THE INTEGRATION OF MATH AND THE BIBLE

by

Rowland Kisner

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Author: Rowland Kisner
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Advisor: Bruce K. Alcorn

The failure of Christian school math teachers to integrate the Bible with their subject in spite of the importance and possibility of integration is used to show the need for specific math integration ideas.

The study begins with a consideration of two main types of integration. They are innate and correlative integration. It is shown that some deny the possibility of math integration on the basis of an incomplete understanding of what integration is. Correlative integration is stated to be the most promising type of integration for math. Various methods of correlative integration are suggested. The method chosen for developing math integration is that of comparing and contrasting similar ideas from math and the Bible. The definition of math as a language is a basis for this method. The method is such that it may be used by qualified teachers to develop further integration.

Geometry and algebra are chosen as two of the more easily integrated areas of math. An examination of various geometry texts yields several areas commonly studied in that course. They are the geometric system and logic, proofs, miscellaneous two-dimensional figures, triangles, parallel lines, polygons, circles, constructions and loci, space geometry, coordinate geometry, and sets. Each area is explained and then discussed with respect to any possible integration. The section on logic is extensive. Algebra is then divided into sections and treated in a similar fashion. The sections are sets, measurement, real numbers, polynomials, linear equations and inequalities, and quadratic equations. Some ideas on arithmetic integration are included here.

It is observed that the number of integration ideas found compared to the scope of math is small and that some areas of math are easier to integrate than others. Few areas are left without some integration.

The warning is given to avoid number mysticism and the idea that math is a source of theology. Nor can math integration be done in an awkward fashion.

Although math does not naturally tell man a great deal about God it may be used as a teaching aid by both math and Bible teachers to illustrate biblical principles.

Accepted by the Faculty of Grace Theological Seminary
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Master of Arts in
Christian School Administration

Bruce K. Alcorn, Ph.D.
Advisor

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CHAPTER I

THE PURPOSE

Bible integration is one of the most highly emphasized ideas in the Christian school philosophy of education. Gaebelein classes it as one of the main functions.[1] In spite of this, it seems that little integration is being done in the classroom, especially in the area of math. Humberd cites one person as saying that all the worthwhile integration in math could be done in two class periods.[2] Some would claim that there is little math integration due to the fact that math can not be integrated. Such a position is contrary to the belief that God is the source of all truth. If math contains any truth, and it is assumed that it does, then this truth comes from God. It would be unreasonable to believe that math could be created without some mark of the Creator left upon it. To say that any subject can not be integrated is to say there is secular truth, yet the Christian philosophy denies a difference between the sacred and the secular.

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[1]Frank E. Gaebelein, The Pattern of God's Truth (Chicago: Moody Press, Moody Paperback Edition, 1968), p. 107.

[2]Jesse David Humberd, Religious Bearings in the Development of Mathematics (hereinafter referred to as Religious Bearings) (Ann Arbor, Mich.: University Microfilms, Inc., 1965), p. 16.

Morris Kline says that there is a relation between math and religion.[3] Humberd says, "The devoted teacher in a Christian school who continues to teach no differently than he would teach in a secular school, must sooner or later sense a lack in his teaching."[4] Others would claim that math is already integrated since it has not been affected by non-biblical assumptions. This problem has been partially due to a difficulty in the definition of integration. This will be dealt with in the following material. According to the rules of logic, if one example of math integration can be shown, the idea that math is already integrated will be shown to be false.

Before one can discuss math integration, he must first understand what is meant by integration. Bible integration is based on the premise that God has revealed truth by special revelation, an inerrant Bible and Christ, and by natural revelation, those truths evident in nature or dealing with human interaction. The former are given to us, but the latter must be discovered. School subjects are based, for the most part, on natural revelation. The common idea of Bible integration is simply a combination of natural and special revelation into one body of truth. This is often referred to as God's truth. Although the term is used extensively in Christian education, few people seem to realize that two

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[3]Morris Kline, Mathematics in Western Culture (New York: Oxford University Press, 1953), p. 453.

