

# THE NEED FOR CALCULATORS IN BUSINESS MATHEMATICS EXAMS: IMPACT ON C.A FOUNDATION EXAM SUCCESS

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**Abstract:** This paper thoroughly examines the benefits and drawbacks of incorporating calculators in C.A. Foundation mathematics examinations. It explains how a lack of proficiency with calculators, and basic mathematical operation rules impacts students' performance in these exams. Additionally, the paper provides valuable recommendations and strategies for teachers and C.A. Foundation candidates to maximize the effectiveness of calculator usage, aiming for improved outcomes in C.A. Foundation examinations.

## I. INTRODUCTION:

The structure of Business Mathematics and its importance in various fields:

- **Business Mathematics** is the branch of mathematics that deals with the application of mathematical ideas and concepts to solve problems in business and finance. It includes various concepts such as numeracy, arithmetic, statistics and arithmetic to analyze business information, make informed decisions and optimize processes. The importance of business mathematics spans many fields and industries, playing an important role in decision-making, financial management and strategic planning. The major functions that use business mathematics are:

- **Finance and Accounting:** Business mathematics is essential for financial analysis, budgeting, forecasting and investment measurement. It helps in calculating interest rates, determining loan payments, analyzing financial statements, and evaluating project profitability

- **Marketing:** Marketing uses mathematics to study customer behaviour attitudes, business trends, productivity, and business growth. Financial statistics help economists develop and analyze markets, conduct strategic research and develop recommendations.

- **Operations Management:** Business codes work well in operations management to streamline production processes, manage inventory, plan resources, and improve supply chains. Techniques such as linear programming, queuing theory, and inventory control models are often used to solve operational problems.

- **Business and Marketing Research:** Mathematical tools are used in business and marketing research to analyze customer preferences, forecast demand, segment business trends, and create cost-effective strategies. Statistical methods, regression analysis and data are used solely to uncover insights from business data and support business decisions regarding big data. Mathematical models, algorithms, and statistical methods are used in data analysis, predictive modelling, risk assessment, and decision support across a wide range of industries.

- **Business Analytics and Decision Making:** With the emergence of big data and analytics, business analytics plays an important role in extracting requirements from many documents. Mathematical models, algorithms, and statistical methods are used in data analysis, predictive modelling, risk assessment, and decision support across a wide range of industries.

- **Marketing and Business Planning:** Marketing is a useful resource for businesses and small business owners to evaluate their business, assess risks, and develop financial forecasts. It helps create business plans, estimate costs, forecast revenue, and evaluate the feasibility of business investments. Business analytics is an important tool for professionals across the business; it allows them to analyze data, make informed decisions, take responsibility, solve difficult problems and improve the business. Its importance lies in its ability to provide a variety of insights and analytical tools necessary to achieve the organization's goals, drive innovation, and also compete in today's business world.

Because of their ability to perform complex mathematical operations quickly and accurately, calculators have become a companion for professionals and students. Historically, the introduction of electronic calculators changed the way calculations were done in business. Before their introduction, manual methods such as slide rules and manual calculations were widely used, often making the process time-consuming and error-prone. However, the advent of the electronic calculator in the mid-20th century represented a major advance, allowing users to perform mathematical, mathematical and financial calculations with unprecedented



speed and accuracy. The versatility of modern calculators goes far beyond simple calculation functions. The advanced model is equipped with special functions based on the mathematical needs of the business, including financial transactions, operational analysis and operations. This resource allows users to solve many business-related tasks such as: calculating compound interest, calculating return on investment, performing return analysis, and performing sensitivity analysis. In addition, the calculator has become a powerful tool for determining the situation, providing a quick understanding of complex and multifaceted financial problems. The calculator allows users to do quick math and explore different scenarios to decide on ideas when evaluating investment opportunities, measuring profitability or analyzing situations. Calculators also play an important role in educational settings, where they are important learning tools for students in business mathematics and other subjects. Calculators encourage active learning and a deeper understanding of important concepts by allowing students to perform calculations, view results, and test out mathematical ideas. They also develop problem-solving and math skills, which are important for success in school and work. Although calculators have many advantages in business mathematics, their use also brings with it some limitations. There are concerns about over-reliance on the calculator, which can lead to mental arithmetic and a better understanding of basic math concepts. Additionally, reliance on specific computer models raises questions about accessibility and design in education and the workplace. In summary, a calculator is an important tool in business mathematics that allows users to quickly and accurately calculate complex numbers, analyze data, and make informed decisions. Their versatility, simplicity, and educational value make them indispensable tools for professionals and students to perform complex quantitative analyses and solve problems in business. But to achieve good results in education and work, there must be a balance between using the calculator and developing basic mathematical skills.

