SPIRITUAL LESSONS IN THE STUDY OF MATHEMATICS:
A SECONDARY SCHOOL PERSPECTIVE

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I . INTRODUCTION

In middle and high schools, the goal of establishing the study of mathematics is to promote balanced intellectual development. Carried further, intellect should be developed to be utilized for the glory of God and to be balanced in all aspects. Ellen G. White described in her book-Child Guidance (pp 332-333) "If one faculty is suffered to remain dormant, or is turned out of its proper course, the purpose of God is not carried out. All the faculties should be well developed. Care should be given to each, for each has a bearing upon the others,.. ".

What are the faculties that can be developed through the study of mathematics? Can such faculty development play a positive role in achieving the spiritual goal? What kind of spiritual lessons can be obtained through the study of mathematics? The goal of mathematical study is to improve the ability to solve problems. Mathematical problem solving involves obtaining the desirable answer using definitions and proven theorems. It is very important to solve the problem without error by understanding the mathematical definitions and then applying the proper theorem for the conditions of the problem.

To determine how the study of mathematics impacts religious life, the following approaches will be discussed. First, several characteristics of mathematical study will be examined in view of the effects of mathematical study on religious life. Second, spiritual lessons obtained through mathematical study will be investigated.

II. CHARACTERISTICS OF MATHEMATICAL STUDY

1. Mathematics can solve a problem within the model of the logical premise.

Most people have experienced difficulties in the study of mathematics. Even now, most students consider mathematics as a hard course. The famous inventor, Thomas Edison also had difficulty in the study of mathematics and was suspended in the end because of mathematics. When he asked a teacher, "Why does one plus one make two?" the teacher and other students were confused and as a consequence, the class could not be continued further. Edison was evaluated as a student who could not study with normal students and later suspended from school. However, as we know, Edison was not a retarded or slow-learning child. The problem that he had, was failing to understand the logic of "1+1=2" in a purely mathematical sense. For him, the realistic situation was more important than mathematical logic. In other words, "1+1=2" is correct in mathematics, but "1+1=1" can also hold true in a practical sense. For example, if one tiger is added to one rabbit, only one tiger remains in the end because the tiger could kill and eat the rabbit. Edison did not adapt himself to new mathematical premise and logic. As mathematics has its own characteristics to solve a problem within the model of logical premises, the concept of salvation described in the Bible can be also understood through the premise of biblical promise and faith.

2. Mathematics can solve a problem through mathematical expression.

Mathematics can be described as a foreign language. The reason most people find the study of mathematics difficult is failure to understand the mathematical

language. When comparing languages, the words of each language are different word but represent the same concept. However, mathematical language is a conceptually different language.

Mathematics solves many problems, expressing facts that can be understood by intuitive experience in our daily life as axioms. There is an axiom in geometry that states, "the sum of the two sides of a triangle is longer than the remaining side." This is the fact that can be obtained through our daily experience if we are old enough to understand the concept of distance. Another example, when a hunting dog chases a rabbit, the dog utilizes a straight line rather than a curved line. Although this is a common sense, the axiom, "the shortest distance between two points is a line," gives many students a headache when it is introduced in geometry. Therefore, most people consider mathematics as a science designed to confuse people and complicate very easy concepts as difficult mathematical axioms and theorems. Then, what is the reason why such phenomena are defined as axioms in mathematics? The answer is that such axioms are applied to solve more advanced problems. In other words, the value and role of the axiom is as a tool to extend the field of geometry rather than the value of a simple axiom that explains a simple phenomenon. In a similar sense, there are many languages of faith in the Holy Bible. In order to grasp correctly the meaning of the Bible words, we must understand the language of the Bible in the viewpoint of salvation described in the Bible. Also, to understand deeply the truth of salvation describe in the Bible, the study of mathematics, a science that expands our way of thinking is very helpful in the study of the Bible.