[4]Humberd, Religious Bearings, p. 12.

different ideas of integration exist in the philosophy of the Christian school movement. The first view of integration is that it is looking at a subject from the Bible's perspective. An example would be accepting the Bible's explanation of the origin of the universe through a supernatural creation rather than evolution, which is the common explanation offered in science books. This idea of integration could well be called innate integration since it uses the Bible to correct the way sinful man has distorted the subject, or to support what is known about the subject. It may change one's view of what is true in a subject area. The second view considers integration to be the union of subject matter with God's truth.[5] It could well be called correlative integration for it is accomplished by correlating Biblical truths with similar truths to be found in a given subject area. The comparing of the infinity studied in math with the infinity of God would fit into this category. Innate integration uses the Bible to affect the view of a subject, while correlative integration compares truths from the Bible with facts from the subject. The main difference is that innate integration uses what the Bible says directly about a subject to support or change one's views, while correlative integration focuses on ideas in the subject and the Bible which may be related directly or indirectly to illustrate or enhance one's views of the subject or the Bible. There are

[5]Gaebelein, The Pattern of God's Truth, p. 9.

two approaches to correlative integration. The first of these is to use facts from the Bible which correspond to various subjects. An example would be finding Bible references which mention math or numbers. This is much like innate integration except that, rather than being evidence for or against an idea, it merely shows the application of the subject in the Bible or mentions its use. The second approach is using subject matter to teach the Bible. Archaeology can be quite useful in this respect for through the study of ancient customs man can better understand what he finds in the Bible. In the first, the Bible gives an appreciation of the subject, while in the second the subject gives an appreciation for the Bible. In order to fully discuss math integration, each of these types of integration will need to be considered with respect to math.

There seems to be very little, if any, place for innate integration in mathematics. Humberd says, "There is simply little that is moral or religious about the manipulation of symbols, or the solving of numerical problems of a technological society."[6] Since the Bible is primarily concerned with moral or religious truth, these are the principle areas in which contradictions to the Bible may be found and thus are the main areas for innate integration. The possibilities for innate integration in a subject increase in proportion to the degree to which the subject has moral or religious aspects.

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[6]Humberd, Religious Bearings, p. 179.

David Eugene Smith, a former president of the Mathematical Association of America has said that math does not claim to make a man love his fellowman more due to the square of the hypotenuse.[7] Where the Bible speaks on subjects that are neither moral nor religious, these statements may be used for innate integration in non-religious subjects. Due to a lack of non-biblical assumptions or contradictions to the Bible, it may be said that math, except for a few areas such as probability, needs no innate integration.

The area of correlative integration seems to be more promising. Humberd gives at least six different ways in which the Bible and math might be correlated, most of which endeavor to use math to give a greater appreciation of the Bible. The first three involve the numerical relations to be found in the Bible. The first of these is gematria, the study of the numerical value of biblical words when numbers are assigned to the various letters of the alphabet. Davis says the Bible does not use the alphabet for numerical values except possibly in Revelation 13:18.[8] The next is the study of numerical structure patterns to bolster the divine origin of the Bible. Nowhere does the Bible claim such a structure. Even if a structure were to be found this would not prove

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[7] Religio Mathematici, The Poetry of Mathematics and Other Essays, pp. 46-48, cited by Humberd, Religious Bearings, p. 283.

[8] John J. Davis, Biblical Numerology (Winona Lake, Ind.: BMH Books, 1968), p. 153.

that the Bible was of divine origin. Thirdly is the search for a symbolic meaning in biblical numbers.[9] Davis says that the only number that has a clearly symbolic meaning in the Bible is the number seven, which symbolizes fullness or completion.[10] Davis has, among others, a category for the mystical use of numbers which he describes as numbers which have hidden meanings or theological ideas, but he says the Bible does not use numbers in this way.[11] In order to use any of these ideas as a basis for finding many relationships between the Bible and math, one would need to construe what the Bible says. Such action is totally inconsistent with a Christian philosophy.

Humberd suggests three more ways for bringing the Bible into the math class. One is by a consideration in the classroom of the moral and spiritual values in the purpose of the school. Many would say that there is little that can be taught ethically through the study of mathematics, but this belief is not as unanimous as some might think. "The Los Angeles schools proposed that a proper consideration of mathematics could strengthen such values as appreciation, integrity, inspiration, respect for law, cooperation, responsibility,

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[9]Humberd, Religious Bearings, pp. 193-194.

[10]Davis, Biblical Numerology, p. 154.