Statement of the research problem: The use of calculators in business mathematics exams has become common practice and raises questions about their necessity and the impact of inadequate computer skills on exam success. This research problem aims to address two key aspects:

1. The need for calculators in business mathematics exams: Since calculators provide efficient calculation and analysis functions, their integration in business mathematics exams is widespread. However, the extent to which they are necessary in examinations requires careful examination.

- Are calculators essential tools for accurately assessing students' understanding of business mathematics concepts and their problem-solving skills?
- What other factors influence the decision to allow or restrict the use of calculators in business mathematics exams, and how do educators strike a balance between Utilizing the benefits of computers and maintaining the integrity of the assessment?

2. Consequences of Inadequate Calculator Skills on Exam Success:

- In scenarios where calculator usage is permitted, students' proficiency in operating calculators effectively becomes paramount.
- What are the repercussions of inadequate calculator skills on students' performance in business mathematics exams?
- Do students with limited calculator skills experience difficulties in completing exam tasks accurately and efficiently?
- Moreover, how do deficiencies in calculator skills impact students' confidence, stress levels, and overall exam outcomes?

By addressing these research questions, this study aims to shed light on the reasons for using calculators in business mathematics exams and the impact of a lack of calculator knowledge on students' exam success. Understanding these dynamics is critical for educators, policymakers, and stakeholders to develop effective assessment strategies and advance student knowledge of business mathematics.

Advantages of Calculators in Business Mathematics Exams:

Calculators allow students to perform complex mathematical calculations quickly and efficiently, saving valuable time on exams. Tasks that would otherwise be tedious and time-consuming, such as lengthy calculations involving large numbers or multiple variables, can be completed in a fraction of the time with the help of calculators. This speed and efficiency allow students to focus more on understanding and analyzing problem-solving approaches rather than getting bogged down in manual calculations.

Calculators help reduce the risk of human error associated with manual calculations, thereby promoting better accuracy in exam solutions. By automating arithmetic operations and mathematical functions, calculators minimize the likelihood of calculation errors, translation errors and calculation inaccuracies. This increased accuracy ensures that students' exam answers reflect a more accurate representation of their mathematical understanding and problem-solving skills.

The use of calculators allows students to explore a broader range of problem-solving techniques and evaluate alternative solutions more efficiently. Complex problems in business mathematics often require iterative calculations, numerical analysis and scenario modelling, which are easily possible with calculators. By providing instant results and feedback, calculators allow students to cycle through different problem-solving approaches, evaluate the feasibility of solutions, and make informed decisions in real-time.

Business mathematics exams often include tasks that require processing large data sets, analyzing financial models, and performing statistical calculations. Calculators equipped with advanced features such as statistical functions, financial calculators, and programming capabilities are well suited to tackling such tasks. Students can use calculators to perform regression analysis, calculate financial ratios, evaluate



investment scenarios, and manipulate complex mathematical expressions precisely and efficiently. In summary, there are many benefits to using calculators in business mathematics exams. From speeding up complex calculations and reducing human error to facilitating problem-solving processes and handling large amounts of data, calculators serve as indispensable tools that improve students' efficiency, accuracy, and analytical skills.

**Disadvantages of Calculator Dependence:** Potential Overdependence Leads to Decreased Mental Calculation Skills: Overreliance on calculators can cause students' skills in mental arithmetic and basic mathematical operations to decline. Relying solely on calculators for routine calculations can hinder students' ability to perform mental calculations, estimate quantities, and independently verify results. This over-reliance on calculators can affect students' mathematical fluency and problem-solving skills, as they may find it difficult to solve problems efficiently without the aid of electronic devices.

**Risk of errors due to incorrect entries or misuse of functions:** Despite their processing power, calculators are prone to errors, especially when users enter incorrect values or misuse functions. Students may accidentally enter incorrect numbers, select incorrect operations, or misinterpret calculator output, resulting in calculation errors and inaccuracies in exam solutions. Additionally, reliance on calculators can lull students into a false sense of security and cause them to overlook errors or not critically evaluate the validity of results obtained through calculator calculations.

**Limited understanding of underlying mathematical concepts:** Over-reliance on calculators can lead to a superficial understanding of underlying mathematical concepts and principles. Relying solely on calculators to perform calculations allows students to bypass the process of conception.

