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Comparison of the mathematics book for the second preparatory grade in Egypt and its equivalent in United Arab Emirates

(Action Research)

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Abstract

This research aims to analyze the mathematics textbook for the second year of preparatory school in Egypt and compare it with the UAE Grade 8 mathematics textbook. The comparison has focused on content, learning objectives, and the strengths and weaknesses of the Egyptian curriculum. Additionally, it has examined key aspects of the UAE textbook that could contribute to the development of the Egyptian curriculum. The study has also evaluated the applications presented in both textbooks and assessment strategies. To support this analysis, we conducted questionnaires on a sample of students.

Key Words: Mathematics Book, Preparatory Stage, Content, Learning methods, Applications.

1. Introduction

Education is the cornerstone of building and developing societies, as it directly contributes to preparing generations capable of facing future challenges. Mathematics, in particular, plays a pivotal role in developing logical thinking and problem-solving skills. The school textbook serves as the primary resource for students in learning mathematics, presenting concepts in an organized manner that ensures systematic knowledge acquisition. It also reflects the state's educational philosophy and guides the learning process in alignment with its educational objectives.

The school textbook is not merely a means of conveying information; it is a comprehensive educational tool aimed at developing students' knowledge and abilities. Additionally, it serves as a reliable reference for both students and teachers, offering a systematic explanation of concepts along with assessment questions that help measure comprehension and retention. Furthermore, the school textbook contributes to developing critical thinking and problem-solving skills, enabling students to apply knowledge effectively in their daily lives and future careers.

Mathematics is one of the most essential subjects, playing a crucial role in enhancing students' cognitive abilities and developing their logical reasoning and problem-solving skills. At the preparatory stage, students encounter complex mathematical concepts, such as algebra and geometry, which form the foundation for multiple scientific fields, including engineering, physics, computer science, and economics. The role of mathematics is not limited to academics; it extends to various aspects of practical life, where it strengthens analytical, reasoning, and critical thinking skills all of which are essential for success in numerous professions and industries. Therefore, it is vital to teach mathematics in a way that helps students develop their applied skills and stimulates creative thinking (Saosing, Noparit,2014, 1686–1693).

The Trends in International Mathematics and Science Study (TIMSS) serves as a global benchmark for assessing the effectiveness of mathematics curricula in different countries. It provides a framework that evaluates students' knowledge, application skills, and reasoning abilities. Both Egypt and UAE aim to align their mathematics textbooks with TIMSS standards to improve student performance and global competitiveness.

The assessment frameworks in TIMSS are organized around two dimensions. The first is the content domain, which specifies the subject matter of the item, and the second is the cognitive domain, specifying the thinking processes to be assessed.

TIMSS (2023) distribution of item across content and cognitive domain:

Content Domains	Percentage
Number	30%
Algebra	30%
Geometry and measurement	20%
Data and probability	20%

Cognitive Domains	Percentages
Knowing	35%
Applying	40%
Reasoning	25%

There are many studies that compare mathematics textbooks in different grade levels between arab countries such as (القرنى، 2023، 150–180),
(الغنام، 2020، 396–463).

In this study, we analyze the differences between the Grade 8 mathematics textbook in Egypt and its counterpart in UAE by comparing content, teaching methods, assessment strategies, technological integration, and economic factors, this research aims to explore how each curriculum aligns with the country's educational vision and contributes to preparing students for future academic and professional challenges.

This comparison aims to analyze how mathematical concepts are presented in the curricula of two Arab countries that share cultural and linguistic similarities, yet may differ in teaching methods and content. Through this study, we can assess the effectiveness of each curriculum in fostering deep understanding of mathematics and enhancing students' logical thinking skills. Additionally, this comparison allows us to identify the strengths and weaknesses of each curriculum and explore how successful experiences can be leveraged to improve education in Egypt.

2. The Theoretical Framework:

1. Content: –

The mathematics textbook in Egypt focuses on three areas: algebra, geometry, and statistics and probability. In algebra, students learn about real numbers and operations on them, linear equations with two variables, inequalities and factorization. The geometry section includes medians of triangle, the isosceles triangle, comparing the measures of the angle of triangle, similarity and projection, area and volume of two and three–dimensional shapes. In statistics and probability, students learn how to collect and organize data. The content aims to enhance students' understanding of basic concepts, mathematical thinking and problem solving.

On the other hand, the mathematics textbook in UAE is divided into main areas: number and its operations, algebra, geometry, statistics and probability. In number and operations, students learn rational and irrational numbers, exponents, and square roots. Additionally, they enhance their skills in performing operations with integers,

fractions and decimals. The algebra section includes the study of linear equations, inequalities, systems of linear equations and functions. Geometry covers triangles, Pythagorean theorem, geometric transformations, congruence, similarity, area and volume of two and three–dimensional shapes. In statistics and probability, students learn how to collect, organize, and analyze data using tables, charts and graphs and how to make predictions based on data.

This curriculum aims to enhance students' ability to understand basic concepts, apply these mathematical concepts in life situations and develop critical thinking and problem solving. Mathematics book in UAE in line with the global education standards of the decade, UAE ranks 20th globally and 2nd in the Arab world according to the TIMSS global education rankings 2023.