3. Mathematics can describe problems that do not normally exist in the real world.

Mathematics can express abstract concepts in a reasonable and logical fashion by means of mathematical definitions and symbols and can express situations that do not exist concretely. There are two examples: (i) if remaining is positive number, lacking is negative number; and (ii) something going to the East is positive number, then something going to the West is negative number. Positive

and negative numbers are expressed as profit and loss, progress and regress, future and past, respectively. These are one-dimensional expressions and represent movement on a vertical line and cannot adequately describe two-dimensional concepts such as East, West, South and North. Two-dimensional concepts have to be used to express that situation. While, in one-dimensional expression, only right and left is distinguished, there are up and down on right side, and also up and down on left side in two-dimensional expression. We live in three-dimensional space that is extended to concept of back and front at each case of two-dimension. Therefore, movement of all objects can be expressed only by three-dimension that is composed of three elements. Although our concrete experience is limited to three-dimensional space, and perhaps to four dimensions if time is included, mathematical thought can be extended to describe space that we cannot concretely experience such as five-dimensional space and beyond.

There is another example. Positions of all real numbers can be expressed using one-dimensional vertical line on the basis of zero. However, the square of any number is not expressed as negative number. Therefore, the square root of a negative number cannot exist as a real number. Mathematics brings in the concept of imaginary numbers in this case to describe square roots of negative numbers and these numbers can be manipulated and analyzed with this extension of mathematical thought.

Let us think again about one-dimensional mathematical thought. We have learned at school something called the number line containing all the real numbers including zero. Each real number can be expressed position or size on the line. The imaginary number can also have its own position and size if we consider two-dimensional plane instead of one-dimensional line and define the distance of a point from zero as a size of the number. A complex number including the real number and the imaginary number can be described in two-dimensional plane. Therefore, using mathematical approach, we can express the imaginary number as something to have its own size.

An analogy can be made between this and faith in God and heaven that we cannot see, as described in Heb 11:1-3. Religious life involves seeing the Heavenly Kingdom and witnessing the Kingdom. As mentioned above, mathematics can express an intangible abstract concept using number, equation, and diagram. Such a mathematical thought can help to understand the existence of heaven and further to improve the power of spiritual thinking.

4. Mathematics can solve the complicated problems using new transformation.

It is also possible to do the four arithmetic operations on the complex numbers as with real numbers. However, multiplication and division of complex numbers are very difficult due to the intrinsic properties of complex numbers. To alleviate this difficulty, complex numbers can be plotted on a complex number plan that can be transformed into polar coordinates using trigonometric formulas. This is described in De Moivre's theorem. This complex number plane can also be applied to high degree equations, which are unsolvable using traditional factor analysis.

Another approach to solving complex mathematical problems is metathesis. Metathesis is a very helpful technique in solving maximum or minimum values and integral calculus. In mathematics, transformation is a powerful and useful method to solve and to understand difficult and complex problems. Rebirth is a term of faith closely related to salvation. Although the meaning of transformation in mathematics and rebirth in the Bible may be slightly different, an analogy can be made between transformation and rebirth in the process of problem solving in mathematics and salvation in religious life.

5. Way of studying mathematics.

The goal of mathematical study is to hone the ability to solve a problem.

Problem solving involves obtaining an answer to a problem using premised definitions and the proved theorems. To excel in mathematics in middle and high schools, students need to practice to understand mathematical definitions correctly and apply them properly. Practice leads to experience in solving and understanding the different kinds of mathematical problems one might encounter. The reason why most students fail to be good on mathematics is not only lack of logicality as described above but also the absence of experience to solve a problem by practice.

The same holds true if the goal of studying a religious life is growing in faith. If practice is required to improve religious life, the relationship between improvement of religious life and method to study mathematics can be explained using the following analogy.

To improve your religious life, you need practice to understand God's word, to memorize it, and then apply it in your life. The practice will increase our faith step by step. There are two types of religious people: people who only understand truth and people who understand and act according to word of truth and solve the religious problem. In order to achieve the ultimate goal of faith, it is very important not only to understand the truth of the word but also to live according to the word. One of the main reasons why most Christians do not experience success in their religious life is the study of the word with no practical application of it.

Most students dislike studying mathematical problems. However, students who enjoy the study of mathematics gather experiences and abilities to solve mathematical problems. Therefore, mathematics is related to religious life since both require the important factors of practice and experience.