**Dependence on specific calculator models that may not always be available:**

Students' proficiency with calculators may depend on familiarity with specific calculator models or brands that may not always be available or acceptable in exam environments. Differences in calculator features, layouts, and user interfaces between different models can be challenging for students who are familiar with using a particular calculator. In cases where students are required to use standardized or provided calculators on exams, reliance on familiar calculator models can disrupt their workflow and impact exam performance.

In summary, while calculators offer numerous advantages in business mathematics exams, an over-reliance on these electronic devices can have several disadvantages. From deteriorating mental arithmetic skills and increasing the risk of errors to promoting limited understanding of mathematical concepts and reliance on specific models of calculators, educators must find a balance between leveraging the benefits

of calculators and fostering students' mathematical skills and independence.

**Effects of poor numeracy skills on exam performance:**

**Reduced efficiency and speed in solving problems:** Students with inadequate numeracy skills may experience delays and inefficiencies when completing exam tasks as they have difficulty navigating calculator functions and performing calculations accurately. Without good numeracy skills, students may spend too much time on simple calculations or encounter difficulties in performing complex mathematical operations, resulting in slower problem-solving processes and reduced productivity during exams.

**Increased likelihood of errors and inaccuracies:** Lack of numeracy skills increases the risk of errors and inaccuracies in exam solutions because students may make errors when entering values, selecting functions, or interpreting calculator output. Without sufficient computer skills, students are more susceptible to calculation errors, implementation errors and misinterpretation of results, which affects the accuracy and reliability of their exam answers.

**High Position of stress and anxiety among students:**

Students who warrant confidence in their computers can witness increased situations of stress and anxiety during examinations because they're hysterical about the possible consequences of committing computation crimes or not completing tasks within the limits that can be completed within the given time. The pressure to perform under time pressure and the query when operating the computer can increase test-related stress and vitiate scholars' capability to concentrate on working problems.

**Impaired problem-solving skills and critical thinking skills:** Inadequate numeracy skills can impair students' problem-solving skills and critical thinking skills, affecting their ability to analyze problems, develop strategies, and effectively evaluate solutions. Students may resort to trial-and-error approaches or rely on guesswork rather than applying systematic problem-solving techniques and mathematical reasoning, resulting in suboptimal exam performance and incomplete understanding of underlying concepts.

**Adverse impact on overall exam scores and academic performance:** The cumulative effect of reduced efficiency, increased errors, increased stress, and impaired problem-solving skills due to poor numeracy skills can adversely affect students' overall exam scores and academic performance. Students may receive lower grades or fail to demonstrate mastery of the concepts and techniques of business mathematics, jeopardizing their academic progress and future opportunities in related fields. In summary, a lack of numeracy skills can significantly impact students' performance on business mathematics exams, affecting their efficiency, accuracy, confidence and overall academic performance. Addressing these challenges requires targeted interventions aimed at improving students' numeracy skills, reducing exam-related stress, and promoting critical thinking and problem-solving skills in mathematical contexts.



Strategies to Optimize Calculator Use for Exam Success: In today's educational landscape, calculators play a critical role in supporting students' mathematical calculations and problem-solving skills. However, the effectiveness of using calculators in exams depends largely on how well students master these tools. This study examines strategies for optimizing calculator use for exam success. The focus is on integrating calculator training into the curriculum, emphasizing conceptual understanding alongside competency, providing guidance in selecting appropriate calculator models, encouraging practice, and providing alternative assessment methods.

Integrating calculator training into the curriculum: Integrating dedicated calculator training into the curriculum ensures that students are familiar with the various functions and features of their calculators. These sessions can cover basic operations, complex functions, programming features (if applicable), and tips for efficient use. Research by Smith and Stein (2018) [1] suggests that the inclusion of such sessions leads to an improvement in students' numeracy skills, which leads to better performance on mathematical assessments.

While calculators can speed up mathematical calculations, students must understand the underlying mathematical concepts. Emphasizing conceptual understanding alongside numeracy promotes deeper understanding and improves problem-solving skills (Hiebert & Grouws, (2015)[2]. Educators should incorporate activities and discussions that strengthen conceptual understanding and ensure that students use calculators as tools to support understanding rather than as aids to replace it. The availability of a large selection of computer models can be overwhelming for students. Advice on selecting appropriate models based on curriculum requirements and examination regulations is crucial. Additionally, educators should ensure that students understand the features and capabilities of the calculators they choose. Research by Choi and Zelezny-Green (2020) [3] highlights the importance of aligning calculator functions with curriculum objectives to maximize their effectiveness in assessments.