In terms of content between Egypt and UAE, it is the same scientific content between the two countries, and since we are an Arab country, this means that the culture in the curriculum is the same, but there are some differences. Each country has its own way of presenting this content. We find that UAE has been interested in providing guidance to students so that they can understand the content. Among the content is a section dedicated to mathematical practices that help the student acquire mathematical skills that enable the student to understand the content. These skills include methods for solving problems, making mathematical inferences, building assumptions, using mathematical tools, and thinking abstractly. After each lesson, there is a section dedicated to achieving these practices. There is a very special section in the UAE book dedicated to the dictionary, which contains some mathematical concepts and some engineering information that the student has studied before, which the student may need while studying the curriculum.

The content is integrated into daily life. This is an important section that helps understand the content, and it is what distinguishes UAE from Egypt. A very large section in the content of exercises that develops the student and helps him understand the content, as these exercises aim to diversify the student's skills. Egypt has already begun to develop the content section so that it contains multiple and varied exercises.

2. Learning methods:–

This study aims to analyze and compare interactive and traditional teaching methods, with a particular emphasis on how the United Arab Emirates (UAE) has successfully implemented interactive strategies in Mathematics education. The research investigates the strengths, weaknesses, and overall

impact of these methods, offering a nuanced understanding of their efficacy in modern educational settings. By focusing on the UAE's innovative approaches, the study highlights key practices and policies that have contributed to significant advancements in Mathematics education.

Interactive Teaching Method: Interactive teaching is a learner–centered approach designed to actively engage students in the learning process. This method prioritizes participation, critical thinking, and teamwork, encouraging students to analyze concepts deeply and collaboratively solve problems. It leverages modern technology, such as smart boards, digital platforms, and educational games, to create a dynamic and engaging learning environment. This approach fosters a more personalized and effective learning experience, tailored to the needs and interests of individual students.

Traditional Teaching Method: The traditional teaching method is a teacher–driven approach that relies heavily on lectures, memorization, and direct instruction. In this framework, the teacher acts as the primary source of knowledge, delivering content to passive learners. Interaction among students is minimal, and the learning process often emphasizes rote learning over critical thinking or collaboration. While this method has been the cornerstone of education for decades, its limitations in fostering engagement and adaptability have become increasingly apparent in modern classrooms.

Comparison Criteria to evaluate the effectiveness of these teaching methods, the study examines the following key parameters:

1. Student Academic Performance: Assessing how each method influences the comprehension, retention, and application of mathematical concepts.
2. Use of Technology: Analyzing the integration of advanced tools and digital resources to enhance the learning experience.
3. Creativity and Critical Thinking: Measuring the development of independent thinking, problem–solving skills, and innovative approaches fostered by each method.

The UAE's Approach to Interactive Teaching UAE has emerged as a global leader in adopting interactive teaching strategies, particularly in Mathematics education. Through a combination of technological advancements, policy reforms, and innovative pedagogical practices, the country has set a benchmark for modern educational systems. Notable initiatives include:

1. Smart Classrooms: The widespread implementation of smart boards, simulations, and digital materials has transformed traditional classrooms into interactive

learning hubs. These tools facilitate visual learning and interactive problem-solving, making mathematical concepts more accessible and engaging.

2. Digital Platforms: Programs such as "Madrasa" and "Alef" provide tailored e-learning solutions that cater to diverse student needs. These platforms offer interactive lessons, quizzes, and real-time feedback, enhancing the overall learning experience.
3. Educational Reforms: Policies like "Teaching 2020" underscore the UAE's commitment to modernizing its education system. These reforms prioritize student-centered learning, equipping educators with the skills and tools necessary to implement interactive teaching effectively.

Specific strategies employed in mathematics education include:

- Gamification: The integration of games, quizzes, and interactive activities makes learning enjoyable and stimulates curiosity.
- Problem-Based Learning (PBL): Teaching through real-world challenges fosters critical thinking and practical application of mathematical concepts.
- Collaborative Learning: Encouraging teamwork and peer interaction helps students tackle complex mathematical problems collectively, building their communication and collaboration skills.

Results and Recommendations Findings: The study reveals that interactive teaching methods significantly enhance several aspects of learning, including:

- Increased student engagement and interest in Mathematics.
- Improved ability to connect mathematical concepts with real-life applications.

Recommendations:

1. Broaden the Use of AI-Driven Tools: The integration of artificial intelligence (AI) tools into education presents immense opportunities for personalized learning. By analyzing individual student performance and preferences, AI can provide tailored recommendations, adaptive learning paths, and instant feedback. Such tools can enhance comprehension and ensure that student progress at their optimal pace, accommodating various learning styles and needs. Expanding the availability of AI tools across schools and educational institutions will foster more inclusive and effective learning environments.
2. Enhance Teacher Training: Teachers play a pivotal role in the successful implementation of interactive teaching methods. To ensure educators are well

equipped, comprehensive training programs should focus on the integration of technology, interactive teaching strategies, and classroom management techniques. Workshops, certifications, and continuous professional development opportunities can help teachers stay updated with emerging trends and tools in education. By fostering a community of well-trained educators, schools can ensure the sustainability and scalability of interactive teaching practices.

