AFTERSCHOOL TRAINING TOOLKIT

Math Tools
Cell Phone Plans

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The Bell sisters, Ding and Ling, are comparing cell phone plans. They want to share a plan and need to decide which option is the best for them. Here are two monthly plans that are available in their area:

- **Plan A:** $30 flat fee per month and $0.10/minute for each call (a "pay as you go" plan);
- **Plan B:** $60 flat fee per month (for up to 900 minutes);

Help the Bell sisters decide which plan is best for them.

Begin by completing the table:

Minutes	Cost	
	Plan A	Plan B
0		
100		
200		
300		
400		
500		
600		
700		
800		
900		
Any number of minutes, N		

1. Using graph paper, plot the points for each plan on the same set of axes. Use a different symbol to mark each plan, and make a key to show which symbol goes with which plan. You will refer back to this hand-drawn graph when you work on the upcoming questions. It is important to make as many connections as you can between what you draw on the graph, and what you enter into and see on the graphing calculator.

1. Enter the equations you found for each plan into the graphing calculator by pressing the $\boxed{Y=}$ button. Then graph the equations by pressing $\boxed{GRAPH.}$

   a. Hint #1: Substitute X for N from your expression in the last row of the table. Press $\boxed{X,T, ,n}$ to display the X in your equation.
   b. Hint #2: Make sure to set an appropriate window for your graph. Press $\boxed{WINDOW}$ to set the parameters. Use the same scale from the graph you made in Question 1 for the Xmin, Xmax, Ymin, and Ymax (set Xscl=100, Yscl=10, and Xres=1).

Sample Graph
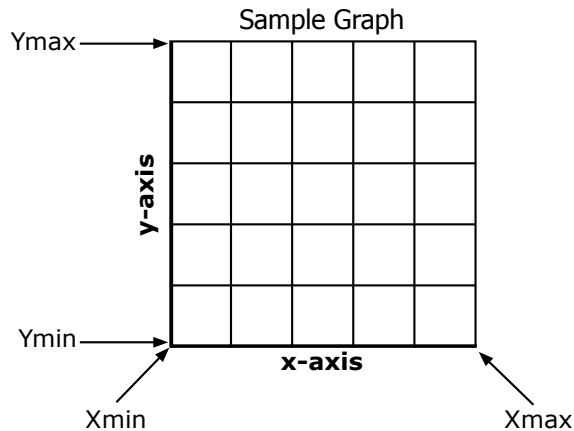
3. There are two y-intercepts on the graph. Name the values of the two y-intercepts. What do the y-intercepts represent in terms of the problem?

4. The two graphs come together at a point of intersection. What is the point of intersection? You can use the $\boxed{CALC}$ button on the graphing calculator to find the exact values. It is above the $\boxed{TRACE}$ button. Choose 5: intersect.

5. Describe what the point of intersection represents in terms of the problem.

6. Is there a way to use the table to determine the intersection point on the graph? If so, how? You can use the TABLE button on the graphing calculator to view the table. It is above the GRAPH button. You can adjust the table by pressing TBLSET , above the WINDOW button.

7. Help the Bell sisters by writing a recommendation for choosing a phone plan. Use data from your graph and table to support your recommendation.

Extension Activities

The Bell sisters find another plan they wish to include in their analysis. They call it **Plan C**. Here are the three plans they are interested in (**Plan A** and **Plan B** haven't changed):

- **Plan A:** $30 flat fee per month and $0.10/minute for each call (a "pay as you go" plan);
- **Plan B:** $60 flat fee per month (for up to 900 minutes);
- **Plan C:** $40 flat fee per month, for up to 500 minutes. For every minute over 500, the company charges $0.40 per minute.

Help the Bell sisters decide which plan is best for them.

Begin by completing the table (you have already completed the columns for **Plan A** and **Plan B**):

Minutes	Cost		
	Plan A	**Plan B**	**Plan C**
0			
100			
200			
300			
400			
500			
600			
700			
800			
900			
Any number of minutes, N			

1. Plot the points for **Plan C** on the same graph you created earlier. Use a different symbol to mark **Plan C**, and make a key to show which symbol goes with which plan.

2. Enter the equations you found for each plan using the $\boxed{\text{Y=}}$ button on the graphing calculator. Once you have entered all three equations, press the $\boxed{\text{GRAPH}}$ button.

    a. Hint #1: To enter a piecewise function, like the one generated by **Plan C**, you can use the following keystrokes:

        Y=(function 1)(X≤500) + (function 2)(X>500), where function 1 and function 2 are the expressions from the final "N" row of the table in column C (substitute X for N).

    b. Hint #2: To enter the < > symbols, press $\boxed{\textbf{2}^{\textbf{nd}}}$ $\boxed{\textbf{MATH}}$, and choose the appropriate symbol.

    c. Hint #3: Make sure to set an appropriate window for your graph. Press $\boxed{\text{WINDOW}}$ to set the parameters. You can use the same scale from the graph you made in Question 1 for the Xmin, Xmax, Ymin, and Ymax (set Xscl=100, Yscl=10, and Xres=1).

3. The three graphs intersect at certain points. How many points of intersection are there? What are the points of intersection? You can use the $\boxed{\text{CALC}}$ button on the graphing calculator to find the exact values. It is above the $\boxed{\text{TRACE}}$ button. Choose 5: intersect.

4. Describe what each point of intersection represents in terms of the problem.

5. Is there a way to use the table to determine the intersection points on the graph? If so, how? You can use the $\boxed{\text{TABLE}}$ button on the graphing calculator to view the table. It is above the $\boxed{\text{GRAPH}}$ button.

6. Help the Bell sisters by writing a recommendation for choosing a phone plan. Use data from your graph and table to support your recommendation.