed the choice to two companies. They need to determine the more economical option.**



<u>Option 1</u>: Roses-R-Red has offered to sell its roses for a fixed down payment of $20 and an additional charge of 75 cents per stem.

<u>Option 2</u>: The Flower Power has offered to sell its roses for a fixed down payment of $60 and an additional charge of 50 cents per stem.

Which is the more economical offer?

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USING TABLES TO FIND THE MORE ECONOMICAL OFFER

From the description of the two offers, write an algebraic rule that will determine the cost of "n" roses. Complete the chart.

# Roses	Process Column	Cost at Roses-R-Red	Process Column	Cost at the Flower Power
30				
60				
90				
120				
150				
180				
210				
240				
270				
300				
n				

1. What patterns do you observe from the table of values?
2. What happens to the cost of the roses as the number of roses purchased increases? What would a graph of this relationship look like?
3. Which company offers the better deal?
4. Is there a point where the two flower dealers charge the same amount? If so, what is the charge? If not, why do the costs never equal?

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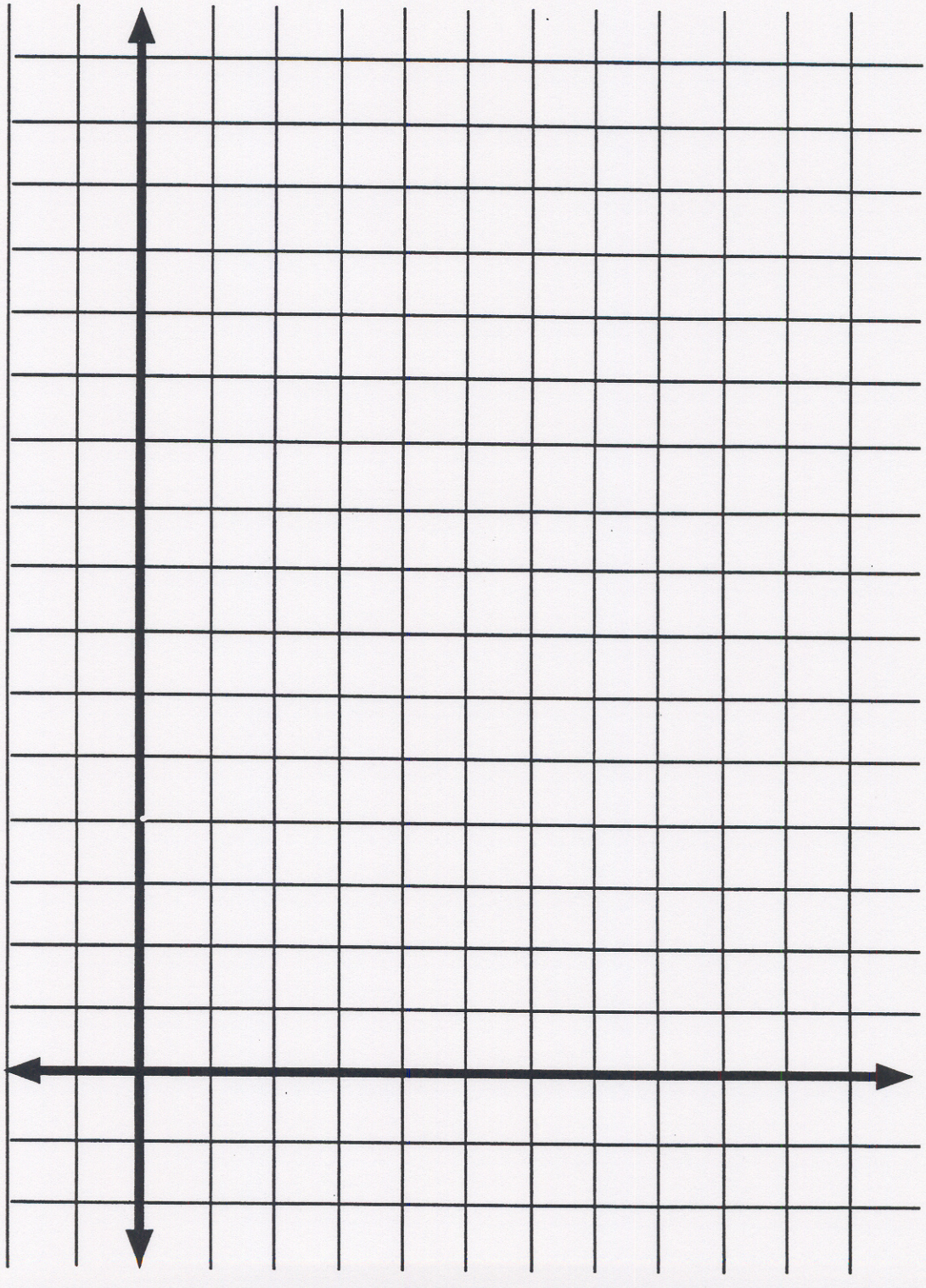
USING GRAPHS TO FIND THE MORE ECONOMICAL OFFER



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NEW ROSE OFFER

To entice these potential new customers, Roses-R-Red decides to eliminate its fixed charge of $20. According to its new offer, the drill team pays only for the roses they buy. When the Flower Power learns about the new offer by its competitor, it immediately enters the price war by reducing its fixed charge also by $20.

Which new deal is the better offer?

How does the new offer compare to the original offer?

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USING TABLES FOR NEW ROSE OFFER

From the description of each of the two new deals, adjust the old function rules for the new charging policies of the two flower dealers. Write an algebraic rule that will determine the cost of "n" roses. Complete the chart.

