Course: Teaching of Mathematics (6409)
Semester: Autumn, 2021

ASSIGNMENT No. 2

Q. 1 Discuss different methods of teaching LCM and GCD elementary school students, provide examples to justify the effectiveness of the methods discussed.

LEAST COMMON MULTIPLE (LCM)

1. List the first several multiples of each number.
2. Look for multiples common to both lists. If there are no common multiples in the lists, write out additional multiples for each number.
3. Look for the smallest number that is common to both lists.
4. This number is the LCM.

Prime Factors Method

Another way to find the least common multiple of two numbers is to use their prime factors. We'll use this method to find the LCM of 1212 and 1818.

We start by finding the prime factorization of each number.

12=2·2·318=2·3·312=2·2·318=2·3·3

Then we write each number as a product of primes, matching primes vertically when possible.

12=2·2·318=2·3·312=2·2·318=2·3·3

Now we bring down the primes in each column. The LCM is the product of these factors.

$$12 = 2 \cdot 2 \cdot 3$$
$$18 = 2 \cdot \quad 3 \cdot 3$$
$$\text{LCM} = 2 \cdot 2 \cdot 3 \cdot 3$$
$$\text{LCM} = 2 \cdot 2 \cdot 3 \cdot 3 = 36$$

Notice that the prime factors of 1212 and the prime factors of 1818 are included in the LCM. By matching up the common primes, each common prime factor is used only once. This ensures that 3636 is the least common multiple.

Prime factorization can also be used to determine the greatest common factor. However, rather than multiplying all the prime factors like we did for the least common multiple, we will multiply only the prime factors that the numbers share. The resulting product is the greatest common factor.

Let's wrap up with a couple of true or false review questions:

1. The least common multiple of 45 and 60 is 15.

The greatest common factor of 45 and 60 is 15, but the least common multiple is 180.

Q. 2 elaborate the use of trigonometry in daily life. Provide examples to teach trigonometry at secondary level.

Trigonometry is a very different subject than most of the math we encounter in our lives previously, and it takes a different way of thinking to understand. For that reason, many people just want to get it over with when trig comes up in school.

Trigonometry can be used to measure the height of a building or mountains:

if you know the distance from where you observe the building and the angle of elevation you can easily find the height of the building. Similarly, if you have the value of one side and the angle of depression from the top of the building you can find and another side in the triangle, all you need to know is one side and angle of the triangle.

Trigonometry in video games:

Have you ever played the game, Mario? When you see him so smoothly glide over the road blocks. He doesn't really jump straight along the Y axis, it is a slightly curved path or a parabolic path that he takes to tackle the obstacles on his way. Trigonometry helps Mario jump over these obstacles. As you know Gaming industry is all about IT and computers and hence Trigonometry is of equal importance for these engineers.

Trigonometry in construction:

In construction we need trigonometry to calculate the following:

- Measuring fields, lots and areas;
- Making walls parallel and perpendicular;
- Installing ceramic tiles;
- Roof inclination;
- The height of the building, the width length etc. and the many other such things where it becomes necessary to use trigonometry.

Architects use trigonometry to calculate structural load, roof slopes, ground surfaces and many other aspects, including sun shading and light angles.

Trigonometry in flight engineering:

Flight engineers have to take in account their speed, distance, and direction along with the speed and direction of the wind. The wind plays an important role in how and when a plane will arrive where ever needed this is solved using vectors to create a triangle using trigonometry to solve. For example, if a plane is travelling at 234 mph, 45 degrees N of E, and there is a wind blowing due south at 20 mph. Trigonometry will help to solve for that third side of your triangle which will lead the plane in the right direction, the plane will actually travel with the force of wind added on to its course.

Trigonometry in physics:

In physics, trigonometry is used to find the components of vectors, model the mechanics of waves (both physical and electromagnetic) and oscillations, sum the strength of fields, and use dot and cross products. Even in projectile motion you have a lot of application of trigonometry.

Do archaeologists use trigonometry?