Promote practice and familiarity with calculator operations through homework and mock exams: Regular practice and familiarity with calculator operations through homework and mock exams are essential for building competency. Encouraging students to solve problems using calculators reinforces learning and increases confidence in their abilities. Furthermore, the inclusion of computational-based questions in exams familiarizes students with exam formats and reduces anxiety (LeFevre et al., 2019) [4]. Educators should provide ample opportunities for practice and constructive feedback to support student progress.

Providing alternative assessment methods for assessing students' mathematical skills without relying solely on calculators: Although calculators are valuable tools, assessments should not be based solely on their use. Integrating alternative assessment methods such as written explanations, problem-solving tasks without calculators, and collaborative projects enables a comprehensive assessment of

students' mathematical skills (Rohrer et al., 2015) [5]. This approach promotes critical thinking, communication skills and creativity, which are essential for success beyond exams. Conclusion: Optimizing calculator use for exam success requires a multifaceted approach that balances competency with conceptual understanding and integrates various strategies into the curriculum. By incorporating calculator training, emphasizing conceptual understanding, providing guidance on selecting appropriate models, encouraging practice, and offering alternative assessment methods, educators can enable students to effectively use calculators as tools for mathematical exploration and problem-solving. Order of the Basic Mathematical Operations and its importance:

The acronym for the BODMAS rule is "Brackets, Orders (Exponents), Division and Multiplication (left to right), Addition and Subtraction (left to right)." In some areas, it is also referred to as PEMDAS. To ensure consistency and correctness in calculations, this rule specifies the order in which operations in mathematical statements must be performed. The BODMAS rule has a direct impact on the use of calculators because it provides users with instructions on how to correctly enter mathematical formulas to obtain precise answers. Brackets: Make sure expressions in parentheses are evaluated first when using a calculator. Most calculators have a button to open and close parentheses so that users can organize expression components by priority order. For example, in the expression  $(4 + 5) * 3$ , the calculator should first add 4 and 5 before multiplying by 3.

Orders (Exponents): Exponents or powers are usually entered using the ^ symbol or a special key on calculators. The BODMAS rule dictates that expressions with exponents after parentheses should be evaluated. For example, in the expression  $2^3 * 4$ , the calculator should first calculate 2 to the power of 3 before multiplying by 4.

Division and multiplication (left to right): Division and multiplication operations have the same priority and are evaluated left to right according to the BODMAS rule. Most modern calculators follow this convention and perform division and multiplication operations as they appear in the expression from left to right. For example, in the expression  $10 \div 2 * 3$ , the calculator should first divide  $(10 \div 2)$  before multiplying by 3.

Addition and subtraction (left to right): Similar to division and multiplication, addition and subtraction operations also have the same priority and are evaluated from left to right. Calculators follow this convention and perform addition and subtraction operations as they appear in the expression from left to right. For example, in the expression  $8 + 4 - 2$ , the calculator should first add 8 and 4 before subtracting 2. By understanding and applying the BODMAS rule, users can correctly enter expressions into their calculator, ensuring that calculations are performed in the intended order of operations and produce accurate results. This understanding is essential for both basic arithmetic and basic arithmetic.



The Chartered Accountant (C.A) Foundation Examination Paper 3 covers topics such as simple interest, compound interest and annuities, which require knowledge of mathematical calculations. Calculator skills play an important role in these exams as they directly impact students' ability to perform accurate calculations within the allotted time frame. This case study examines real-world scenarios in which student numeracy skills impacted student performance on C.A Foundation exam.

**Scenario 1: Simple Interest Calculation During the C.A Foundation exams,** students had to solve questions on simple interest calculations. However, many students had difficulty performing the calculations correctly on their calculators, resulting in errors in their answers. Common problems included entering incorrect interest rates, misinterpreting periods, and failing to convert percentages to decimals.

**Example 1:** Calculate the simple interest on a principal amount of Rs.5000 at an interest rate of 8% per annum for 3 years.

**Correct Calculation:** Simple Interest =  $P * T * i$   
= (Principal  $\times$  Time  $\times$  Rate)  
= Rs. (5000  $\times$  3  $\times$  0.08) = Rs.1200

However, due to calculator errors, some students obtained incorrect results, affecting their overall performance on the exam.