[11]Ibid., pp. 154-155.

reverence, faith, perspective, tolerance, and humility."[12] Mary Boole, the wife of George Boole and famous in her own right as an arithmetic teacher agrees. Gustav Spiller said,

> Of the more common subjects there remains now only mathematics, at first sight a most unpromising subject to deal with ethically. Yet Mrs. Boole has shown that not only can arithmetic be taught thus, but that it cannot very well be taught effectively in any other way. In general, the selected examples might largely be of an ethical character, and the need for precision in all thought might be illustrated by applying mathematical subject methods to what are ordinarily considered non-mathematical subjects.[13]

In the Christian school this type of correlative integration would use biblical truths as the basis for classroom behavior which would in turn reinforce biblical ethics. A study of this area of integration would prove useful, but it will not be studied further here. Humberd has also suggested that historical references might be used for integration. His dissertation has a wealth of such examples.[14] Finally, he says that religious ideas can be brought into the math class by the comparison and contrast of mathematical ideas with religious ideas such as infinity, limit, absolute truth, and authority.[15] All three of these methods seem to be valid.

Thus far, it has been assumed that integration is

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[12] Humberd, Religious Bearings, p. 281.

[13] Report on Moral Instruction and Moral Training, quoted in Humberd, Religious Bearings, pp. 186-187.

[14] Humberd, Religious Bearings.

[15] Ibid., pp. 280-281.

important in the Christian school and that math can be integrated by correlation in at least three ways (by a consideration in the classroom of the moral and spiritual values in the purpose of the school, by historical references, and by the comparison and contrast of mathematical ideas with religious ideas). Furthermore, it is assumed that few math teachers, if any, integrate. The obvious question is, "Why do teachers not integrate math, if it is both possible and important that they do so?" The assumed answer is that math teachers do not integrate because they see no correlations between the Bible and math. Three methods of developing correlations were given in the last paragraph. The problem with which this paper seeks to deal is that of developing correlations between the Bible and math by comparing and contrasting mathematical ideas as in the third method. The hypothesis which this paper will attempt to disprove is that, "There are no comparisons nor contrasts to be made between biblical and mathematical ideas."

CHAPTER II

THE METHOD

There would seem to be three principle methods of securing comparisons or contrasts between math and the Bible. The first would be from a survey of Christian math teachers and others involved in Christian education. The results from a survey by Humberd on math integration in Christian schools shows little interest, much less knowledge, in this area.[16] In a paper prepared for the 1976 National Institute for Christian School Administration, Ruth Haycock refers to math integration as a field "to be developed."[17] Since it has already been assumed that few math teachers, if any, integrate, and these facts confirm the lack of knowledge, a formal survey of these people would have little profit for the amount of effort expended.

A second method would be to study literature dealing with math integration. Gaebelein has included a short section on math integration in The Pattern of God's Truth.[18] Humberd's

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[16] Humberd, Religious Bearings, pp. 14-18.

[17] Ruth C. Haycock, "Helping Teachers Develop Bible Integration," (hereinafter referred to as "Bible Integration") paper presented at the National Institute for Christian School Administration at Grace College, Winona Lake, Ind., 1976.

[18] Gaebelein, The Pattern of God's Truth, pp. 57-64.

dissertation also has several helpful items.[19] However, there is not an abundance of material in the field as was shown by the previous reference to Haycock's paper.[20] Some material has been obtained and is included.

The third method and the primary one for this paper is that of developing comparisons or contrasts between math and the Bible by personal study and that of friends and acquaintances using some basic principles of integration. First, one must define the subject to be integrated and the purpose it serves. In this paper math is thought of as a language dealing with abstract ideas. Humberd considers math to be man's best language for understanding the universe.[21] It is true that he would limit this to a language for quantitative relationships,[22] yet it must be remembered that this paper is not concerned with finding biblical ideas which are innate to math but with correlating abstract biblical concepts with those abstract quantitative relationships to be found in the language of math. As biblical ideas are correlated with abstract math ideas, the language which explains and illustrates the latter will enrich one's understanding of the former. Furthermore, math is not limited solely to quantitative

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[19]Humberd, Religious Bearings.

[20]Haycock, "Bible Integration."

[21]Humberd, Religious Bearings, p. 20.