3. Ensure Accessibility: Accessibility is a cornerstone of equitable education. Efforts should be made to extend interactive teaching resources to underserved and remote areas. This includes providing affordable devices, internet connectivity, and digital content that can be accessed offline. Governments and educational institutions should collaborate to address infrastructure challenges and ensure that every student, regardless of their socioeconomic background, has access to quality education. Initiatives like public-private partnerships and community-driven programs can play a crucial role in bridging the digital divide.

3. Education and Its Connection to the Economy:

UAE's education strategy is closely aligned with its economic diversification plans. Initiatives such as the UAE Vision 2021 and the Artificial Intelligence Strategy emphasize the importance of building a knowledge-based economy. Education policies are tailored to support innovation and the development of skills in areas like science, technology, and entrepreneurship. The country has modernized its curricula to promote critical thinking, digital literacy, and lifelong learning. Moreover, the UAE has attracted international universities and research institutions to boost its educational offerings.

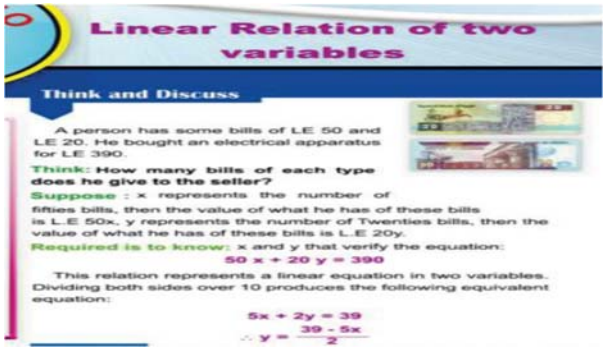
Egypt: recognizing the need to improve its education system, has launched reforms aimed at modernizing curricula, promoting creativity, and expanding vocational training. However, these efforts are limited by the country's economic constraints. Many schools, especially in rural areas, suffer from overcrowding and a lack of resources. Although the government is encouraging technical and vocational education to reduce the gap between graduate skills and labor market demands, implementation remains slow and uneven.

4. Applications

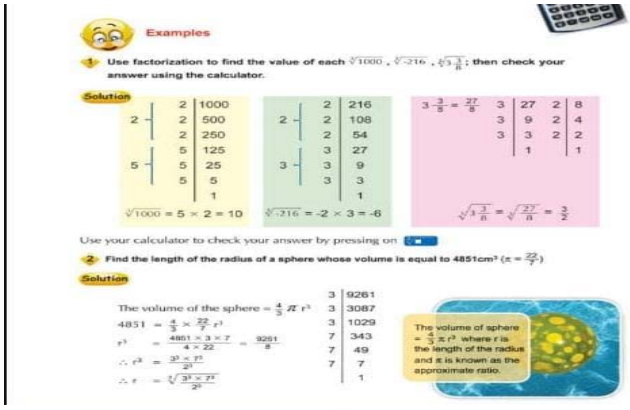
UAE has focused on the diversity of applications in its content, as it provides many exercises that link mathematics to daily life, as they were interested in the applications covering all cognitive aspects. In the beginning, there are exercises on knowledge such as laws or definitions, then exercises for application on the content such as solving problems related to laws. There is a very important part, which is the part related to creative thinking skills, which is the highest part in the applications that measure the extent of the student's comprehension of the content. Each part of the applications measures the percentage of the student's understanding of the content presented to him. These applications appear in algebra, geometry and statistics. In algebra, students learn how to use algebraic expressions, equations and inequalities to solve practical problems involving distance, time and money. In addition, they apply real numbers, decimals and fractions in sports like baseball, tennis and hockey. Additionally, they apply square roots in Bulletin Boards. Geometry is used to understand shapes, angles, and measurements especially in the fields of architectural and design. They also study transformations and symmetry, which are useful in art and engineering. In statistics, students learn how to collect, organize, and analyze data using tables, charts and graphs. Also, they learn how to calculate measures such as mean, median and mode and how to use them in decision– making problems.

On the other hand, the applications in Egypt book are traditional mathematical problems and few. These applications appear in algebra, geometry and statistics. In algebra, students apply equations to solve problems involving time, money and measurements. Geometry applications involve calculating areas, perimeter and volumes of different shapes. In statistics, students learn how to collect, organize, and interpret data through charts and graphs.

Examples of applications in Egypt textbook:



Examples of applications in UAE textbook:



Examples

1 Use factorization to find the value of each $\sqrt[3]{1000}$, $\sqrt[3]{-216}$, $\sqrt[3]{3\frac{3}{8}}$; then check your answer using the calculator.

