Break-Even Point
Lesson Plan

Objective

Introduce students to fundamental concepts of starting and running a business successfully focusing on break-even point analysis.

Students will be able to:

- Understand the vocabulary associated with revenue and expenses
- Understand the relationship among revenue, expenses, and profit
- Analyze break-even data in a variety of situations
- Calculate price, sales units, and revenue values for different situations

Consumer Math Standards and Benchmarks

Common Core State Standards Initiative (CCSSI): The Common Core State Standards Initiative is a state-led effort coordinated by the National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO), developed to standardize learning practices across the nation and prepare students for college.

CCSSI Mission Statement: Provide a consistent, clear understanding of what students are expected to learn, so teachers and parents know what they need to do to help them. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that our young people need for success in college and careers. With American students fully prepared for the future, our communities will be best positioned to compete successfully in the global economy.

This lesson corresponds with the eight Standards for Mathematical Practice as published by CCSSI:

Mathematical Practices

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

The National Standards in K-12 Personal Finance Education

The National Standards in K-12 Personal Finance Education were created and are maintained by the Jump$tart Coalition® for Personal Financial Literacy. The Standards outline the personal finance knowledge and skills that K-12 students should possess.

The Jump$tart Coalition asserts that all young people graduating from high school should be able to take individual responsibility for their personal economic well-being. Financially literate high school graduates should know how to:

- Find, evaluate, and apply financial information
- Set financial goals and plan to achieve them
- Develop income-earning potential and the ability to save
- Use financial services effectively
- Meet financial obligations
- Build and protect wealth

Standards Addressed

Financial Responsibility and Decision Making

- Standard 1**:** Take responsibility for personal financial decisions
- Standard 2**:** Find and evaluate financial information from a variety of sources
- Standard 4**:** Make financial decisions by systematically considering alternatives and consequences

Planning and Money Management

- Standard 2**:** Develop a system for keeping and using financial records
- Standard 6**:** Develop a personal financial plan

Risk Management and Insurance

- Standard 1**:** Identify common types of risks and basic risk management methods

Saving and Investing

- Standard 2**:** Explain how investing builds wealth and helps meet financial goals
- Standard 3**:** Evaluate investment alternatives
- Standard 4**:** Describe how to buy and sell investments

Teaching Materials

- Lesson plan
- Break-even point student content document
- Analytical examples with pre-calculated examples
- Assessment/evaluation worksheet

Lesson Activity

Determine prior knowledge: suggested questions to determine knowledge of fundamental vocabulary and concepts:

- What is profit and where does it come from?
    - Revenue above and beyond expenses
- What is revenue and how does it differ from income?
    - Revenue is earned income from a business source or occupation. Income can be passive such as interest and dividends.
- What is your understanding of a break-even point in an investment activity?

Introduce/present break-even point content document (see attachment):

- Page one introduces the fundamental equation: Profit = Revenue - Expenses
- Break-even point is the point where Revenue = Expenses and Profit = 0 (page one and two of content document)
    - Break down expenses to fixed and variable expenses
        - Fixed expenses do not vary based on units sold

        - Rent, utilities, insurance, licenses
        - Labor can be a fixed expense if workers are paid salary or hourly, not by the job
        - Labor can also be a variable expense if the worker is paid per product produced or per service rendered
    - Variable expenses are related to production of each unit
        - Raw materials, packaging, per-unit expenses
  - Example on page two calculates break-even point and checks comprehension

Had I sold 11 units instead of 10 units this week, my revenue would have exceeded my expenses and I would have made a profit.

P = Price = $15.00
X = units sold = 11
FC = fixed costs = 94.50
V = variable costs = 1.50

$$Px = FC + Vx + \Pr ofit$$
$$(15)(11) = (94.50) + (1.50)(11) + \Pr ofit$$
$$165 = 94.50 + 16.50 + \Pr ofit$$
$$165 = 111 + \Pr ofit$$
$$\Pr ofit = 165 - 111$$
$$\Pr ofit = \$54.00$$

Contribution Margin (pages two and three of student document)

- Contribution margin is the amount of revenue available to service the fixed costs after reducing revenue by the variable costs needed to produce the units.