Trigonometry is used to divide up the excavation sites properly into equal areas of work. Archaeologists identify different tools used by the civilization, using trigonometry can help them in these excavate. They can also use it to measure the distance from underground water systems.

Trigonometry in criminology:

In criminology, trigonometry can help to calculate a projectile's trajectory, to estimate what might have caused a collision in a car accident or how did an object fall down from somewhere, or in which angle was a bullet shot etc.

Trigonometry in marine biology;

Marine biologists often use trigonometry to establish measurements. For example, to find out how light levels at different depths affect the ability of algae to photosynthesize. Trigonometry is used in finding the distance between celestial bodies. Also, marine biologists utilize mathematical models to measure and understand sea animals and their behaviour. Marine biologists may use trigonometry to determine the size of wild animals from a distance.

Trigonometry in marine engineering:

In marine engineering trigonometry is used to build and navigate marine vessels. To be more specific trigonometry is used to design the Marine ramp, which is a sloping surface to connect lower and higher level areas, it can be a slope or even a staircase depending on its application.

Trigonometry used in navigation:

Trigonometry is used to set directions such as the north south east west, it tells you what direction to take with the compass to get on a straight direction. It is used in navigation in order to pinpoint a location. It is also used to find the distance of the shore from a point in the sea. It is also used to see the horizon.

Other uses of trigonometry:

- It is used in oceanography in calculating the height of tides in oceans.
- The sine and cosine functions are fundamental to the theory of periodic functions, those that describe the sound and light waves.
- Calculus is made up of Trigonometry and Algebra.
- Trigonometry can be used to roof a house, to make the roof inclined (in the case of single individual bungalows) and the height of the roof in buildings etc.

- It is used naval and aviation industries.
- It is used in cartography (creation of maps).
- Also trigonometry has its applications in satellite systems.

Q. 3 highlight the scope and significance of financial arithmetic in mathematics. Elaborate techniques of teaching financial arithmetic by providing examples.

1. Introduction

Financial mathematics is the product of applying mathematics to portfolio selection theory and option pricing theory. With the rapid development of the economic situation, the products and derivatives of the financial industry are constantly optimized and innovative, and new financial products and services are gradually increasing. The operation of financial markets, the design and pricing of financial derivatives, and the analysis and management of risk become very important, and the research and development of financial mathematics is becoming more and more important. Therefore, it is of practical significance to analyze the specific application of mathematics in the financial field.

Financial mathematics, also called analytical finance, mathematical finance and mathematical finance, is an interdisciplinary subject of mathematics and finance that arose in the late 1980s and early 90s. Financial mathematics mainly uses the modern mathematical theory and method (such as stochastic analysis, stochastic optimal control, portfolio analysis, nonlinear analysis, multivariate statistical analysis, mathematical programming, modern computational methods etc.) of financial (including banking, investment, bonds, funds, stocks, futures, options and other financial instruments and markets) analysis the number of theory and practice. The core problem is the selection theory of the optimal investment strategy and the asset pricing theory under the uncertain condition. Financial mathematics not only have a direct effect on the innovation of financial instruments and financial markets operate efficiently, but also for the company's investment decision-making and evaluation of project research and development (such as real options) and risk management in financial institutions has been widely used.

From a broad point of view, financial mathematics is a new discipline which applies mathematical theories and methods to the operation of Finance and economy. From the narrow perspective, mathematical problems in the financial field is mainly on the stock selection and portfolio analysis of asset pricing theory combined under conditions of uncertainty, which is the optimal arbitrage, and equilibrium theory the three most important basic concepts.

Applying mathematics to the financial field is based on some financial or economic assumptions, and uses abstract mathematical methods to construct mathematical models of how the financial mechanism works. Financial mathematics mainly includes the basic concepts and methods of mathematics, the related natural science methods and so on. They are applied in various forms of entry theory. The use of mathematics is to express, reason, and prove the underlying principles of finance. From the nature of financial mathematics,

financial mathematics is an important branch of finance. Therefore, financial mathematics is completely based on the background and foundation of financial theory. The people who engage in financial mathematics through formal financial academic training will have more advantages in this context. Finance is used as a subdiscipline of economics of identity development, though it has a characteristic enough from the economic independence, but it still requires economic principle and economic technology related as background. At the same time, financial mathematics also needs financial knowledge, tax theory and accounting principles as the background of knowledge.