# Roses	Process Column	Cost at Roses-R-Red	Process Column	Cost at the Flower Power
30				
60				
90				
120				
150				
180				
210				
240				
270				
300				
n				

1. What patterns do you observe in the new table of values?
2. Compare the costs on this chart to the costs on the first chart? What changes do you observe? Predict what the graph will look like.
3. Which company offers the better deal?
4. Is there a point where the two flower dealers charge the same amount? If so, what is the charge? If not, why do the costs never equal?

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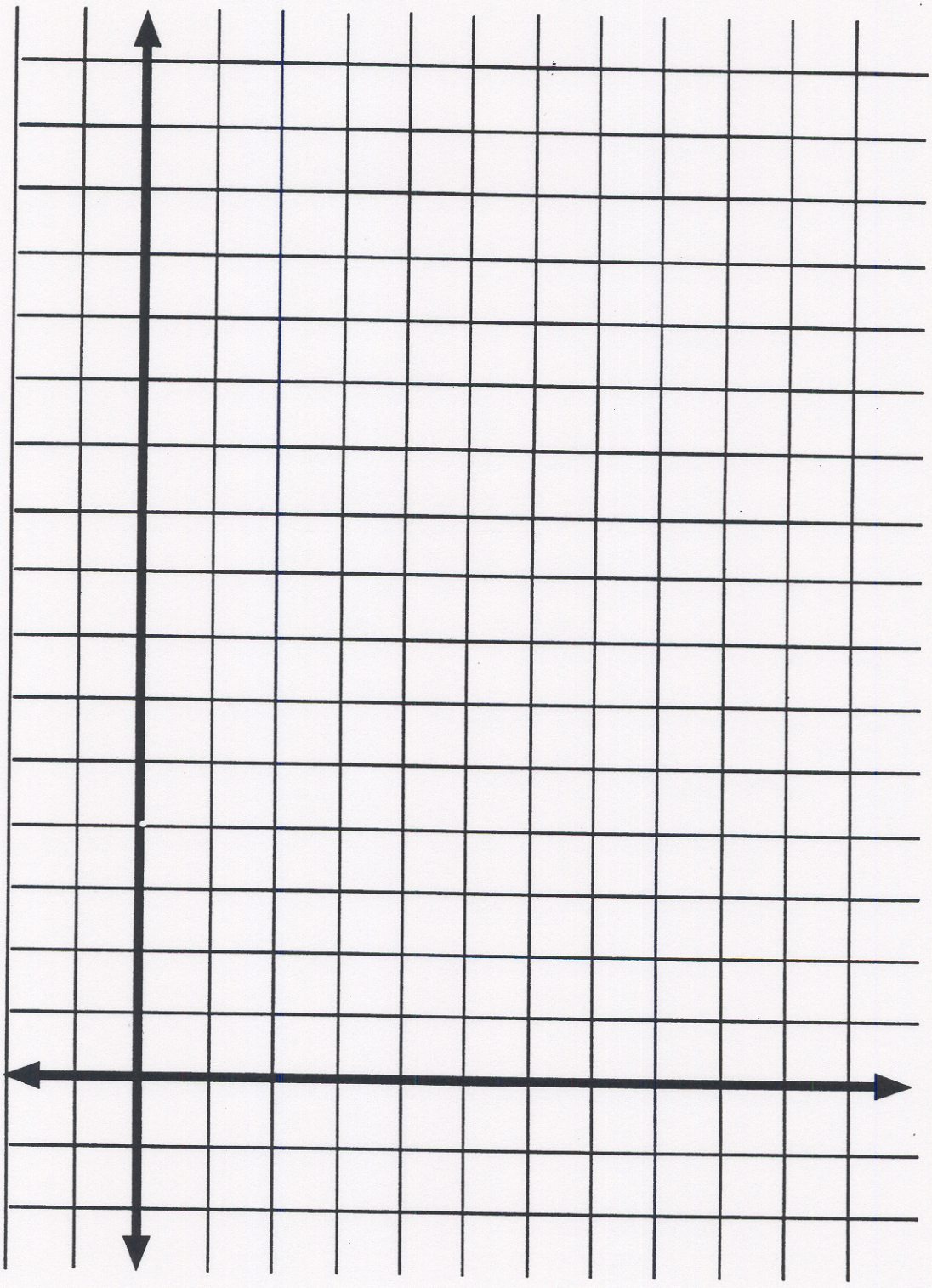
USING GRAPHS FOR NEW ROSE OFFER



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BETTER-PAYING SUMMER JOB

Focus: Comparison of two linear functions arising out of a problem situation through the use of tables and graphs.

Objective:

Algebra I TEKS, Linear Functions #5
The student understands that linear functions can be represented in different ways and translates among their various representations.

Algebra I TEKS, Linear Functions #6
The student understands the meaning of the slope and intercepts of linear functions and interprets and describes the effects of changes in parameters of linear functions in real-world and mathematical situations.

Terms: Rate of increase, slope, y-intercept, x-intercept

Set-Up: Participants should be seated at tables in groups of 3-4.

Materials: Transparencies #25-27, Activities #25-26, graphing calculators

Prerequisites: Linear function, slope, y-intercept, x-intercept

Procedure:

Transparency #25: Better-Paying Summer Job
Activity #25: Better-Paying Summer Job

Participants are to complete the table, create a scatter plot of the data points, and answer the questions.

Number of Hours Worked	Wages Earned Job Offer #1	Wages Earned Job Offer #2
0	-45	0
20	+45	70
40	135	140
60	225	210
80	315	280
100	405	350
120	495	420
n	4.5n-45	3.5n

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