[22]Ibid., p. 14.

relationships, for the relationships of geometric figures and the principles of logic are not quantitative relationships. A study of these abstract relationships and principles of logic will lead to a better understanding of certain relationships and logical conclusions to be found in the Bible.

Since math may be thought of as a language or study of abstract relationships and since abstract relationships are seen in the Bible, a correlation of similar ideas from both fields is possible.

Another principle is stated by J. Robertson McQuilkin in reference to integration of the behavioral sciences and Scripture. He says, "But my contention is that true integration, as distinct from helpful interaction, must be accomplished by individuals with dual competence."[23] He means by this that a person should have stressed both the study of the subject and the study of the Bible in his background, not one a great deal more than the other.[24] The more one knows about both areas, in this case math and the Bible, the better will be his chances of seeing correlations between the two. If he does not know Biblical truths to start with, he will find it impossible to integrate them into his subject area, or, if he does not know his subject, he will not be able

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[23]J. Robertson McQuilkin, "The Behavioral Sciences under the Authority of Scripture," Journal of the Evangelical Theological Society 20:1 (March, 1977), 42.

[24]Ibid., pp. 42-43.

to see all the integration possibilities.

The format for this study is to correlate the Bible with math by examining various areas of math and trying to ascertain how principles from each can be correlated with biblical ideas. The study begins in the field of geometry, since geometry is not as interrelated with the rest of math as is algebra, for example. Also, geometry seems to be one of the most promising areas of math for developing correlative integration. Several different high school geometry textbooks have been surveyed to determine various topics discussed in high school geometry. These books are Modern Geometry, Modern Geometry: Structure and Method, Geometry: A Modern Approach, Plane Geometry with Space Concepts, and Geometry.[25] Each of the topics are then considered individually with respect to any possible correlation between the topic and a biblical principle. The reason biblical ideas are correlated with math topics rather than math topics correlated with biblical ideas is not that math is more important or more authoritative than the Bible, but only that the purpose of this study is to

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[25]Eugene D. Nichols, William F. Palmer, and John F. Schacht, Modern Geometry (New York: Holt, Rinehart and Winston, 1968); Ray C. Jurgensen, Alfred J. Donnelly, and Mary P. Dolciani, Modern Geometry: Structure and Method (Boston: Houghton Mifflin Co., 1965); Marie S. Wilcox, Geometry: A Modern Approach, 2nd ed., teacher's ed. (Menlo Park, Cal.: Addison-Wesley Publishing Co., 1974); A. M. Welchons, W. R. Krickenberger, and Helen R. Pearson, Plane Geometry with Space Concepts (Lexington, Mass.: Ginn & Co., a Xerox Education Co., 1976); Edwin E. Moise and Floyd L. Downs, Jr., Geometry (Menlo Park, Cal.: Addison-Wesley Publishing Co., 1967)

focus upon the correlative integration of math with God's truth rather than to relegate the vast scope of theology to mathematical terminology. Each general topic is listed and explained with any correlations. When such a correlation has been found, either through a personal examination of the topic, through the ideas of acquaintances, or through study of the related literature, the biblical principle is explained along with the correlation between the principle and the topic. Not all possible examples of integration have been included, but examples of many of the various types have been given. To include all the useful conditional statements, for instance, would be a very difficult task. Some ideas were omitted to avoid repetition. The purpose of this paper is to show that integration is possible, not to give every conceivable idea. Should a particular area of geometry not be mentioned in this paper, the omission is due to a lack of emphasis upon that area in the textbooks used for this study. If no correlation has been found for a particular topic, this is stated, but such a statement does not infer that no such relationship exists, only that it has not been discovered in the study for this paper.

After geometry, algebra is considered in a similar manner. Many of the areas studied in arithmetic are included in the section on algebra. The books used for algebra will be Introductory Algebra 1 (both the first and second editions), Introductory Algebra 2, Discovering Algebra 1, Modern Algebra:

Structure and Method: Book 1, and Algebra.[26]

The method discussed in this chapter for developing correlative integration between math and the Bible is systematic, easy to understand, and covers most of the topics in the subjects discussed, though it may not exhaust all the possibilities for correlation.