The theoretical basis of financial mathematics also includes mathematical modeling and statistical theory, the first step is a mathematical or statistical modeling, which is from the complex financial environment were key factors to identify related factors and independent factors, and then from a series of assumptions to deduce various relations, finally obtains the conclusion to make the conclusion explain. This modeling activity is not only very useful and very important, because in finance a small error, an error is derived, a wrong conclusion, or a conclusion of error explanation may lead to a financial disaster. In addition, in the study of financial mathematics, the application of computer technology also has a very prominent position.

In the modern financial theory, mathematics in the field of finance is another important application is analyzed in option pricing and investment decision using differential game method, and the application of this aspect has made remarkable achievements. Because the whole law of financial market does not accord with the hypothesis of steady state, the abnormal fluctuation of securities will lead to abnormal change in the process of abnormal fluctuation, and this kind of change will not obey the Brown motion. At this point, we need to use stochastic dynamic model to study and analyze the whole decision-making of securities investment. This method is not only in theory or in practice, but also has a great deviation. The financial problems and countermeasures by using the differential method to non geometry in the financial field of the Brown distribution has important use, not only can effectively relax this assumption can also be uncertain disturbances become hostile to the illusion of hand. The stability (robustness) of the strongest portfolio strategy can be obtained through the optimization analysis of the whole uncertain problem.

At the same time, in the process of entering the field of the analysis of the problem in using differential game method, only needs a Behrman equation, and this equation belongs to the first-order differential equation is two order partial differential equation to solve the problem of random in much simpler. So, the application of differential game method to study the problems in the financial sector will have broad prospects, especially has very important significance for the study of the random strategy, repeat, combination and other financial problems of securities investment.

Using differential game method to study option pricing problem and investment decision problem is an important direction of the development of modern financial theory, and some achievements have been achieved. When the financial market does not satisfy the steady-state assumption or abnormal fluctuations in stock prices, often do not obey the geometry Brown motion, then using the method of random dynamic model of securities

investment decision problems both in theory, or in fact there is deviation from. Using the differential game method to study the financial decision problem can relax the hypothesis. The uncertainty disturbance is assumed to be a hostile one, and the optimal investment strategy with strong robustness can be obtained by optimizing the worst case. In addition, the Behrman equation for differential games is a first-order partial differential equation, which is much simpler than the two order partial differential equations for stochastic control problems. Therefore, the application of differential game method to the study of financial problems has broad application prospects.

Q. 4 explain different measurement scales by providing examples, also elaborate that how these scales help in interpretation of test scores?

In Statistics, the variables or numbers are defined and categorised using different **scales of measurements**. Each **level of measurement** scale has specific properties that determine the various use of statistical analysis. In this article, we will learn four types of scales such as nominal, ordinal, interval and ratio scale.

A scale is a device or an object used to measure or quantify any event or another object.

There are four different scales of measurement. The data can be defined as being one of the four scales. The four types of scales are:

- Nominal Scale
- Ordinal Scale
- Interval Scale
- Ratio Scale

Nominal Scale

A nominal scale is the 1st level of measurement scale in which the numbers serve as "tags" or "labels" to classify or identify the objects. A nominal scale usually deals with the non-numeric variables or the numbers that do not have any value.

Characteristics of Nominal Scale

- A nominal scale variable is classified into two or more categories. In this measurement mechanism, the answer should fall into either of the classes.
- It is qualitative. The numbers are used here to identify the objects.
- The numbers don't define the object characteristics. The only permissible aspect of numbers in the nominal scale is "counting."

Example:

An example of a nominal scale measurement is given below:

What is your gender?

M- Male

F- Female

Here, the variables are used as tags, and the answer to this question should be either M or F.