Ⅲ. SPRITUAL APPLICATION

1. Promise

Gen 17:19

"And God said, Sarah thy wife shall bear thee a son indeed; and thou shalt call his name Isaac: and I will establish my covenant with him for an everlasting covenant, and with his seed after him."

Mathematics uses many definitions. Whenever you start to teach each subject, it is very important to clarify the definition. Some students try to solve problems in their own way, not by an already established mathematical definition. Such a student cannot reach a correct answer due to contradictions in his logic. There can be no mathematical proof if he does not agree to follow established mathematical definitions, postulates, and axioms. Since salvation is the absolute entity that the Bible has promised, there is no other way to obtain salvation except Jesus. Bible truth can be better understood when related to the idea of axioms and premises in mathematics.

You may ask the following questions after making your students read follows: Eze 20:12,20; Gen 4:4,5 17:4,16,19; Heb 6:17

Question 1. Why was the seventh day established as the Sabbath that has been blessed and worshiped? How could Abraham become the father of all nations? Why is Isaac the only son of faith? Why was the offering of Cain not accepted? What is the common word that is included in the answer?
Answer: covenant, promise

Question 2. What maintains such a promise?
Answer: faith

2. The Seal of God and the mark of the beast

Rev 14:1,9

"And I looked, and, lo, a Lamb stood on the mount Sion, and with him an hundred forty and four thousand, having his Father's name written in their foreheads"

"And the third angel followed them, saying with a loud voice, If any man worship the beast and his image, and receive his mark in his forehead, or in his hand,"

"Set" is defined as "a number of things of the same kind that belong or are used together"

Question 1. Can "a gathering of fat people" be a "Set"? Answer: No. Because there is no standard or definition of "fat" people, e.g., heavier than 100 kg.

Question 2. Can "a gathering of the people saved in the day of Jesus' advent" be a "Set"? Answer: Yes. Because there is a standard that is the seal of God

3. Rebirth in new world

Rev 21:3-5

"And I heard a great voice out of heaven saying, Behold, the tabernacle of God is with men, and he will dwell with them, and they shall be his people, and God himself shall be with them, and be their God.

And God shall wipe away all tears from their eyes; and there shall be no more death, neither sorrow, nor crying, neither shall there be any more pain: for the former things are passed away.

And he that sat upon the throne said, Behold, I make all things new. And he said unto me, Write: for these words are true and faithful."

Multiplication and division of complex numbers can be accomplished by corresponding numbers to points on a complex number plane which in turn correspond to polar coordinates using De Moivre's theorem. Also, traditionally unsolvable equations of high degree can be solved using the theorem. Using the concept as described above, the following spiritual truth can be explained. There are various problems in human relationship that cannot be simply solved by human effort. In order to solve the problem, a change of thinking is necessary. We need a new worldview or concepts to solve complicated problems in our human relationships just as a complex number plane is required to solve complicated equations containing complex numbers. Self can be expressed as one point and a new name can be given to us just as all complex numbers are transferred to one point and name if complex number is transformed to new nomenclature in right-angle coordinates.

Application:

Simplify $\left(\dfrac{1+i}{\sqrt{3}+i}\right)^{12}$

$$1+i = \sqrt{2}\left(\cos\frac{\pi}{4}+i\sin\frac{\pi}{4}\right), \quad \sqrt{3}+i = 2\left(\cos\frac{\pi}{6}+i\sin\frac{\pi}{6}\right)$$

$$\frac{1+i}{\sqrt{3}+i} = \frac{\sqrt{2}}{2}\left(\cos\left(\frac{\pi}{4}-\frac{\pi}{6}\right)+i\sin\left(\frac{\pi}{4}-\frac{\pi}{6}\right)\right) = \frac{\sqrt{2}}{2}\left(\cos\frac{\pi}{12}+i\sin\frac{\pi}{12}\right)$$

$$\left(\frac{1+i}{\sqrt{3}+i}\right)^{12} = \left(\frac{\sqrt{2}}{2}\right)^{12}\left(\cos\frac{\pi}{12}\times 12+i\sin\frac{\pi}{12}\times 12\right) \qquad \text{(De Moivre's theorem)}$$

$$= \frac{1}{64}\left(\cos\pi+i\sin\pi\right) = -\frac{1}{64}$$

Spiritual meaning of the following items can be found in the Bible: Matt5:3-12; Rev21:1-5.

