

MATH AT WORK

CONNECTING MATH TO 21ST CENTURY CAREERS

From the Webisode: Math Meets Entrepreneurship
featuring the cast of *Shark Tank*

Lesson 1 Breaking Even

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In this lesson, students will use the four basic operations to find the break-even point of a product.

TEACHER

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GRADES 4-5 INSTRUCTIONAL FOCUS

- Solve multi-step word problems using the four basic operations.
- Evaluate and use parentheses in numerical expressions.
- Add, subtract, multiply, and divide decimals to hundredths.

LANGUAGE SUPPORT

Math Terms

order of operations

the order in which to evaluate an expression with more than one operation.

unknown

an amount that is not given.

Academic Language

initial cost

a one-time expense when starting a business.

profit

the difference between the amount earned and the amount spent.

break-even point

the point when a company's profits equal its expenses.

SET UP

Introduce Chapter 2 from *Math Meets Entrepreneurship*.

Ask questions to introduce Lesson 1.

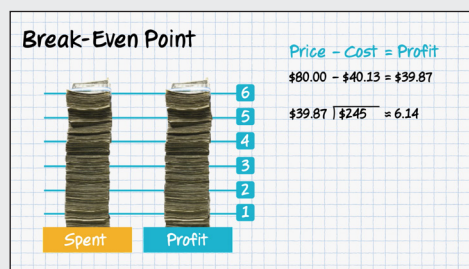
For example: **What steps do you take when solving a word problem?** (Read the problem, make a plan, solve, check for reasonableness.)

Ask students to describe the steps they would use to solve a word problem. Explain that establishing a problem-solving routine can help them make sense of the problem.

Today, we'll use a problem-solving routine to how many wristbands Angela and Crystal need to sell to break even.



Play Chapter 2: Breaking Even



[Pause at 4:55]

PLAN

Create a plan to solve the problem.

The initial costs to start the company are \$245. Wristbands cost \$40.13 each to build. Angela and Crystal are selling the wristbands for \$80 each. How many wristbands must they sell to break even?

We want to find how many wristbands Angela and Crystal need to sell to break even.

Read the problem aloud to students.

Cover the values in the problem situation. Lead a discussion about how students would solve this problem.

For example: **What information are Angela and Crystal looking for?** (the number of wristbands they must sell to make a profit or have a loss.)

Introduce the academic vocabulary terms.

Does the initial cost change if more wristbands are sold? Why? (no, because it is a one-time cost.)

Point out that the word "each" in the problem suggests that the total amount they spend depends on the number of wristbands they sell.

How can you find the profit for each wristband?

(find the difference between the price it is sold for and the amount it costs to make.)

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Mathematical Thinking: Reason Quantitatively

Students use quantitative reasoning to solve a problem out of context, and then contextualize their solutions.

SOLVE

Have student pairs solve the problem as you circulate.

Encourage students to come up with multiple strategies and represent the problem situation in different ways. Guide students to work backwards to check their work.

Support

Ask questions based on common errors to support student understanding.

- Which operation should you do first?
- Which amount is a one-time cost? Which amount is a cost that they have to pay an unknown number of times?
- Is it possible to sell that many wristbands? Why or why not?

Extend

Ask questions to encourage students to expand their thinking.

- Can you write an equation to solve this problem?
- How can you use a variable to find the answer to this problem?
- How many wristbands do they need to sell to make a profit of at least \$100?

SHARE

Have students present their solutions.

Ask students from each pair to explain their solutions to the class. Show at least two different approaches to solving the problem and one incorrect solution. To extend classroom discussion, call on students to explain the reasoning of the student who is presenting.

POSSIBLE STUDENT WORK:

$$\begin{aligned} \text{The number of wristbands sold} &= \$245 \div (\$80.00 - \$40.13) \\ &= 245 \div 39.87 \\ &\approx 6.14 \end{aligned}$$

6.14 rounds up to 7.

Angela and Crystal must sell 7 wristbands to break even.

PRACTICE

Have students complete the Practice and Reflect sections on Student page 2 in class or as a homework assignment.

Students choose a product to sell and analyze costs to run their business.



Play the Chapter 2 Solution from *Math Meets Entrepreneurship*.

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PLAN

Create a plan to solve the problem with your partner.

To break even, I need my profits to be the same as my costs. So I will figure out an expression for how much money I spend and how much money I get. Then I will set them equal to each other.

SOLVE

Use your plan to solve the problem.

POSSIBLE STUDENT WORK:

Let w = the number of wristbands sold

Money Spent = Money Received

$$245 + (40.13 \times w) = 80 \times w$$

$$245 = (80 \times w) - (40.13 \times w)$$

$$245 = (80 - 40.13) \times w$$

$$245 = 39.87 \times w$$

$$245 \div 39.87 = w$$

$$6.14 \approx w$$

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PRACTICE

Apply your skills to solve another problem.

It's your turn to start a business! Choose the product you will sell and pick your office space. How many items do you need to sell each month to break even?

CHOICE 1: PICK YOUR PRODUCT

- Light-up Hair Extensions (each extension costs \$1.00 to make and sells for \$2.50)
- Cardboard Robots (each robot costs \$3.57 to make and sells for \$9.10)
- Comic Books (each comic book costs \$1.96 to make and sells for \$10.00)

CHOICE 2: PICK YOUR OFFICE SPACE

Economy

- Office: Free (work from home)
- Internet: \$50 per month
- Phone: \$25 per month

Standard

- Office: \$900 per month (shared office space)
- Internet: free
- Cell Phone: \$50 per month

Luxury

- Work from a centrally located private office: \$3,000 per month
- High Speed Internet: \$75 per month
- Cell Phone: \$50 per month

POSSIBLE STUDENT WORK:

Light-Up Hair Extensions Economy Option

$$(50 + 25) \div (2.5 - 1) = 75 \div 1.5 = 50$$

Check:
 $75 + (1 \times 50) = 2.5 \times 50$
 $125 = 125$

I would have to sell 50 extensions per month to break even.

Comic Books Standard Option

$$(900 + 50) \div (10.00 - 1.96) = 950 \div 8.04 \approx 118.16$$

Check:
 $119 \times \$8.04 = \956.76
 $\$956.76 \approx \950

I would have to sell 119 comic books per month to break even.

REFLECT

Explain how you made sense of the math.

A) What made you choose your product and office space?

I chose the product comic books because the sale price was a lot bigger than the cost to make it.

I chose the standard office space because it had lower monthly costs than the luxury option.

B) What choice could you change to sell less items to break even? Explain.

I could change Choice 2 to the economy option so my costs would be lower and my profits would be higher.
Higher profits mean that I don't have to sell as many items.

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