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[26]Russell F. Jacobs, Introductory Algebra 1, (New York: Harcourt, Brace & World, 1968), and Introductory Algebra 1, 2nd ed., teacher's ed. (New York: Harcourt Brace Jovanovich, 1973), and Introductory Algebra 2, 2nd ed., teacher's ed. (New York: Harcourt Brace Jovanovich, 1973), and Discovering Algebra 1, teacher's ed. (New York: Harcourt Brace Jovanovich, 1974); Mary P. Dolciani, Simon L. Berman, and Julius Freilich, Modern Algebra: Structure and Method: Book 1 (city page torn out: Houghton Mifflin, 1962); Richard E. Johnson, Lona Lee Lendsey, and William E. Slesnick, Algebra (Menlo Park, Cal.: Addison-Wesley Publishing Co., 1967)

CHAPTER III

GEOMETRY

The subject of geometry can be divided into eleven basic areas. These are a consideration of a geometric system and logic, proofs, a study of miscellaneous two-dimensional figures such as lines and angles, triangles, parallel lines, polygons, circles, constructions and loci, space geometry, coordinate geometry, and sets. This is probably not the order in which these would be discussed in a textbook. The ideas under each topic may also vary from text to text. Each of these areas has within its scope a great number of individual facts. Where an integration idea concerns one of these facts it will be named and explained, but, since many of these facts are not integrated specifically, they will not be mentioned in order to concentrate upon those which do. Each of the main topics already listed will be described briefly whether or not an area of integration has been found.

The first area is the study of a geometric system and logic. This involves the meaning of and need for definitions, undefined terms, postulates, and theorems. The study of truth tables, venn diagrams, converses, contrapositives and inverses are also included. This whole area readily lends itself to correlative integration. Students are taught that every geometric or other mathematical system is based upon undefined terms and postulates which are accepted without proof. While they are being taught these facts, the truth of the following quote should be impressed upon them.

> . . . we have in mathematics the best and richest example of the power (and limitations) of human reason. If we wish to illustrate what we mean by correct argument, a subtle argument, an elegant argument, we shall surely turn to mathematics for our examples.[27]

By reminding them that math, the most logical of all disciplines, must accept some things without proof, they can easily be made to see that any system of thought accepts certain ideas as true without proof. Since the acceptance of an idea as true without proof is nothing less than an act of faith, a Christian philosophy of life is not logically inferior to any other system because it accepts the existence of God, the inspiration of the Bible, and other truths by faith. Since the strength of any system of logic depends entirely upon the strength of its assumptions, a Christian philosophy is stronger because it has more evidence, such as fulfilled prophecy, to support its assumptions than does any other system. The fact that a system depends on its assumptions is illustrated by the famous parallel postulate. Euclid's geometry, which

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[27]"Mathematical Education - A Viewpoint," quoted in Vilas E. Deane, "Attitudes in the Mathematics Classroom: Teacher and Student," paper written while working on Ph.D., Spring, 1973, p. 3.

is the basis for high school geometry books, assumes that there is only one line through a given point, parallel to a given line. Yet, other consistent but different geometries exist which assume that there are an infinite number of parallels to a given line through a given point or that there are no parallels at all. Next, the technique of assuming basic postulates and logically developing a system of truth from them such as is done in geometry is the same as is needed to develop a systematic theology. Humberd says that ministers should study math to learn to think clearly.[28] Origen gave his pupils training in geometry.[29] Correlative integration at its best would be to follow a course in geometry with a course in systematic theology.

The study of truth tables should aid the student in understanding Christian principles. Take, for example, the statement, "If a person is a Christian, then he will perform good works." This statement is a paraphrase of the teaching found in James 2. Let p be the phrase, "If a person is a Christian." Let q be the phrase, "then he will perform good works." Following the rules for truth tables, table 1 would be developed.

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[28] Humberd, Religious Bearings, pp. 1-2.

[29] Jesse David Humberd, "Religious Bearings in the Development of Mathematics," paper presented at NCTM meeting, Canton, Oh., 21 March, 1975, p. 10.

