

Quantitative Reasoning Instructor Guide

Math in Business

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Learning Outcomes

[Detailed Course Learning Outcome Spreadsheet is linked here.](#)

Topic	Student Learning Goals
Introduction to Business Math	Understand the significance of business math
Finance and Accounting	Explain fundamental financial statements, including the accounting equation, income statement, statement of owner's equity, balance sheet, and statement of cash flows
Marketing and Sales	Describe concepts like pricing strategies, market analysis, and sales forecasting
Operations and Supply Chain	Describe concepts like inventory management, production scheduling, and optimization
Freelancing	Identify how math is used in freelancing

Summary of Module

Background You'll Need

The assumed prerequisite skills:

- Convert between decimals and fractions
- Simplify fractions

Introduction to Business Math

This section provides an overview of how mathematics is applied in business contexts. It begins by outlining the relevance of business math in areas like finance, marketing, and operations, highlighting key concepts such as Net Present Value and compound interest. The section then emphasizes the importance of quantitative literacy in interpreting data and financial statements, crucial for making informed business decisions. It also covers the application of mathematical methods in real-world business scenarios, demonstrating the practical use of these skills in areas like data analysis and problem-solving.

Finance and Accounting

This section provides a comprehensive overview of key financial concepts and practices. It begins by introducing the importance of financial information in business, detailing the roles of accounting and bookkeeping, and the users of financial reports. The section then progresses to explain the fundamental accounting equation ($\text{Assets} = \text{Liabilities} + \text{Owner's Equity}$), emphasizing the significance of double-entry bookkeeping in maintaining financial balance. Following this, students learn about the preparation and interpretation of essential financial statements: the Income Statement, Statement of Retained Earnings, Balance Sheet, and Statement of Cash Flows.

Marketing and Sales

In this section, students explore key marketing and sales concepts with a focus on their mathematical foundations. The first part introduces various pricing strategies, including cost-based pricing, competitor-based pricing, and value-based pricing. The second part delves into market analysis, emphasizing the importance of understanding consumer behavior, market trends, and the competitive landscape using statistical tools like correlation, regression, and time-series analysis, as well as comparative and SWOT analysis for strategic insights. The final part covers sales forecasting, highlighting its critical role in business management and detailing methods like time-series analysis and causal models that incorporate external factors such as economic indicators and market trends.

Operations and Supply Chain

In this section, students are introduced to key concepts in operations management. The section begins with optimization techniques, including linear programming, integer programming, network optimization, and sensitivity analysis, highlighting their roles in resource allocation and cost reduction. It then progresses to scheduling, using an auto shop example to explain diagraphs, processors, finishing time, optimal schedule, idle time, and critical time. The final part of the section focuses on advanced scheduling, introducing the List Processing Algorithm for creating efficient schedules and discussing other algorithms like the decreasing time algorithm, the critical path algorithm, and the backflow algorithm.

Freelancing

In this section, students are introduced to key aspects of successful freelancing, with a focus on practical mathematical and strategic skills. The course begins by exploring various pricing strategies, including hourly, fixed, and value-based pricing, and guides students in calculating appropriate rates and estimating taxes. It then emphasizes the importance of budgeting, especially for managing variable incomes in freelancing, and teaches profit and loss analysis as a tool for financial assessment. The section also delves into effective time management for the creation of realistic project timelines.

Module Resources

Cheat Sheet



[Math in Business Cheat Sheet](#)

Worksheets/Handouts



[Business Math in Practice - Scenario 1](#)



[Business Math in Practice - Scenario 2](#)



[Business Math in Practice - Scenario 3](#)



[Business Math in Practice - Scenario 1 Answer Key](#)



[Business Math in Practice - Scenario 2 Answer Key](#)



[Business Math in Practice - Scenario 3 Answer Key](#)



[Business Math Applications Discussion](#)



[Business Decision Analysis Writing Task](#)

Activity One: Business Math in Practice

Evidence-Based Teaching Practice



Engagement

Educators engage students in activities that require them to do more than passively listen to a live or recorded lecture by presenting real-world business scenarios across different industries, which helps students connect mathematical concepts to practical applications.



