Understanding the Concept of Breaking Even

SUBMITTED BY: Nina Hoe, University of Pennsylvania

SUBJECT(S): Computation

GRADE LEVEL(S): 9, 10, 11, 12

☰ OVERVIEW:

In this lesson, students are introduced to the idea of break even, revenues and expenses (both fixed and variable). The lesson begins with a whole group discussion of these topics, applied to different business scenarios. In small groups, students work through calculating break-even points for businesses with fixed expenses only. Finally, students report of their findings and prepare for the subsequent lesson that extends beyond a simple fixed expense model to incorporate variable expenses as well.

☰ RELATED ARTICLES:

- "The Silicon Valley Start-up that Began with Legos and a Market Need"
- "Career Spotlight: Inside Actuarial Science"

Standards:

NBEA Standard(s):

- Number Relationships
- Mathematical Foundations
- Patterns, Functions and Algebra

Common Core Standard(s):

Modeling

F-LE.2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

A-CED.1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

Objectives/Purposes:

- Understand the concept of breaking even and the relationship between revenues and expenses.
- Model break-even situations graphically.
- Solve systems of equations numerically and graphically

Knowledge@Wharton Articles:

- "Power, Leverage and a Strategic Approach to the Negotiation Process"
- "Smooth as Silk: Product Diversification Gives Afghan Women a Competitive Edge"

Whole Class Discussion: (*15 mins*)

1. What do you think it means to "break even"? Have you heard this term before?

Student Worksheet

Play the Wharton Global Youth Program (WGYP) Glossary: Break Even

"Break even is when revenues and expenses are equal. Or, put another way, when net income is zero. The Bluth Company is projected to break even, at selling 100,000 tables. If they sell less tables, they'll make a loss. If they sell more tables, they'll make a profit."

Play the WGYP Glossary: Break Even Point

"Break even point refers to either the quantity of output sold, or the total revenues where operating income is zero. The Bluth Company's break even point in quantity is 100,000 tables, and in sales dollars, is $1 million."

Essentially, the break-even point is when:

Revenues = Expenses

Revenues – Expenses = 0 (or the Net Income = 0)

2. What are revenues?

Play the WGYP Glossary: Revenues

"Revenues are the sales of products, merchandise and services that a company makes to customers due to the normal business activities. The Philadelphia Phillies, the 2008 World Series Champions, generated a record-breaking $216 million in revenues from ticket sales, merchandise, and refreshments last year."

3. What are expenses?
4. What are fixed vs. variable expenses/costs?

Play the WGYP Glossary: Fixed/Variable Cost

"A fixed cost is a cost that remains unchanged in total, regardless of changes in the level of total activity or volume. Earthquake insurance for a table factory is a fixed cost, because regardless of whether 200 or 2000 tables are made, the cost for earthquake insurance will be the same. A variable cost is a cost that changes directly in proportion to changes in the level of total activity, or volume. The wood used to make a table is a variable cost, because each additional table requires additional wood for the tables to be made."

5. If you ran a corner store – what would your **revenues** be? *(your total sales, how much money was in the register at the end of each day)*
6. If you ran a corner store – what would you **fixed expenses** be? *(paying hourly or salaried employees – note that this would not include commissions, bonuses, and paying employees for services rendered, rent for the space or mortgage, utilities, etc)*

7. If you ran a corner store – what would you **variable expenses** be? *(cost of food and merchandise to stock the shelves, potentially adding additional employees if the need got high enough)*

Different businesses have different profiles and different relationships between and proportions of fixed and variable.

8. Brainstorm some businesses that would have higher fixed costs and lower variable costs. *(ex: barber shop, massage parlor, bicycle rental shop)*
9. Brainstorm some businesses that would have lower fixed costs and higher variable costs. *(ex: grocery or retail store, anything where you are selling something tangible)*

10. Why is knowing your break-even point important?
11. What does it mean if revenues are greater than expenses?
12. What does it mean if revenues are less than expenses?

(Optional – 5 mins)

Read the Knowledge@Wharton article: "Power, Leverage and a Strategic Approach to the Negotiation Process"

13. Why is it important for these women to know their break-even points?

Every start up business has to anticipate that in the beginning, the expenses will be larger than the revenues and that their business will essentially be loosing money initially. Business owners and investors look to break-even projections to analyze the risk involved with starting a particular business. Companies think about break-even points in different ways, and ask different questions regarding breaking even. Sometimes, a new company will expect that expenses will exceed revenues in the beginning, so they may ask – given this **pricing** strategy, at what point in time will we reach a break-even point? Another company may use the break-even point as a goal, and ask – if we want to break even within three years, what pricing strategy must we use?