Solution

2	1000
2	500
2	250
5	125
5	25
5	5
	1

$\sqrt[3]{1000} = 5 \times 2 = 10$

2	216
2	108
2	54
3	27
3	9
3	3
	1

$\sqrt[3]{-216} = -2 \times 3 = -6$

3	27	2	8
	3	2	4
	3	2	2
	1		1

$\sqrt[3]{3\frac{3}{8}} = \sqrt[3]{\frac{27}{8}} = \frac{3}{2}$

Use your calculator to check your answer by pressing on

2 Find the length of the radius of a sphere whose volume is equal to 4851cm³ ($\pi = \frac{22}{7}$)

Solution

The volume of the sphere $= \frac{4}{3}\pi r^3$

$4851 = \frac{4}{3} \times \frac{22}{7} r^3$

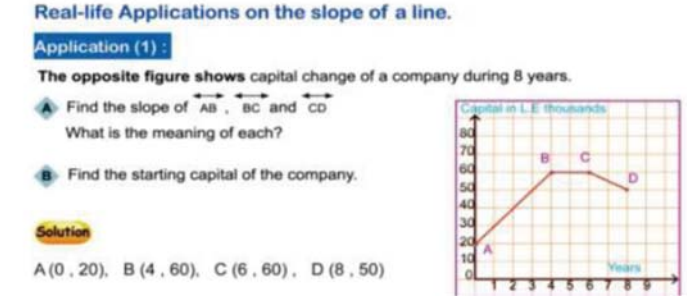
$r^3 = \frac{4851 \times 3 \times 7}{4 \times 22} = \frac{9261}{8}$

$\therefore r^3 = \frac{3^3 \times 7^3}{2^3}$

$\therefore r = \sqrt[3]{\frac{3^3 \times 7^3}{2^3}}$

3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

The volume of sphere $= \frac{4}{3}\pi r^3$ where r is the length of the radius and π is known as the approximate ratio.



Real-life Applications on the slope of a line.

Application (1) :

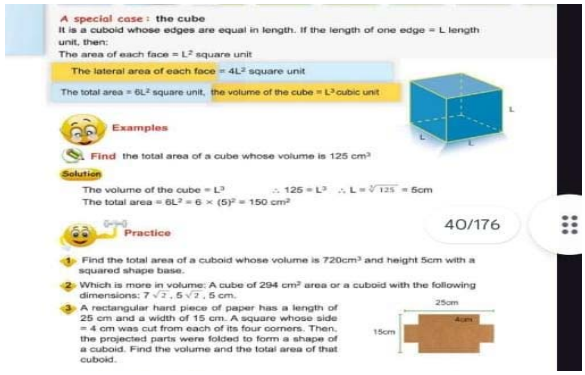
The opposite figure shows capital change of a company during 8 years.

A Find the slope of $\overleftrightarrow{AB}$, $\overleftrightarrow{BC}$ and $\overleftrightarrow{CD}$ What is the meaning of each?

B Find the starting capital of the company.

Solution

A (0 , 20), B (4 , 60), C (6 , 60) , D (8 , 50)



A special case : **the cube**

It is a cuboid whose edges are equal in length. If the length of one edge = L length unit, then:

The area of each face = L^2 square unit

The lateral area of each face = $4L^2$ square unit

The total area = $6L^2$ square unit, the volume of the cube = L^3 cubic unit

Examples

Find the total area of a cube whose volume is 125 cm³

Solution

The volume of the cube = L^3 $\therefore 125 = L^3$ $\therefore L = \sqrt[3]{125} = 5$cm

The total area = $6L^2 = 6 \times (5)^2 = 150$ cm²

Practice

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1 Find the total area of a cuboid whose volume is 720cm³ and height 5cm with a squared shape base.

2 Which is more in volume: A cube of 294 cm² area or a cuboid with the following dimensions: $7\sqrt{2}$, $5\sqrt{2}$, 5 cm.

3 A rectangular hard piece of paper has a length of 25 cm and a width of 15 cm. A square whose side = 4 cm was cut from each of its four corners. Then, the projected parts were folded to form a shape of a cuboid. Find the volume and the total area of that cuboid.

traffic fluidity?

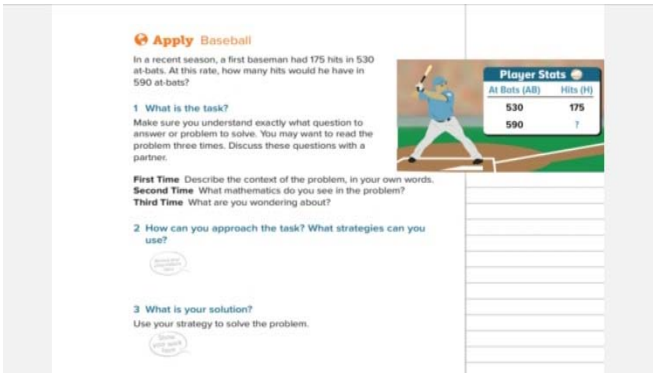
Collecting data

Let's work together Cooperate with your classmates on collecting data from their sources through distribution of roles:

A **Group 1:** Collects primary data about the problem under discussion through a survey that asks about (the means of transportation - Roads conditions - time of traffic jam - Existence of traffic signs - existence of security).

B **Group 2:** Collects secondary data about the problem under discussion from the traffic reports - the internet - the mass media).

C **Group 3:** Observes the crowdest roads, the drivers' behavior and their obedience to traffic rules the pedestrians' commitment to the virtues to the road as well as crossing the roads at safe places.



Apply Baseball

In a recent season, a first baseman had 175 hits in 530 at-bats. At this rate, how many hits would he have in 590 at-bats?

Player Stats

At Bats (AB)	Hits (H)
530	175
590	?