**Scenario 2: Compound Interest Computation.** In another instance, students encountered questions requiring compound interest calculations, which involved more complex computations compared to simple interest. Despite having a basic understanding of the formula, some students struggled to correctly input variables into their calculators, leading to errors in calculations.

**Example 2:** Find the compound interest on an investment of Rs.3000 at an annual interest rate of 5%, compounded annually for 2 years.

**Correct Calculation:** Compound Interest =  $P(1 + i)^n - P$ ,  
Where  $i = R/100$   
= Rs.3000  $[(1 + 0.05)^2] - Rs.3000 \approx Rs.320.79$

However, inaccurate calculator inputs resulted in incorrect answers for some students, impacting their exam scores.

**Scenario 3: Annuity Calculation** Annuity calculations involve determining periodic payments or future values of investments. Students faced challenges in setting up annuity calculations on their calculators, particularly in cases involving varying interest rates or payment frequencies.

**Example 3:** Calculate the future value of an annuity that pays Rs.500 at the end of each year for 5 years, with an annual interest rate of 6%.

**Correct Calculation:** Future Value of Annuity =  $Payment \times [(1 + i)^n - 1] / i$   
= Rs.500  $\times [(1 + 0.06)^5 - 1] / 0.06 \approx Rs.2834.96$

Although some students understood the concept, they had difficulty entering the correct formulas and variables into their calculators, resulting in calculation errors.

**Conclusion:** For the C.A Foundation Quantitative Aptitude - Business Mathematics questions, mastery of calculator usage

has a significant impact on students' performance in topics such as simple interest, compound interest and annuity. Students must not only have a strong understanding of mathematical concepts but also be able to use calculators effectively to perform accurate calculations within exam time constraints. Educators should emphasize the importance of computational skills to ensure student success on business mathematics exams through training sessions, practice exercises, and guidance on calculator use strategies. Although there may be no specific academic studies that focus exclusively on the relationship between numeracy skills and exam success in C.A. Foundation Business Mathematics, we can analyze broader research on mathematics education and numeracy to provide insights relevant to this context. Here is an analysis based on available research:

**Impact of computational knowledge on mathematical performance:** Numerous studies in mathematics education have examined the relationship between computational knowledge and academic performance. Research by Hembree and Dessart (1986) [6] found a positive relationship between numeracy skills and problem-solving skills in mathematics. Similarly, a meta-analysis by Hattie (2009) [7] showed that the effective use of calculators improved students' mathematical performance in various areas.

**Role of calculator training in test preparation:** Studies have highlighted the importance of incorporating calculator training sessions into mathematics curricula to improve students' numeracy skills and problem-solving strategies. For example, research by Smith and Stein (2018)[1] highlighted the importance of providing explicit instruction on calculator functions to increase students' efficiency in mathematical tasks.

**Effect of calculator use on exam performance:** While specific studies on C.A. Foundation exams may do so. Research on the use of calculators in standardized exams, while limited, provides insight into their impact on exam performance. Studies by Pella and Kurland (1985) [8] and Klein and Stromeyer (1975) [9] showed that students who are proficient with calculators tend to perform better on exams, especially when solving complex mathematical problems.

**Integrating computational skills into assessment:** Incorporating computational questions into assessments and exams is now common in mathematics education. However, research suggests that the effectiveness of calculator use depends on students' understanding of mathematical concepts as well as the ability to operate calculators (Choi & Zelezny-Green, 2020) [3]. Therefore, assessments should assess both conceptual understanding and numeracy skills to provide a comprehensive measure of students' mathematical abilities.

**Teacher Practices and Numeracy:** Educators play a critical role in promoting students' numeracy skills through teaching practices and instruction. Research from the National Council of Teachers of Mathematics (NCTM) emphasized the importance of professional development for teachers to effectively integrate calculators into mathematics instruction



to support student learning and test preparation (NCTM, 2000) [10]. RAYAPROLU VISWAPRASAD AND DR KONDA SRINIVASA RAO(2024)[11] studies found that a lack of technical skills tends to negatively correlate with success in the math section of the C.A. foundation entrance exam, and the correlation coefficient between these two is -0.173702.

## II. IN SUMMARY,

While specific studies that directly examine the relationship between numeracy skills and exam success in the C.A Foundation Business Mathematics course is lacking, broader research in mathematics education suggests a positive relationship between numeracy skills and academic performance. Effective integration of numeracy training, assessment practices and teacher support can contribute to better test performance in business mathematics and other mathematical areas. Further research specifically focused on the C.A. exams Foundation could provide valuable insights into the role of numeracy skills in students' success on these exams.

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