(1) $1+i$, $\sqrt{3}+i$ ----------------------------------- old name

(2) Complicated number plane----------------- heaven

(3) $\sqrt{2}\left(\cos\dfrac{\pi}{4}+i\sin\dfrac{\pi}{4}\right)$, $2\left(\cos\dfrac{\pi}{6}+i\sin\dfrac{\pi}{6}\right)$------- new name

(4) $\left(\dfrac{1+i}{\sqrt{3}+i}\right)^{12}$ --------------------------------- complicated problem

(5) De Moivre's theorem----------------------- Heavenly law

(6) $-\dfrac{1}{64}$ -------------------------------------- problem solving

Lesson:

We can easily solve the complicated problems of our life using the equation of Christian life. Successful Christians are people who possess the ability to solve complicated problems by the principle of faith.

4. Only one master

Matt 6:24

"No man can serve two masters: for either he will hate the one, and love the other; or else he will hold to the one, and despise the other. Ye cannot serve God and mammon. "

A simultaneous first order equation is an equation that consists of a pair of linear equations of the first degree having two unknown quantities.

$$\begin{cases} ax+by=c \\ a'x+b'y=c' \end{cases}$$

The value that simultaneously satisfies two equations called the "answer" and is found by solving the given simultaneous equation. Before solving the simultaneous equation, you must eliminate one of two unknown quantities and then make a linear equation of the first order. You must eliminate one out of two.

Lesson:

We cannot get the answer of salvation when we possess both hope of eternal life and love of the world just as we cannot obtain answer of unknown quantity when two quantities exist.

5. Righteousness of Christ

Gal 2:16

"Knowing that a man is not justified by the works of the law, but by the faith of Jesus Christ, even we have believed in Jesus Christ, that we might be justified by the faith of Christ, and not by the works of the law: for by the works of the law shall no flesh be justified"

A limiting value

$$\lim_{n \to \infty} \frac{1}{n} = 0, \quad \lim_{n \to \infty} \frac{1000}{n} = 0, \quad \lim_{n \to \infty} \frac{10000}{n} = 0, \quad \lim_{n \to \infty} \frac{100000}{n} = 0$$

Application:

Numerator ------------------- our sinful life

$\lim\limits_{n \to \infty}$ --------------------- infinite love of Jesus

0 ---------------------------- forgiveness of sin

Lesson:

Even if our sin is large, we are considered as innocent men when we believe in the infinite love of Jesus just as even if a numerator is large, a limiting value is zero when the denominator is an infinite number.

6. Life with fruits

John 12:24

"Verily, verily, I say unto you, Except a corn of wheat fall into the ground and die, it abideth alone: but if it die, it bringeth forth much fruit."

ex) In 1, $\dfrac{1}{0.1}$, $\dfrac{1}{0.01}$, $\dfrac{1}{0.001}$, $\dfrac{1}{x}$, $\dfrac{1}{x}$ becomes large indefinitely when x gets

close to 0 indefinitely. In other words, we get $\dfrac{1}{0.1} = 10$, $\dfrac{1}{0.01} = 100$,

$\dfrac{1}{0.001} = 1000$, ... and $\lim\limits_{x \to +0} \dfrac{1}{x} = \infty$

Application:

In a fraction with a fixed numerator, the value of a formula becomes large when the value of a denominator becomes smaller.

The fixed value of a numerator: Finite talent

Denominator: Self

$\lim\limits_{x \to +0}$: Self becomes small infinitely and die

$\lim\limits_{x \to +0} \dfrac{1}{x} = \infty$: Infinite power, many fruits

Lesson:

All who would bring forth fruit as workers together with Christ must first fall into the ground and die. The life must be cast into the furrow of the world's need. Self-love, self-interest, must perish. But the law of self-sacrifice is the law of self-preservation.(OL86) Finite power of a man can exert his infinite spiritual power in Christ through the experience of dying himself.