  Contribution Margin = Revenue - Variable Costs

Comprehension check (pages two and three of student document)
I sell a product for $15.00 and sell 25 of them this week. My variable costs are $1.50 each to produce my product. Can you calculate the contribution margin?

Revenue = ($15.00) x (25 units) = $375.00
Variable Costs = (25 units) x ($1.50) = $37.50
CM = Revenue – Variable Costs
CM = $375.00 - $37.50 = $337.50

Am I making money? Explain your answer.

(The example does not say what the fixed costs are so it can't be determined if the contribution margin is enough to cover the fixed costs and contribute to a profit.)

Break-even sales units (page three of student document)

The number of units that must be sold to reach the break-even point: Px = Vx + FC
X is the number of units sold to bring the equation into balance. Use algebra to solve for X:
Px = Vx + FC
(Px – Vx) = FC

$X(P - V) = FC$

$$x = \frac{FC}{(P - V)}$$

Comprehension Check

Exercise for students to calculate:

If I sell a product for $79.99 that costs me $11.99 per unit to produce and my fixed costs amount to $27,336.00, how many units must I sell to break-even?

$$x = \frac{FC}{(P - V)} = \frac{\$27{,}336}{(\$79.99 - \$11.99)} = \frac{27{,}336}{68} = 402$$

Break-even sales dollars (pages three and four of student document): The amount of revenue needed to reach the break-even point.

Once the break-even sales units figure is calculated then the break-even sales dollars can be determined:

Break-even sales dollars = Price per unit X break-even sales units

$$\text{Break-even sales dollars} = \frac{P \times FC}{(P - V)}$$

Work through the example of break-even sales dollars calculation (page five of student document)

Class Discussion

Suggested discussion points to pose with students. Expected responses are also included, but student perspectives may provide interesting conversation.

Think about the formula: Revenue = Expenses + Profit

Name three ways to increase profit from a business.
Expected responses:

- Increase Revenue
  - Increase revenue by raising prices. Expenses will remain constant resulting in an increase in profit.
  - Increase revenue by selling more units. The contribution margin will rise further than variable expenses resulting in an increase in profit.
- Reduce Expenses
  - Reducing fixed costs, variable costs, or both will result in an increase in profit to keep the right side of the equation in balance with revenue.
- All of the above

Think about the formula: Revenue = Price per unit X number of units sold

- Name three ways to increase revenue

Expected responses:

- Raise prices
- Increase sales
- Both of the above

Think about the formula: Expenses = Vx + FC

- Name four ways to reduce expenses.

Expected responses:

- Reduce fixed costs
- Reduce variable cost per unit
- Reduce sales
- All of the above

Reducing sales will lower expenses, but is this a conservative business practice that will benefit the company? Explain.

Exercise

The following table can be displayed on a projection screen or written on a board by students with teacher direction.

Consider Sal and Mario's Pepperoni Delight Restaurant, which only sells pepperoni pizza. The expenses for Sal and Mario's are below.

(The variable costs are per pizza)

Fixed Costs		**Variable Costs**	
General Labor	$1,500	Flour	$0.50
Rent	$3,000	Yeast	$0.05
Insurance	$200	Water	$0.01
Advertising	$500	Cheese	$3.00
Utilities	$450	Pepperoni	$2.00
Total	**$5,650**	**Total**	**$5.56**

What is the minimum price Sal and Mario can charge for each pizza? $5.56 covers the variable costs of each pizza, so one pizza could be sold for this price.

If Sal and Mario price their pizza at $10.00 each, what is their contribution margin?

CM = Revenue – Variable Cost = \$10.00 - \$5.56 = \$4.44

- \$4.44 per pizza
- Calculate the break-even sales units and break-even sales dollar figures

$$BreakEvenSalesUnits = x = \frac{FC}{(P - V)} = \frac{\$5,650}{(\$10.00 - \$5.56)} = \frac{5650}{4.44} = 1,272.5 = 1,273 pizzas$$

- 1,273 pizzas

Break-even sales dollars = Price per unit X break-even sales units

- Sales dollars = (\$10.00) x (1,273 pizzas) = \$12,730.00

<u>Assessment/Evaluation</u>

Following is the break-even point assessment to check students' comprehension.