Scaffolding

Educators provide extra supports to students as they begin learning new ideas and practicing new skills by breaking down complex business mathematics concepts into manageable tasks within each worksheet.



Self-Reflection

Educators create opportunities for students to assess their own work and engage in metacognitive reflection, including identifying their strengths, growth opportunities, and ways to adjust their approach to learning the course material by utilizing the cross-sharing sessions and exit cards to provide students with opportunities for reflection and feedback.

Background

In this activity, students will work in groups to explore practical applications of business mathematics in different industry scenarios through a series of worksheets. Each worksheet presents a unique business context — such as a startup company, a retail business, and a hospitality chain — and is divided into sections covering key areas like Finance and Accounting, Marketing and Sales, and Operations and Supply Chain. Students will engage in tasks that require them to apply mathematical concepts to real-world business situations, ranging from financial analysis and market trend evaluation to operations optimization. The questions are designed to encourage critical thinking and practical problem-solving. After completing their respective worksheets, groups will participate in cross-sharing sessions, presenting their findings and discussing the varied applications of business math across different scenarios.

Instructions

Time Estimate: 60-90 minutes

1. Conversation starter

Considering the diverse roles mathematics play in various business sectors, how do you think mastering these concepts can impact your decision-making in real-world business scenarios? Can you think of a recent business situation, perhaps in the news, where mathematical analysis was crucial?

2. Review

You may wish to do a brief overview of the fundamental concepts of business mathematics, including key financial equations, marketing analysis techniques, and operations optimization strategies. It's also essential to refresh the principles of interpreting financial statements and applying statistical tools in market analysis to ensure students can effectively engage with the activity's tasks.

3. Split the class into groups of 3-4 students

Organize the class into small groups of 3-4 students. Aim for a mix of abilities and backgrounds in each group to promote diverse perspectives and collaborative learning. Students will need to be able to write down their ideas either on paper or their own copy of the worksheets.

4. Distribute Worksheets

Hand out the different worksheets to each group. Ensure that each group receives one of the three unique worksheets, each focusing on a different business scenario. A pdf of the station worksheets can be found in the Module Resources of this document.

5. Group Sharing and Discussion

After completing the worksheet, groups will cross-share their findings with others who worked on different scenarios. This will help in understanding diverse business applications of mathematics in real-world contexts.

Discussion Prompts

- **What are the challenges and benefits of using time-series analysis for sales forecasting in businesses?**

Answer: Time-series analysis is beneficial for sales forecasting as it allows businesses to identify trends and patterns over time, which can be crucial for planning and resource allocation. However, one of the main challenges is that it heavily relies on historical data and assumes that past patterns will continue, which may not always be the case, especially in rapidly changing markets. Additionally, time-series analysis can be complex and requires a deep understanding of statistical methods.

- **In what ways can the fundamental accounting equation ($\text{Assets} = \text{Liabilities} + \text{Owner's Equity}$) provide insights into a company's financial health?**

Misconception: A common misconception is that a high level of assets automatically indicates a healthy financial state for a company. However, this equation shows that the value of assets must be analyzed in relation to liabilities and owner's equity to get a true picture of financial health. A company with high assets but also high liabilities may not be financially strong. Understanding this equation helps in evaluating a company's ability to meet its obligations, invest in growth, and generate profit for owners or shareholders.

- **How do different pricing strategies, like cost-based, competitor-based, and value-based pricing, affect a company's market positioning and profitability?**

Goal: The goal is to understand that while cost-based pricing focuses on covering costs and ensuring a profit margin, competitor-based pricing is about aligning with market standards, and value-based pricing is centered around customer perception of value. Each strategy has its own merits and challenges, and their effectiveness can vary depending on the industry, target market, and overall business strategy.