7. The poor in spirit

Mat 5:3

"Blessed are the poor in spirit: for theirs is the kingdom of heaven."

Condition to be an identical equation:

In the equation, unknown x can be any number as long as the following conditions are met:

$ax + b = 0 \Leftrightarrow a = 0, b = 0$

$ax^2 + bx + c = 0 \Leftrightarrow a = 0, b = 0, c = 0$

x can be any number and satisfy the equation as long as a,b,c are 0.

$0x + 0 = 0$ or $0x^2 + 0x + 0 = 0$.

Application:

Problem $\rightarrow$ Various Equations

Anyone $\rightarrow$ x

Poor in Spirit $\rightarrow$ any constant a,b and c must be 0

Conflict will not arise $\rightarrow$ no matter what the value of x is, the result of equation is always 0.

Lesson:

Many conflicts arise frequently in human relationships. If we want to prevent more conflicts between people, we should be poor in spirit. In other words, we should recognize our need and be humble, then conflicts will never arise again.

8. Baptismal pledge

Rom 6:4

"Therefore we are buried with him by baptism into death: that like as Christ was raised up from the dead by the glory of the Father, even so we also should walk in newness of life."

The range of variable in the substitution:

Question:

Find the minimum value for
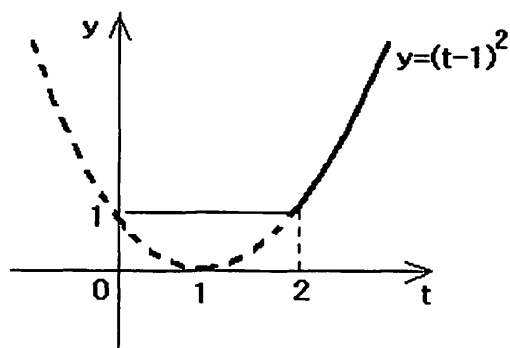
the function $y = (x^2 - 2x + 3)^2 - 2(x^2 - 2x + 3) + 1$

Answer:

Let's substitute $x^2 - 2x + 3 = t$

then function $y = t^2 - 2t + 1 = (t - 1)^2$

Hence, $t = (x - 1)^2 + 2, \quad t \geq 2$

Therefore, the equation $y = (t - 1)^2 \quad t \geq 2$.

Then the graph of the variation of the value y will be as follows. Therefore when t=2, y gets the minimum value 1.

Application:

In order to solve the problem like this, the substitution and determining the range of t are very important. Maximum and Minimum value must be within the range of t. By not defining the range of t, answer becomes incorrect. Substitution is used in complex mathematical equation and problem. It is similar with the functionality and role of the rebirth that is directly linked with our spiritual salvation. Defining the range of variable is also similar to our promise to God at the time of one's baptism. By not defining the range of variable, one cannot get the correct answer. By not following the promise and commitment at the time of baptism, One also fails the Christian life even after

the baptism.

Lesson:

Those who were born again as God's children should live differently from their life before rebirth. The reason for our life is to live for God's glory.

IV. CONCLUSION

When teaching a mathematics course, it is not difficult to give spiritual meaning to the subject. In fact, many philosophers from ancient Greek to modern age were also mathematicians. Among them, Isaac Newton and Immanuel Kant studied mathematics, philosophy, and theology. I cannot explain deeply the academic relationships between mathematics, philosophy, and theology because of my lack of knowledge in the fields other than mathematics. However, I believe that mathematical thought can be utilized to the study of the Bible, and applying the mathematical approach, the meaning of Bible truths can be reinforced.

In middle and high schools, longer class hours are assigned to math courses than other courses, and mathematics is one of the required courses for students who plan to take college exams. Math teachers can have a considerable impact on students because most of them are very interested in mathematics. For spiritual guidance of students, teachers should develop their teaching methods and apply their developed methods in class with respect to the characteristics of each class. Therefore, teachers have to have a definite goal to achieve in each subject and also to have expertise in their teaching materials. Also, teachers should have Biblical knowledge as well as religious experience. They need training to express their spiritual experience in connection to the class subject. Finally, teachers should create a learning atmosphere with a creative and thoughtful approach.

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