TABLE 1

TRUTH TABLE

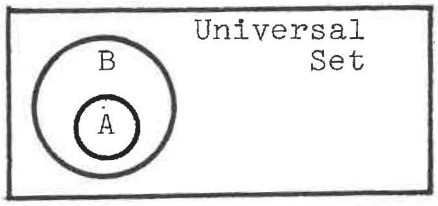
p	q	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

Note that, if it is true that the person is a Christian, and it is true that he performs good works, the statement is considered to be true. If it is false that the person is a Christian, the statement is still considered true regardless of the person's works because the statement made no assertion as to what would happen if the person were not a Christian. The only case in which the statement would be shown to be false would be if it is true that the person is a Christian, but he did not perform good works. Since the Bible is always truthful, then we know that it would be impossible for a person to be a Christian and not to show it by his life. A discussion of this would lead to other references which teach that a man can be evaluated by the kind of life which he lives. Scripture abounds in statements which readily lend themselves to an examination such as this. The truth table would not be used to prove the validity of Scripture, but only to illustrate it.

Venn diagrams can also be used to illustrate biblical principles. If circle A represents those who are Christians, and circle B represents those who claim to be Christians, a Venn diagram representation of Matthew 7:21 would look like figure 1.

FIGURE 1

VENN DIAGRAM



Not all those in circle B can be rightly included in circle A, but all those in circle A are in circle B. A discussion of this could easily lead to the need for Christians to make an open profession as well as test their own sincerity.

A study of conditional, if-then, statements also leads to inverses, converses, and contrapositives. Once again the statement, "If a person is a Christian, then he will perform good works," may be used to illustrate. Students should learn that if a statement is true, then its contrapositive will also be true. The contrapositive of the above statement is, "If he does not perform good works, then a person is not a Christian." A student who understands the relation between a statement and its contrapositive will readily see that this second statement is necessarily true, but many students have probably not looked at this truth in this way. The converse of the original statement is also interesting for it is, "If a person performs good works, then he is a Christian." The truth or falseness of this statement does not depend on the original statement, so it must be considered separately. Such a discussion should lead to a definition of "good works." Since students should learn how to make good definitions in geometry, this is a very appropriate question. The ability to make good definitions would clarify many theological questions. A discussion of the doctrine of total depravity and its place in a system of theology could easily follow. In the process, the inverse of the original statement, "If a person is not a Christian, then he will not perform good works," may be used to shed light upon the issue. The book of Romans abounds in statements which can be evaluated in this manner. The statement, "A person will go to heaven if, and only if, he is a Christian," has added meaning for the pupil who realizes that "if, and only if," means that a statement and its converse are true.

The words, "one, and only one," mean that such an item as might be mentioned exists, but that there is no more than one such item. Such is the case with a line perpendicular to a given line containing a given point not on the given line. For the math student the statement, "There is one, and only one, way to heaven," notes both the existence of a way and the uniqueness of that way at the same time.

The second major area of study in geometry is proofs. This encompasses the study of various types of proofs such as analogy, inductive, and deductive, along with the validity of each type. One of the first points to be made is that just because a statement appears to be true does not necessarily mean that it is. Optical illusions are often used as illustrations. This is also true in the Christian life. Today's Christian would find it easy to begin following some "miracle worker," if he were to base his beliefs on the outward appearance rather than on the facts to be found in Scripture. Similar points can be made from a study of proof by analogy. Students are taught that analogies are valid only if the two situations are exactly the same. Although the Old Testament saints were expected to offer sacrifices, Christians need not follow their example because the situations are not exactly the same. Although they were sinners just like men today, Christ has instituted a new program. Inductive reasoning is a better form of proof, but it still has deficiencies. An inductive proof draws a conclusion based upon the outcomes of several test cases. This form of reasoning is used extensively in science and is closely related to pragmatism. Students can see that by this type of reasoning Christ could not have risen from the dead, yet He did. A study of inductive reasoning will help the student see the fallacy referred to in 2 Peter 3:3-8. Here the world uses inductive reasoning to say Christ will not return, but the Bible shows the fact that they overlook which Christians should not. This passage highlights the weakness of inductive reasoning in that it is not valid unless it considers every possibility. Inductive reasoning is based upon uniformitarian assumptions. Here, the problems in evolution which is based on uniformitarian assumptions and inductive reasoning can be considered. Students can be shown that pragmatism is wrong when it assumes that whatever works is truth, for it does not consider God's laws. Care should be taken to insure that pupils do not assume that science or inductive reasoning itself is always incorrect. Much of our daily activity is based upon useful inductive reasoning. When fulfilled prophecy is used to support the inspiration of Scripture, this is useful, inductive reasoning.