1 What is the task?

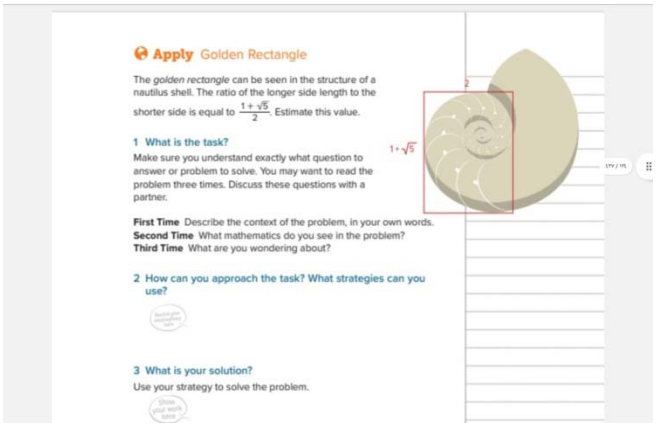
Make sure you understand exactly what question to answer or problem to solve. You may want to read the problem three times. Discuss these questions with a partner.

First Time Describe the context of the problem, in your own words.
Second Time What mathematics do you see in the problem?
Third Time What are you wondering about?

2 How can you approach the task? What strategies can you use?

3 What is your solution?

Use your strategy to solve the problem.



Apply Golden Rectangle

The *golden rectangle* can be seen in the structure of a nautilus shell. The ratio of the longer side length to the shorter side is equal to $\frac{1+\sqrt{5}}{2}$. Estimate this value.

$1+\sqrt{5}$

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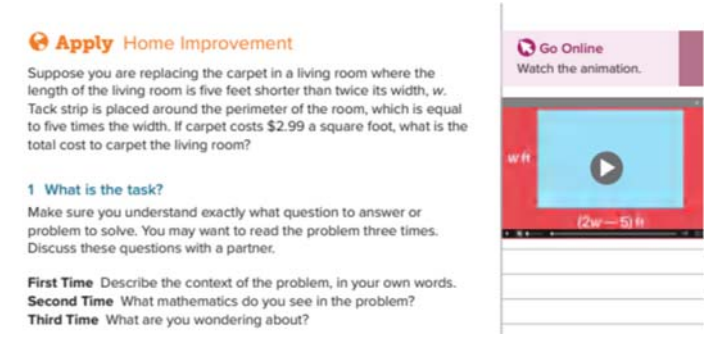

Apply Home Improvement

Suppose you are replacing the carpet in a living room where the length of the living room is five feet shorter than twice its width, *w*. Tack strip is placed around the perimeter of the room, which is equal to five times the width. If carpet costs $2.99 a square foot, what is the total cost to carpet the living room?

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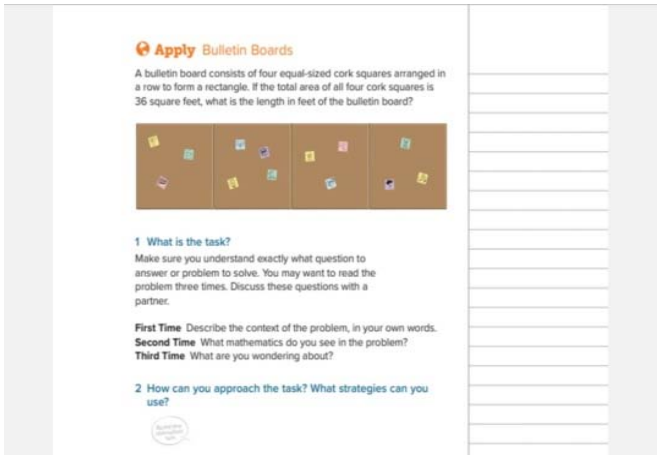
Go Online
Watch the animation.



Apply Bulletin Boards

A bulletin board consists of four equal-sized cork squares arranged in a row to form a rectangle. If the total area of all four cork squares is 36 square feet, what is the length in feet of the bulletin board?

1 What is the task?

Make sure you understand exactly what question to answer or problem to solve. You may want to read the problem three times. Discuss these questions with a partner.

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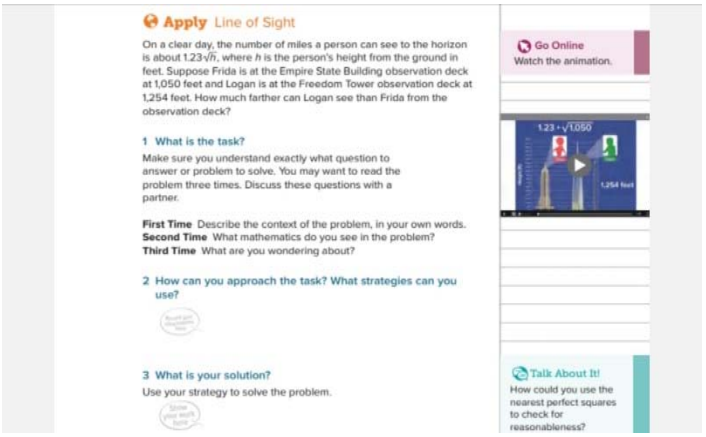

Apply Line of Sight

On a clear day, the number of miles a person can see to the horizon is about $1.23\sqrt{h}$, where h is the person's height from the ground in feet. Suppose Frida is at the Empire State Building observation deck at 1,050 feet and Logan is at the Freedom Tower observation deck at 1,254 feet. How much farther can Logan see than Frida from the observation deck?