Ordinal Scale

The ordinal scale is the 2nd level of measurement that reports the ordering and ranking of data without establishing the degree of variation between them. Ordinal represents the "order." Ordinal data is known as qualitative data or categorical data. It can be grouped, named and also ranked.

Characteristics of the Ordinal Scale

- The ordinal scale shows the relative ranking of the variables
- It identifies and describes the magnitude of a variable
- Along with the information provided by the nominal scale, ordinal scales give the rankings of those variables
- The interval properties are not known
- The surveyors can quickly analyse the degree of agreement concerning the identified order of variables

Example:

- Ranking of school students – 1st, 2nd, 3rd, etc.
- Ratings in restaurants
- Evaluating the frequency of occurrences
    - Very often
    - Often
    - Not often
    - Not at all
- Assessing the degree of agreement
    - Totally agree
    - Agree
    - Neutral
    - Disagree
    - Totally disagree

Interval Scale

The interval scale is the 3rd level of measurement scale. It is defined as a quantitative measurement scale in which the difference between the two variables is meaningful. In other words, the variables are measured in an exact manner, not as in a relative way in which the presence of zero is arbitrary.

Characteristics of Interval Scale:

- The interval scale is quantitative as it can quantify the difference between the values
- It allows calculating the mean and median of the variables
- To understand the difference between the variables, you can subtract the values between the variables

- The interval scale is the preferred scale in Statistics as it helps to assign any numerical values to arbitrary assessment such as feelings, calendar types, etc.

Example:

- Likert Scale
- Net Promoter Score (NPS)
- Bipolar Matrix Table

Ratio Scale

The ratio scale is the 4th level of measurement scale, which is quantitative. It is a type of variable measurement scale. It allows researchers to compare the differences or intervals. The ratio scale has a unique feature. It possesses the character of the origin or zero points.

Characteristics of Ratio Scale:

- Ratio scale has a feature of absolute zero
- It doesn't have negative numbers, because of its zero-point feature
- It affords unique opportunities for statistical analysis. The variables can be orderly added, subtracted, multiplied, divided. Mean, median, and mode can be calculated using the ratio scale.
- Ratio scale has unique and useful properties. One such feature is that it allows unit conversions like kilogram – calories, gram – calories, etc.

Example:

An example of a ratio scale is:

What is your weight in Kgs?

- Less than 55 kgs
- 55 – 75 kgs
- 76 – 85 kgs
- 86 – 95 kgs
- More than 95 kgs

Q. 5 highlight the benefits of planning assessment in teaching of mathematics. Also develop five short answer questions to be used for formative assessment learners.

Aims and objectives of the course

In order to begin with lesson planning, it is important to know the aims and objectives of the course being taught to students. A teacher should be prepared not only to teach the students but also to make sure that they take some fruitful thought regarding the lesson at the end of the class. The aims and objectives should answer questions regarding all the angles of the course. The questions could be like the following:

Teaching and learning activities

Once the aims and objectives are in place, it is important to make sure that the planned lesson is understandable by the students. The teacher should prepare different explanation methods for the students to understand the

topic easily. The methods could include giving real-life examples or creating a hypothetical situation related to the topic. Moreover, showing videos related to the topic may also assist in better understanding. Including activities related to the lesson is helpful for students to remember the topic being taught.

The key is time management. A teacher has to time all the activities during the class hours in order to finish the lesson according to the plan. Everything including explanation, examples, and activities have to be timed in a manner that the lesson is not extended for the next class.

Assessments to check student understanding of the topic

In order to check the understanding after the planning and learning activities, it is important that the teacher drafts questions in different ways to check the knowledge and understanding of the topic. It's the teacher's decision to check the understanding orally or in writing. For this question answer session, time is required. The questions have to be preplanned. The teacher should be aware of what she planned for the students to learn so that questions can be drafted accordingly. Also, activities can be planned to check the knowledge and understanding of the matter.