Deductive reasoning is the type of reasoning which is used to develop a system of geometry. It uses statements which are assumed to be universally true to prove facts about specific items. This is the type of reasoning needed to develop a consistent systematic theology, for it is assumed that the conclusion is always true, provided the original assumption is true. The dependency of any system of thought upon assumptions has already been discussed. It should be mentioned that, if one begins with the wrong assumptions, the conclusion may be incorrect in spite of correct reasoning. Here, the student can see that the non-Christian has many incorrect beliefs because he has begun with incorrect assumptions. Often the student must, by reading a theorem, decide what information is given and what is to be proven. This requires the ability to carefully examine a sentence. This same ability is required in Bible study. A simple example of this would be the ability to see that the Bible does not say that three wise men followed the star. In writing a deductive proof, the student must be able to give a reason for every assertion which he makes. This is exactly what Christians are told to be able to do in 1 Peter 3:15 where they are told to be able to give a reason for their beliefs. A consideration of this fact may lead to a discussion as to whether the existence of God can be proven. At this time the more famous arguments for the existence of God may be studied. The teleological argument finds great support in the order of mathematics and uses inductive reasoning. The cosmological argument uses inductive reasoning, and the ontological argument is based upon the definition of God. Since the order of mathematics (a product of consistent reasoning), inductive reasoning, and definitions are all within the scope of geometry, they could be considered in detail. None of these uses deductive reasoning and therefore are not conclusive. Since deductive reasoning is based upon assumptions and the existence of God is a basic assumption, no deductive proof can be made without using circular reasoning. Circular reasoning is another item which must be considered in geometry. It must also be shown there can be no proof that God does not exist and that, consequently, the belief in the existence of God or the lack of it is an assumption as was previously stated. The student should be shown that his belief in God was not a result of the chances of probability, but of the convicting work of the Holy Spirit who chooses people specifically, not at random. An examination of the reasons for belief in the inspiration of Scripture would prove similar to that of the belief in the existence of God.

One special type of deductive proof is called an indirect proof. This type of proof assumes the opposite of what is to be proven and then shows this assumption leads to a contradiction of a previously known fact necessitating the rejection of the assumption and the acceptance of the original statement. This can be illustrated in 1 John 1:10 where John writes that if one assumes that one does not sin, he contradicts what God has said in Romans 3:23, and therefore his assumption is incorrect.

Auxiliary lines are lines which are not given in the information given with a proof, but can be added to the figure if such a line is known to exist. For instance, a line can be drawn to bisect an angle because every angle has a bisector. These lines are added to assist in the proof. The person who studies biblical truth may need to add auxiliary lines in the sense that he may draw upon facts from passages other than the one at hand to understand the given passage. When one studies the Old Testament law, he must keep in mind the New Testament facts about the purpose of the law though they are not given in the Old Testament passage under consideration.

Although geometry should give the student deep respect for the power of logic to solve problems and the knowledge that it is a God-given gift to man, which God expects him to use, it must be made clear that logic is a tool for revealing truth, but not the source thereof. Kurt Gödel, a mathematician, has shown that, "It is impossible to establish the consistency of a large class of deductive systems unless one adopts principles of reasoning so complex that their consistency is as doubtful as that of the systems themselves."[30] Only God is the source of truth, and the inconsistency in logic illustrates that they must rely upon God even for the ability to reason correctly. Were they to worship logic rather than God, they would become examples of Romans 1:25, where men worshipped the created rather than the Creator.

The next area of geometry is the study of miscellaneous two-dimensional figures such as lines, line segments, and angles. This would include definitions or descriptions of the figures as well as theorems about their characteristics.

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[30]Claire Fisher Adler, Modern Geometry - An Integrated First Course, 2nd ed. (New York: McGraw-Hill Book Co., 1967), p. 61

The first item to be considered is a point. Any two points determine the direction of a line. This could be used to illustrate that two things are needed to obtain the correct direction doctrinally. The first is the Bible while the second is the Holy Spirit. Just as an infinite number of lines may be drawn through one point, so an infinite number of interpretations might be given to the Bible were it not for the guiding hand of the Holy Spirit.