Play the WGYP Glossary: Pricing

"Pricing is the price a firm sets for the products it sells. Wal-Mart has a pricing policy to be as low or lower than any of the competitors. Wal-Mart will match or beat anyone's prices."

There are also initial, start-up, or capital costs or investments involved in starting a business that may not be figured into the monthly expenses. For example, to start up a corner store, you would need to invest in shelving, a price gun, signage, etc.

Small Group/Pair Activity: (20 mins)

FIXED COSTS ONLY BUSINESS

You want to open a haircutting salon.

1. Based on the previous discussion, is this business likely to have higher fixed costs or variable costs? Why? *(Fixed costs. Because an owner has to pay the hairdressers and all of the equipment no matter what. The variable expenses, such as shampoo/conditioner, are very limited)*
2. What are some of the fixed expenses associated with this business? *(see #4)*
3. If 1 person comes in for a haircut or 30 people, how does this affect your expenses in general? What are the variable expenses? *(The fixed expenses are not affected. The variable expenses might be more shampoo and conditioner, maybe higher utilities.)*
4. What would be some of your initial, or start-up costs? *(Chairs, shampoo sinks, scissors.)*

Because variable costs are quite minimal, for the purposes of this initial activity, we will ignore them and look only at the fixed costs. Also ignoring the initial investments that you would need to make to start up the business, your monthly expenses are as follows:

Fixed Expenses	Cost per Month
Store front rental	$1,000
Utilities	$300
Payroll: 2 employees – $12/hour – 40 hours per week	$3,840
Insurance	$200
Advertising/Marketing	$1000
Total	=$6,340.00

1. Fill in the table below:

Number of Haircuts Sold per Month	Monthly Fixed Expenses
0	$6,340
20	$6,340
100	$6,340
200	$6,340
300	$6,340
400	$6,340

1. Write an equation for your fixed expenses as a function of the number of haircuts you sell. (Let y = your expenses and x = the number of haircuts sold.) – HINT: do your fixed expenses change at all as the number of haircuts sold changes? *(y = 6,340)*

1. You plan to charge $20 per haircut. Fill in the table below:

Number of Haircuts Sold per Month	Monthly Revenues
0	$0
20	$400
100	$2,000
200	$4.000
300	$6,000
400	$8,000

1. Write an equation for your revenue as a function of the number of haircuts you sell if you charge $20 per haircut. (Let y = your revenues and x = the number of haircuts sold.) *(y = 20x)*

2. On the axes below graph these two lines (f and g). Put money on the y-axis and number of haircuts on the x-axis.

3. Describe what this graph shows. *(In a monthly period, the fixed expenses are always the same, and the revenues increase as the number of haircuts sold increase.)*

4. At what point do the lines intersect? What is this point!?? (Give the coordinates.) *approx (317, 6340)*

5. Calculate manually the break-even point if you sell haircuts for $20 each. *6,340 = 20x; x = 6,340/20 = 317 à (317, 6340)*

6. Now let's go back to incorporate the initial investments you made (i.e. the swivel chairs, scissors, hair dryers, etc.) – which totaled $8,300. You had saved this money up, but want to pay yourself back for this investment within the first three years you are open for business. Do you need to sell more or fewer haircuts to break even from this investment than indicated by your previous calculation? Explain. *(You need to sell more haircuts. Each month you not only need to break even with your fixed expenses but also need to be putting money towards the initial expenses.)*

7. If you charge $20 for a haircut, and are certain that you can sell 400 haircuts per month, estimate how long it will take you to break even from your initial investment. *(Answers will vary.)*

8. What are your monthly revenues now? *($20 x 400 = $8,000)*

9. Write an equation that models cumulative total revenues as a function of the time (in months). Let y = revenues ($) and x = # of months. *(y = 8000x)*

10. Write an equation that models cumulative total expenses, accounting for both initial and fixed expenses, as a function of time (in months). Let y = expenses ($) and x = # of months. *(y = 6340x + 8300)*

11. At what point do these lines meet? Solve this numerically and graphically. *(8000x = 6340x + 8300; 1660x = 8300; x = 5; 5 months)*

(This lesson is a 2 part lesson – the subsequent lesson focuses on breaking even with FIXED AND VARIABLE EXPENSES)

Tying It All Together: (*10 mins*)

Whole Class Discussion:

1. If time allows, have students report back on their findings. Student groups can be responsible for putting different # problems on the board. If not, resume this in the next period.

Practice Outside of the Classroom: Look at other businesses and think about the fixed and variable expenses. Think about where their break-even points might be.

What Worked and What I Would Do Differently: