

Objectives

In this lesson, you will:

- Analyze cost and income equations.
- Graph cost and income equations on the same graph.
- Find the break-even point graphically.



SCENARIO You have a part-time job at a company that makes and sells color art markers. As part of your job, you are studying the company's production costs. The markers are made one color at a time. It costs \$2 to manufacture each marker and there is a \$100 set-up cost for each color. You are also studying the **income**, or the amount of money that the company earns, from the sales of the markers. The company sells the markers to office and art supply stores for \$3 per marker.

Key Terms

- income
- profit
- point of intersection
- break-even point

**Problem 1 Making and Selling Markers**

- A. Write an equation that gives the production cost in dollars to make one color of marker in terms of the number of markers produced. Be sure to describe what your variables represent. Use a complete sentence in your answer.
- B. Write an equation that gives the income in dollars in terms of the number of markers sold. Be sure to describe what your variables represent. Use a complete sentence in your answer.
- C. Find the production cost to make 80 markers of the same color. Show all your work and use a complete sentence in your answer.

Find the income from selling the 80 markers that you made. Show all your work and use a complete sentence in your answer.

Find the profit from the sale of the 80 markers that you made. Show all your work and use a complete sentence in your answer.

Take Note

Remember that the **profit** is the amount of money that is left from sales (income) after the production costs are subtracted.

Problem 1 Making and Selling Markers

- D. Find the production cost to make 100 markers of the same color. Show all your work and use a complete sentence in your answer.

Find the income from selling the 100 markers that you made. Show all your work and use a complete sentence in your answer.

Find the profit if 100 markers are made and sold. Show all your work and use a complete sentence in your answer.

Investigate Problem 1

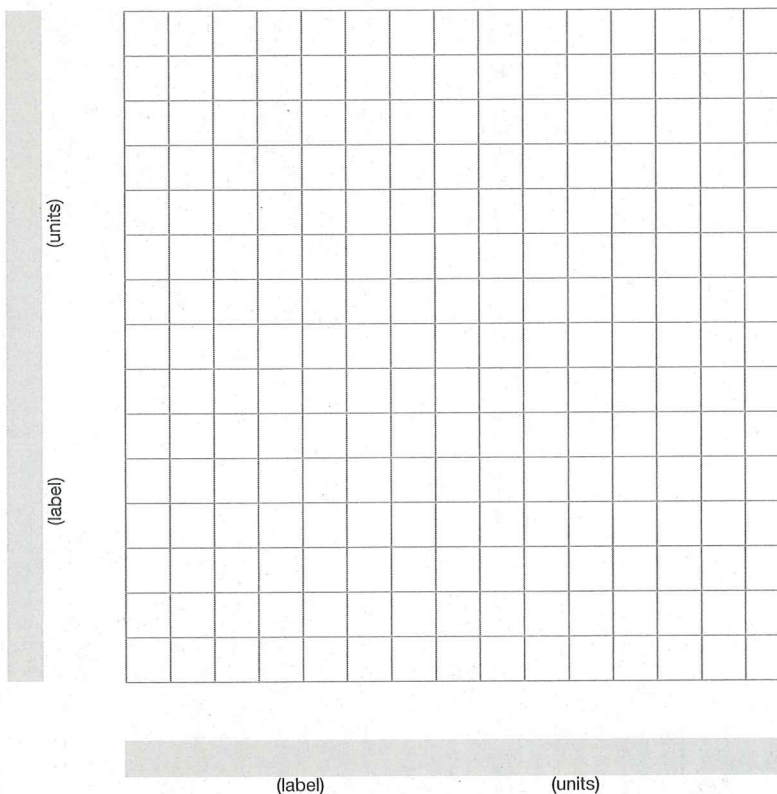
1. Complete the table of values that shows the production cost and income for different numbers of markers of the same color.

Quantity Name	Number of markers	Product cost	Income
Unit	markers	dollars	dollars
Expression	x		
	0		
	20		
	30		
	35		
	55		
	125		
	200		
	400		

Investigate Problem 1

2. Create a graph of both the production cost and income equations on the grid below. Use the bounds and intervals below. Be sure to label your graph clearly.

Variable quantity	Lower bound	Upper bound	Interval
Markers	0	150	10
Money	0	450	30



3. Use your graph to determine the numbers of markers for which the production cost is greater than the income. Use a complete sentence in your answer.

Use complete sentences to explain how you found your answer.

Investigate Problem 1

4. Use your graph to determine the numbers of markers for which the income is greater than the production cost. Use a complete sentence in your answer.

Use complete sentences to explain how you found your answer.

5. Use your graph to determine the number of markers for which the income is equal to the production cost. Use a complete sentence in your answer.

Use complete sentences to explain how you found your answer.

Take Note

Whenever you see the share with the class icon, your group should prepare a short presentation to share with the class that describes how you solved the problem. Be prepared to ask questions during other groups' presentations and to answer questions during your presentation.



6. Describe the numbers of markers that must be sold in order for your profit to be at least \$0. Use complete sentences to explain how you found your answer.

Problem 2 Making and Selling T-Shirts



Your work at the marker company has inspired you to start your own business. You decide to design and sell customized T-shirts. The company that supplies your T-shirts charges you \$7.50 for each T-shirt and a set-up cost of \$22.50 for a new design. You decide to sell the T-shirts for \$8.25 each.

- A. Write an equation that gives the production cost in dollars to make one design of T-shirt in terms of the number of T-shirts made. Be sure to describe what your variables represent. Use a complete sentence in your answer.
- B. Write an equation that gives the income (the amount of money that you earn) in dollars in terms of the number of T-shirts sold. Be sure to describe what your variables represent. Use a complete sentence in your answer.
- C. Find the production cost to make 15 T-shirts in the same design. Show all your work and use a complete sentence in your answer.

Find the income from selling the 15 T-shirts that you made. Show all your work and use a complete sentence in your answer.

Find the profit from the sale of the 15 T-shirts that you made. Show all your work and use a complete sentence in your answer.

- D. Find the production cost to make 30 T-shirts in the same design. Show all your work and use a complete sentence in your answer.

Find the income from selling the 30 T-shirts that you made. Show all your work and use a complete sentence in your answer.

Find the profit if 30 T-shirts are made and sold. Show all your work and use a complete sentence in your answer.

Take Note

Remember that the profit is the amount of money that is left from sales (income) after the production costs are subtracted.

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Investigate Problem 2

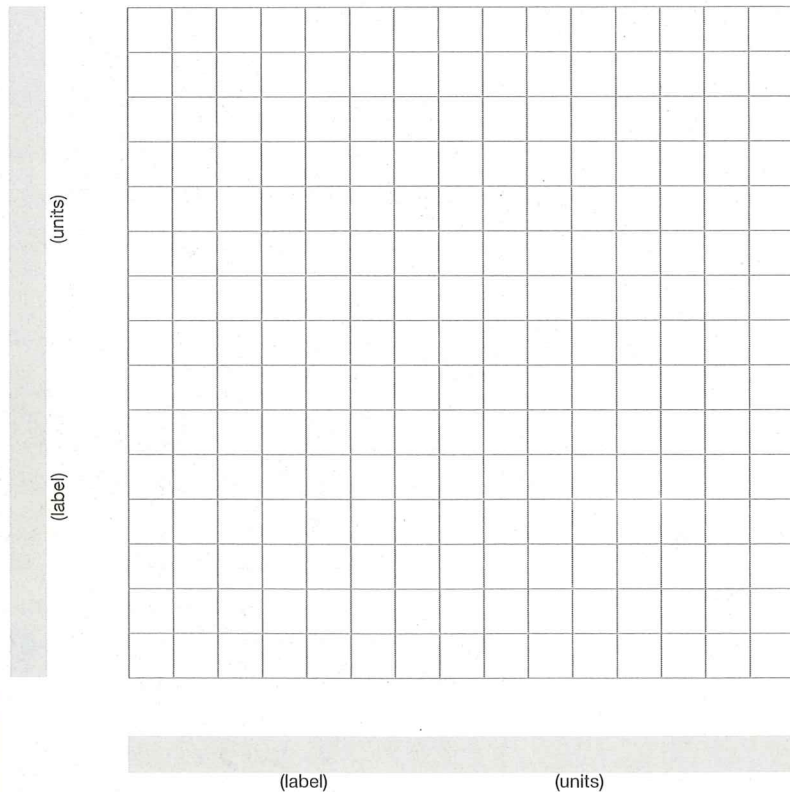
1. Complete the table of values on the next page that shows the production cost and income for different numbers of T-shirts in the same design.

Investigate Problem 2

Quantity Name	Number of T-shirts	Product cost	Income
Unit	T-shirts	dollars	dollars
Expression	x		
0			
20			
25			
30			
100			
200			
400			

2. Create a graph of both the production cost and income equations on the grid below. Use the bounds and intervals below. Be sure to label your graph clearly.

Variable quantity	Lower bound	Upper bound	Interval
T-shirts	0	45	3
Money	0	375	25



Investigate Problem 2

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3. Use your graph to determine the numbers of T-shirts for which the production cost is greater than the income. Use a complete sentence in your answer.

Use complete sentences to explain how you found your answer.

4. Use your graph to determine the numbers of T-shirts for which the income is greater than the production cost. Use a complete sentence in your answer.

Use complete sentences to explain how you found your answer.

5. Use your graph to determine the number of T-shirts for which the income is equal to the production cost. Use a complete sentence in your answer.

Use complete sentences to explain how you found your answer.

Investigate Problem 2

6. Describe the numbers of T-shirts that must be sold in order for your profit to be at least \$0. Use complete sentences to explain how you found your answer.

7. **Just the Math: Break-Even Point** When two graphs cross (or intersect) each other, the point where they cross is called a **point of intersection**. When one line represents the production cost of an item and the other line represents the income from selling the item, the x -coordinate of this point is called the break-even point. What is the **break-even point** for making and selling markers? Use a complete sentence in your answer.

What is the company's profit at the break-even point?
Show all your work and use a complete sentence in your answer.

What is the break-even point for making and selling T-shirts?
Use a complete sentence in your answer.

What is your profit from the T-shirts at the break-even point?
Show your work and use a complete sentence in your answer.