1. Blue Corp shows monthly fixed costs of \$1,797 and per unit cost of \$9.28 while selling 411 units in a single month.

   What is the minimum price Blue Corp must sell each unit for to break-even?

$$X = \frac{FC}{(P-V)} \qquad 411 = \frac{1797}{(P - 9.28)} \qquad 411(P - 9.28) = 1797 \qquad P = \frac{1797}{411} + 9.28$$

   P = \$13.65

2. A start-up company has the following expenses:
   Rent = \$1,100
   Utilities = \$265
   Material and assembly = \$12.65/unit
   Monthly labor = \$625

   If their product sells for \$29.99/unit, how many units must they sell to break-even?

FC =	1100	rent	P = 29.99	V = 12.65
	265	utilities		
	625	labor		
	1990			

$$X = \frac{1990}{(29.99 - 12.65)} = \frac{1990}{17.34} = 114.76$$

   X = 115 units

3. I sell a product for \$24.75 and fill orders averaging 37 units per day. My cost to produce and assemble each item is \$3.11. If I am open for business five days per week, what is my contribution margin per unit?

   CM = Revenue – Variable Cost
   CM = 24.75(1) – 3.11(1)

CM= $21.64/unit

4. What is the break-even sales dollars figure for an operation that sells 615 products at $17.50, when each item costs $7.05 to produce, and the fixed costs for the operation are $3,700/month?

$$X = \frac{FC}{(P-V)} = \frac{3700}{(17.50 - 7.05)} = \frac{370}{10.45} = 354 \text{ (Break-even sales units)}$$

Break-even sales dollars = 354 x $17.50 = $6,195

5. A company sells 900 units/month at $49.99 each, with an $18.12 per unit cost, and $2,175 monthly fixed cost. Is this company making a profit?

Px = FC + Vx + Profit
(49.99) x 900 = 2175 + (18.12) 900 = 2175 + 16308 + Profit
44991 = 18483 + Profit

Yes, their profit = $26,508

6. Tandem Trucking spends $11,455 per month to run their business. They make an average of 420 deliveries per month at a fee of $55.00 per delivery. Rounded to the nearest percent, what is Tandem's monthly return on their $11,455 investment?

FC = 11,455 x = 420 P = $55

55(420) = 11455 + Profit 23100 = 11455 + Profit Profit = $11,645

$$\text{Return} = \frac{\text{Profit}}{\text{Investment}} = \frac{11,645}{11455} = 1.0166 = 1.02$$

Return = 102 percent

7. I sell a product for $35.00. My fixed costs for the week are $194.00 and it costs me $2.10 per product to produce. If I sell only six products this week, how am I doing?

35(6) = 194 + 2.10(6) + Profit
210 = 194 + 12.60 + Profit
210 = 206.60 + Profit
$3.40 = Profit (Broke-even with a slight profit of $3.40)

8. Zyleron Corp shows monthly fixed costs of $37,210 and per unit costs of $34.79 while selling 275 units in a single month. What is the minimum price Zyleron Corp must sell each unit for to break-even?

Px = FC + Vx P(275) = 37,210 + 34.79(275) = 275(P) = 46,777.25

$$P = \frac{46,777.25}{275}$$

P = $170.01

9. A start-up company has the following expenses:
   Rent = $875
   Utilities = $115
   Material and assembly = $4.75/unit
   Monthly labor = $480
   If their product sells for $18.99/unit, how many units must they sell to break-even?

   FC = rent + utilities + labor = 875 + 115 + 480 = $1,470
   VC = $4.75
   P = $18.99

   $$X = \frac{FC}{(P-V)} = \frac{1470}{(18.99-4.75)} = \frac{1470}{14.24} = 103.23$$

   X = 103 units

10. I sell a product for $21.50 and fill orders averaging 19 units per day. My cost to produce and assemble each item is $8.47. If I am open for business five days per week, what is my contribution margin each week?

    P = 21.50 x = 19 x 5 = 95/week VC = 8.47

    Contribution Margin = Revenue – Variable Cost

    CM = (21.50)(95) – 8.47(95)
    CM = 2042.50 – 804.65
    CM= $1,237.85/week

Answer Key

Question	Answer
1	$13.65
2	115 units
3	$21.64/unit
4	$6,195
5	Yes, they are making a profit of $26,508
6	102%
7	Broke-even with a slight profit of $3.40.
8	$170.01
9	103 units
10	$1,237.85/week