Go Online
Watch the animation.

1 What is the task?

Make sure you understand exactly what question to answer or problem to solve. You may want to read the problem three times. Discuss these questions with a partner.

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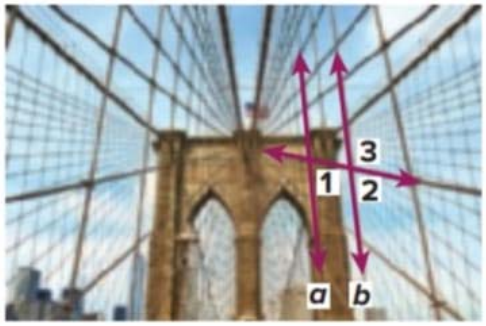
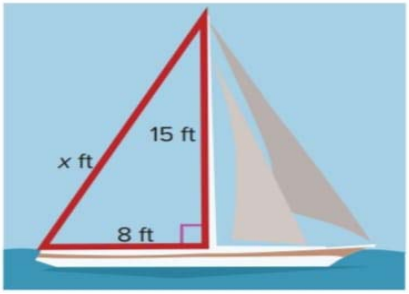
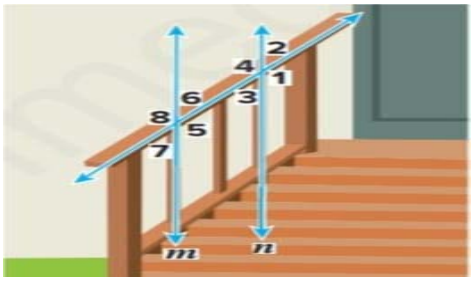
Use your strategy to solve the problem.

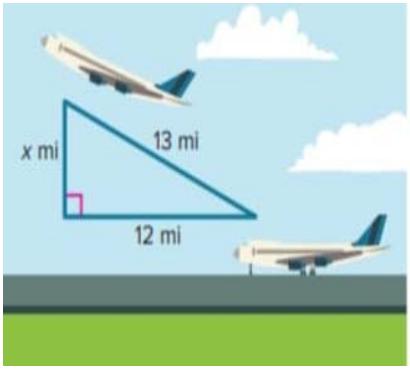
Talk About It!

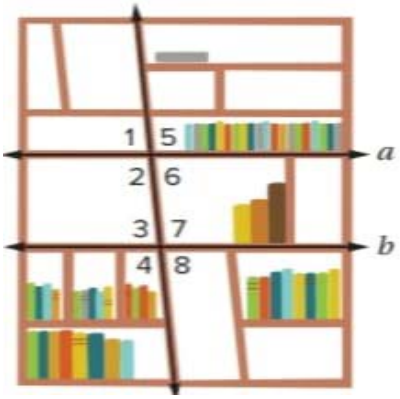
How could you use the nearest perfect squares to check for reasonableness?

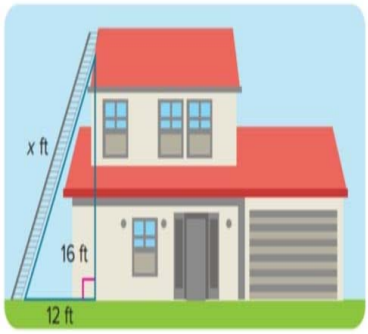












5. **Technology**

Using technology in education:

Technology in Egypt:

Egypt has been gradually integrating technology into its education system through government initiatives and programs like the "Education 2.0" reform. However, challenges such as limited infrastructure, inconsistent access to devices, and internet connectivity affect its implementation.

Mathematics Education:

Use of tools like interactive whiteboards and educational software is limited to urban schools. Students often rely on traditional teaching methods, such as lectures and printed textbooks.

Technology-enhanced learning, such as gamified math applications or online platforms, is less common in public schools.

Challenges:

Budget constraints and uneven access to resources.

Limited teacher training in using advanced educational technology.

Technology in Education in UAE:

The UAE has invested heavily in its education system, aiming to align with global standards. The country has embraced technology through initiatives like "Smart Learning" programs and collaboration with tech companies.

Mathematics Education:

1. Grade 8 students often use platforms like Mathletics, Khan Academy, or custom-made tools to enhance understanding.

2. Integration of artificial intelligence in adaptive learning tools.

3. Use of iPads, interactive whiteboards, and augmented reality to make math lessons engaging.

Advantages:

1. Well-equipped schools with high-speed internet and devices.

2. Continuous professional development for teachers in tech integration.

The impact of using technology on learning Mathematics for Grade 8 in Egypt and UAE

In Egypt:

The lack of widespread technological integration often leads to traditional rote learning. Students miss personalized learning experiences that could enhance problem-solving skills.

In UAE:

High-tech integration fosters interactive and personalized learning, improving students' mathematical understanding and engagement

The UAE is also investing in the development of artificial intelligence (AI)

for education. AI can be used to personalize instruction, to provide feedback, and to grade assignments. It can also be used to create adaptive learning platforms and to generate personalized learning plans.

The use of technology in UAE education is still in its early stages, but it is growing rapidly. The UAE government is committed to making technology an integral part of its education system. This commitment is helping to prepare UAE students for the challenges of the 21st century.