- **What role does sensitivity analysis play in operational and financial planning, and why is it crucial for businesses?**

Answer: Sensitivity analysis is vital in operational and financial planning as it allows businesses to understand how changes in key variables (like cost of materials, market demand, interest rates) impact outcomes. It's crucial because it helps businesses prepare for different scenarios, making their planning more robust and adaptable. For example, by understanding how a change in market demand could affect profits, a company can develop strategies to mitigate risks associated with demand fluctuations.

Reflection

After the activity, we recommend that students complete exit cards. Have each student write on a piece of paper one key concept they learned from the activity and one concept they have questions about. Below are some suggestions for students:

- Discuss one new insight you gained about the impact of pricing strategies on a company's market positioning.
- How did the activity change your understanding of the role of time-series analysis in sales forecasting?
- Can you give an example of a situation where sensitivity analysis would be particularly important for a business?
- If you were to advise a business on optimizing their operations, which mathematical method discussed today would you recommend, and why?
- Describe how collaborating with your group influenced your approach to solving the business math problems presented in the worksheets.
- If you could suggest one improvement to this activity for future classes, what would it be and why?
- What was the most valuable insight you gained from the cross-sharing session with other groups?

Online Variation

In a synchronous online course, this activity can be effectively facilitated using platforms like Zoom or Microsoft Teams. Begin by using the main session to introduce the activity and its objectives, and then utilize breakout rooms for group discussions, where each group works on their assigned worksheet. Share digital versions of the worksheets through the chat or on a shared drive. During the activity, the instructor can rotate among the breakout rooms to provide guidance and answer questions. After the groups complete their tasks, reconvene in the main session for a cross-sharing session, allowing each group to present their findings.

For a completely online course, the activity can be structured using a learning management system (LMS) or a dedicated course website. Distribute the worksheets as downloadable documents or interactive assignments on the platform. Students can work in groups using discussion forums or collaborative tools like Google Docs to facilitate communication and joint problem-solving. After completing the worksheets, students can post their analyses in a dedicated forum or submit them as assignments. Encourage peer feedback by having students review and comment on other groups' submissions.

Assignments

Business Math Applications Discussion

In this discussion, students will explore mathematical applications in business by selecting and analyzing a specific concept used in areas such as pricing strategies, financial statement analysis, inventory management, scheduling, sales forecasting, or freelance rate calculation. Students will identify the mathematical concepts and formulas involved in their chosen application, explain why it's important for business decision-making, consider necessary data inputs, and discuss limitations or potential pitfalls. They'll locate a real-world example from an article, case study, or personal experience that demonstrates how a business used this mathematical application and describe the outcomes achieved. In their posts, students will include at least one mathematical calculation or formula that demonstrates the application, showing how mathematical principles translate to practical business contexts. Through peer engagement, students will compare different applications, ask thoughtful questions about classmates' examples, and suggest additional business applications.

[Business Math Applications Discussion](#)

We ask that you make your own copy to edit and adjust to fit the needs of your classroom

Business Decision Analysis Writing Task

In this assignment, students will apply mathematical concepts to analyze a business scenario and make informed decisions for a fictional boutique bakery considering expansion. Students will begin by calculating profit margins for current and potential products, determining monthly profits, and analyzing break-even points to recommend which new product line to add. Next, they'll evaluate time and resource allocation by calculating production hours required for all products, creating an optimal weekly production schedule, and analyzing whether to hire additional staff or invest in equipment based on mathematical projections. The assignment culminates with students creating a projected monthly income statement for the expanded product line, calculating the return on investment for new equipment, and performing sensitivity analysis for various scenarios (materials cost increases, lower-than-projected sales, and higher fixed costs). Students will synthesize their findings in an executive summary with specific, actionable recommendations based on their calculations.

[Business Decision Analysis Writing Task](#)

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