Benefits of lesson planning

"By failing to prepare, you are preparing to fail." Thus, an organised teacher will always be able to deliver the lesson within the given time frame (during the limited class timings). With the additional time saved, a teacher can give additional attention and time to students that require additional help. Also, there will be a sense of control and direction while teaching. Even if there is confusion amongst the students, the teacher will be able to guide them effectively as the teacher will be well versed with the subject matter and will be able to cater the questions without any stress.

A teachers' most important trait is confidence. Lesson planning can help the teacher to be well prepared and be aware of what he/she intends on teaching the students. To meet your student's expectations, one must be a certified tutor. To become one, you need to do the Level 4 Certificate in Education and Training course. It can help the teacher to focus more on the basic knowledge first then take the students towards the next step. The teacher will never stammer or mumble during the lecture because of the timely preparation of the lesson.

Furthermore, a teacher is one of the first few inspirations of a child. Setting a good example of pre-planning can always assist a teacher to become a good inspiration and the confidence with which the teacher delivers the lesson will make the student realise the importance of planning ahead of time and adopt this habit for other disciplines of life.

The ethnic diversity in schools is increasing with the passage of time as the people from rural areas have realised the importance of education. Thus, the learning capacity of each student varies from one another. Lesson planning can minimise this understanding gap if the teacher plans the lesson effectively. This can be done by taking the first step that is, start teaching from the core so that nobody is left behind and that every student is on the same page and then the teacher moves ahead with the topic.

Conclusion

A lesson plan does not necessarily have to be a detailed script that contains the plan of every interaction with students in the classroom. It should preferably have the general overview of the aims and objectives of the course, the plan of teaching and learning activities of the course and the activities planned to check the students' understanding. The driving force behind lesson planning is the motivation for the teacher and hunger to learn more by students is what keeps a teacher going.

Methods for Teaching Math

When we talk about a **method** of instruction, we mean how content is being taught. This runs the gamut from style of instruction—for example, lecture vs. hands-on—to materials used. Here are some tried and true methods for teaching math:

Use Visuals

Many students need to see a lesson in addition to hearing it. While explaining an operation or skill, use a visual or graphic to help get the point across. This can be as simple as showing the lesson on a document camera or as savvy as using a video or other technology tool.

Note that children do best when instruction is paired with a visual; using a visual as a stand-alone teaching device isn't always effective. Vary your usage to keep students engaged.

Make Connections

Our brains are machines that thrive on connections. In fact, long-term memory is a complicated web of neurons, or brain cells, banded together. To help students make sense of concepts, provide them with connections to the real world or previously taught lessons. Always begin a new lesson with a reminder of the last. For example, you might say, 'Yesterday, we learned about the numerator in fractions. Today, we'll take a closer look at the other part of a fraction: the denominator.'

Also, pay close attention to how students react to the connections you make. For example, one group might understand best when you use board games as an example, while another group might react better to an example connected to sports.

Use Assessments

Math is typically a progression-based subject. Skills build one upon another, and the order in which they're taught is predetermined. Because of this, a math teacher doesn't have to think much about what to teach when, but it is necessary to use assessments to determine student understanding. **Formative assessments**, or informal assessments meant to check in on student learning and drive future instruction, should be used frequently. This can help teachers identify students who struggle and allow additional small group or one-on-one instruction.

Formative assessments aren't usually taken for grades. Students need to feel comfortable with their exploration of a subject without fear of their performance being used for grading.

Focus on Strategies

As we'll talk about later, math is all about problem-solving using strategies. Sometimes, there's only one way to solve a problem, but many times there are multiple avenues to the answer. When teaching, model several

strategies for understanding and exploring a concept. Encourage students to apply high-level skills when given problems and focus on the thought process involved in the solution. Although math usually only has one right answer, being able to reason through the steps to find the answer is the most important part of being a successful math student.

Teaching Math Strategies

As we discussed earlier, we want our students to be mathematical thinkers. This means they need to think strategically about solving math problems. A **strategy**, then, is a way teachers instruct for maximum benefit. Teachers use strategies to help students learn math as well. Thinking about how to best deliver a lesson is foremost in quality teaching.