Ministry of Education UAE: **https://www.moe.gov.ae/ar/Pages/home.aspx**

12. Laimoon

Laimoon is a professional course and training program search engine for professionals looking to advance their careers. They work with over 200 training providers to help consumers and organizations select the best course for their requirements among over 40,000 programs. The platform began in Dubai, UAE, and currently serves over one million customers each month in over 30 countries worldwide.

Laimoon has a separate portal for providers that allows them to add their courses.

Bonus: Laimoon also has a corporate business. It connects businesses with top education providers so that working professionals can also upskill themselves and serve their companies better.

Website: https://laimoon.com/

https://www.laimoon.com/

13. Dubai Education Guide

Dubai Education Guide, as the name suggests, is a comprehensive guide to schools and universities in Dubai and other places in the middle east. The website has separate sections for nursery schools, high schools, colleges, and universities. It also enlists training centers for working professionals. They also have a rich blog section covering numerous topics.

Dubai Education Guide allows advertising for institutions. They also accept guest blogs. The relevant contact details are present at the footer of their website.

Bonus: Dubai Education Guide is a great source of contact information for schools, colleges, universities, and other educational institutions.

Website: https://www.dubaieduguide.com/

https://www.dubaieduguide.com/

3. Yalla Schools

Yalla Schools is a website geared toward parents. It allows parents to choose the best school for their children after comparing multiple metrics which is generally a difficult undertaking as there are several aspects to consider before coming to a decision. It enables parents to find, compare, and apply to the best schools and nurseries in the UAE. Fees, overview, leadership & teachers, curriculum, admission information, rating & reviews, facilities, and location are all available for schools in the UAE.

Yallas Schools allows advertising on its website and has a dedicated form to take in advertising information.

Bonus: The website also has lists of the best Indian schools in UAE (CBSE & CISCE), British schools (CIE Cambridge), IB Schools, and MOE Schools in UAE.

Website: https://www.yallaschools.com/

4. Master Studies

https://www.yallaschools.com/

8. Khaleej Times

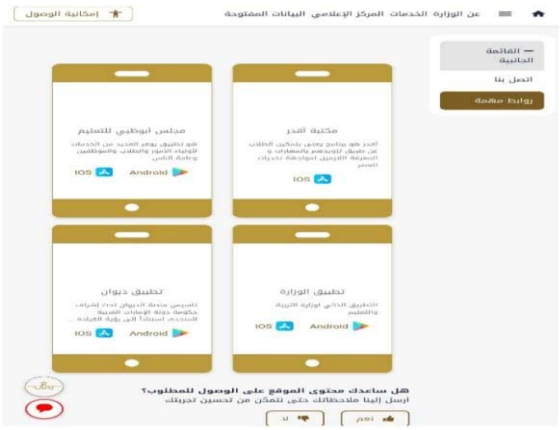
Galadari Printing and Publishing Co. L.L.C is the publishing firm of the Khaleej Times, the UAE's first and major English daily. The newspaper first appeared in April 1978. Their website was created in 1997 and is one of the UAE's major English digital news outlets, reaching over fifteen million people monthly through a large network of social media platforms.

Education institutions can advertise with them. They allow display ads as well as partner content.

Bonus: Khaleej Times is a great way to reach out to parents as it has a high monthly readership.

Website: https://www.khaleejtimes.com/

https://www.khaleejtimes.com/



6. Evaluation

Evaluation is one of the important aspects of the educational process as it enables us to determine students level of understanding, identify their strengths and weaknesses and develop strategies to enhance student learning.

Differences in Evaluation between Egypt and United Arab Emirates (UAE).

In Egypt

1. Evaluation Approach

Evaluation in Egypt depends on exam that measure students 'ability to understand

basic concepts and apply them in solving problems. With recent educational reforms in Egypt, exams have started to measure students 'critical thinking, creativity, and problem–solving skills

2. Structure of Exams

National exams in higher grades have been replaced by multiple smaller assessments throughout the year, providing a continuous evaluation system.

In UAE:

1. Evaluation Approach:

UAE follows diverse curriculums (e.g., British, American, CBSE, UAE Ministry of Education). Public schools emphasize the Arabic language, Islamic studies, and English proficiency, while private schools offer a range of international syllabi.

Evaluations are standardized, especially in public schools, focusing on comprehensive and equitable learning

2. Structure of Exams:

Public school students undertake standardized exams, particularly in Grade 9 (Preparatory Stage) and Grade 12. Private schools following international curriculums have their respective evaluation frameworks.

3. Modern Practices:

Technology and active learning are central to UAE education, with continuous assessment and project–based evaluations gaining traction in many private institutions

3. Methods of Research and the tools used

In this section, we have presented the common lessons between the two books in algebra and geometry in the same manner as shown in the UAE textbook, including some of the applications found in it.

In addition, we designed an educational application called Like terms to simplify the idea of like algebraic terms. This concept is a key to understanding linear relationships between two variables. The application presents the material in a clear and interactive manner, making it easier for students to grasp the content and build a solid understanding of the targeted unit.

https://www.appsgeyser.com/18474632

"Like Terms" is just a game memory like similar cards but with mathematical operations.

Questionnaires have been conducted on a sample of students. These questionnaires are questions that measure the extent to which the three cognitive domains knowledge, application and reasoning are achieved before and after adding applications to some lessons in the first semester. The three–way Likert scale has been relied upon to conduct and analyze these questionnaires.

First: Algebra

Students	Knowledge questions	Application questions	Critical thinking questions
1	3	2	3
2	3	1	2
3	3	2	1
4	3	2	2
5	3	3	1
6	3	3	1
7	2	3	1
8	2	3	1
9	1	2	1
10	2	2	1
11	3	2	1
12	3	1	1
13	1	1	1
14	2	2	2
15	1	2	2
16	2	1	2
17	2	2	1
18	1	2	1
19	2	1	1
20	1	3	2
Average	$\frac{43}{20} = 2.15$	$\frac{40}{20} = 2$	$\frac{28}{20} = 1.4$

$$Mean = \frac{5.55}{3} = 1.85$$

Second: Geometry

Students	Knowledge questions	Application questions	Critical thinking questions
1	1	2	1
2	3	3	1
3	2	1	1
4	1	2	1
5	1	3	1
6	3	2	3
7	1	2	1
8	3	2	1
9	1	2	2
10	3	1	1
11	1	2	1
12	3	1	1
13	1	2	2
14	2	1	2
15	2	2	1
16	1	2	1
17	3	1	1
18	2	2	2
19	3	1	2
20	1	2	2
Average	$\frac{38}{20} = 1.9$	$\frac{36}{20} = 1.8$	$\frac{28}{20} = 1.4$

$$Mean = \frac{5.1}{3} = 1.7$$

After adding applications:

First: Algebra

Students	Knowledge questions	Application questions	Critical thinking questions
1	3	3	2
2	3	3	3
3	3	3	1
4	3	3	1
5	3	3	2
6	3	2	1
7	3	2	1
8	3	3	2
9	3	3	3
10	3	3	3
11	3	3	3
12	2	2	2
13	1	2	1
14	2	1	1
15	1	1	2
16	2	1	2
17	1	2	2
18	3	1	2
19	2	2	1
20	1	2	1
Average	$\frac{48}{20} = 2.4$	$\frac{45}{20} = 2.25$	$\frac{36}{20} = 1.8$

$$Mean = \frac{6.45}{3} = 2.15$$

Second: Geometry

Students	Knowledge questions	Application questions	Critical thinking questions
1	2	2	1
2	3	3	2
3	3	3	1
4	3	3	3
5	3	3	3
6	3	3	3
7	3	3	3
8	3	3	2
9	3	3	2
10	3	3	3
11	3	3	3
12	3	3	2
13	3	3	2
14	2	2	2
15	3	2	2
16	1	2	2
17	2	1	1
18	2	2	1
19	1	3	2
20	2	1	1
Average	$\frac{51}{20} = 2.55$	$\frac{51}{20} = 2.55$	$\frac{41}{20} = 2.05$

$$Mean = \frac{7.15}{3} = 2.38$$

4. Results of Research

Before adding applications:

It is clear from questionnaires that:

- **The general average for achieving the three cognitive domains in algebra=1.85**
- **The general average for achieving the three cognitive domains in geometry =1.7**

After adding applications:

- **The general average for achieving the three cognitive domains in algebra=2.15**
- **The general average for achieving the three cognitive domains in geometry =2.38**

5. Interpretation of Results

According to the three–point Likert scale

The value of the general average for achieving the three cognitive domains in algebra and geometry before and after adding applications means that it increases from 61.7% to 71.7% in algebra and from 56.7% to 79.3% in geometry after adding applications.

6. Conclusion

This research aims to develop and enhance six key elements related to the structure and effectiveness of mathematics textbooks in Egypt and the UAE. These elements are content, learning resources, economic aspects, applications, assessment, and technology.

Firstly, content should be more thoughtfully designed. The textbook must become a central educational resource by including a wide range of real–life examples that gradually increase in complexity, making it easier for students to relate and understand concepts deeply. In addition, the content should incorporate varied formats such as illustrations, charts, and group activities to cater to different learning styles.

Secondly, in terms of learning resources, there is a strong need for dedicated, reliable, and easily accessible platforms. These platforms should be monitored by an official committee to ensure credibility and should be available exclusively to students and teachers, enhancing the focus on education. They must also be continuously updated and fully aligned with the curriculum to support student learning effectively.

Thirdly, the economic aspect is crucial. Governments should allocate a specific portion of the national budget to support educational development, especially in the

field of digital education and modern learning technologies, to keep up with global progress.

Fourthly, after the content has achieved its educational purpose, there should be a strong focus on practical applications. These real-life applications help students connect what they have learned with the world around them, reinforcing understanding and relevance.

Fifthly, assessment should be varied in both format and substance. In terms of format, evaluation methods should include electronic exams, scientific competitions, and traditional written tests. Regarding content, assessments should align with TIMSS standards and include three components: knowledge-based questions, application tasks, and reasoning challenges.

Finally, technology must be integrated as a core element of the educational process. Students should learn to use various technological tools, such as interactive whiteboards, smart boards, tablets, and digital projectors, as essential parts of modern education. Moreover, teachers should receive ongoing training to effectively incorporate these technologies into their teaching practices.

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