A line has one dimension, length. A line is infinite in length in two directions. A segment is a part of a line with a finite length. Let the line represent the mind of God. The Christian is to think about things in the same way that God thinks about them. The Christian mind should be like a segment out of the line which represents the mind of God. The Christian mind can possess some of the thoughts of God, but it can not possess all of them, nor think as deeply about them, for the Christian mind, like the segment, is finite. Segments may be long or short, and the Christian mind may possess many or few of the thoughts of God depending on his spiritual growth, but he will never have the infinite mind of God. Since a line has no width, any drawing is only a representation of a line and not a line. The symbols in Revelation are only ways of representing what will happen and not the actual events. The locusts would be an example.

A ray is a part of a line that extends infinitely in one direction from a starting point. Let a line represent an infinite time line during all of which God has existed. A ray would represent the time during which man has existed. Like the line, God has no beginning nor end. Like the ray, man has a beginning but no end. He will exist eternally either in heaven or hell. This could be used to emphasize the difference between the pre-existence theory of the soul and the fact that the soul begins at conception.

An angle is composed of two rays with a common end-point. Except in the case of a zero degree angle, the rays go in different directions. Christians may choose different directions in their lives, but they must remember that they all have the same starting point in Christ. In geometry there may be a restriction on the size of angles and consequently on the direction of the rays just as there are some restrictions on the directions which Christians may take with their lives.

Supplementary angles are angles whose sum is 180 degrees. Every angle, no matter how small, has a supplement. Let 180 degrees symbolize the amount of resources needed to accomplish a task God has given. No matter how small a person's natural resources may be, God always makes up the difference. A 180 degree angle has no supplement because, like God, it is sufficient of itself.

The fourth area of geometry is concerned with triangles. The classifications of triangles and facts about them are studied and proven. An equilateral triangle is a triangle with all three sides of equal length. Each side is a segment which can be considered as an independent geometric figure, yet all three together compose but one triangle. An equilateral triangle may be used to illustrate the trinity. All three are distinct persons, but they are one God. Each has exactly the same characteristics as the others.

Another area of geometry is parallel lines. This contains the study of corresponding angles, alternate interior angles, and transversals. A common definition of parallel lines is, "Parallel lines are two lines which never meet." In theology there are areas of truth which do not seem to meet or agree. The incarnation of Christ is an example. It would seem impossible for Christ to be totally man and totally God. It has already been mentioned that one geometry asserts that all lines meet at infinity if not before, though they may appear to be parallel from one perspective. This approach may help one to deal with apparent paradoxes in theology by realizing that the two ideas come together at infinity if not before, and an infinite God can see how they come together. As the Christian's mind becomes more like Christ's, he can come closer to God's infinite perspective.

Next, is the study of polygons. The types of polygons, perimeters, and areas are all considered. A regular polygon is a polygon having all its sides and angles equal. As the number of sides increases toward infinity, the polygon looks more and more like a circle. This consideration of the figure as the number of sides increases to infinity involves what is referred to as a limit. Since it is impossible to have an infinite number of sides, the limit will never be reached. Humberd explains an integration of this idea when he says, "Genuine ideals are not goals to be reached, but perfections to be endlessly pursued. They are like mathematical limits, and religious ideals, which may be approached more and more nearly, but never attained to perfection."[31] Although the Christian can never be perfect, he is commanded to approach it as nearly as possible. Other possible integrations of polygons would be to have the class find the floor area of the ark or the perimeter and area of the tabernacle.[32]

The sixth area is circles, their parts, their dimensions, and related angles. No examples can be given here.

Constructions and loci deal with the compass, protractor, straightedge, and a study of the relations between points. With respect to constructions there are three classic, impossible problems. They are the trisection of an angle, the duplication of the cube, and squaring the circle. These problems are impossible if one is limited to Euclidean tools, a collapsible compass and an unmarked straightedge. Many

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[31] Humberd, Religious Bearings, p. 287.

[32] Eugene R. Lillback, "New Math and Biblical Applications," paper presented at the 14th annual teacher's conference of the Association of teachers of Christian Schools, Winona Lake, Ind., 8-9 October, 1971, p. 8.

men through the centuries have voluntarily limited themselves to these tools to see if they could solve the problems and failed. When Christ came to earth, He voluntarily limited Himself to a human body and human temptations and succeeded in living the perfect life which was impossible for man.

Space geometry is the next area to be examined. Polyhedrons, their surface areas and volumes, as well as the relations of lines in three dimensions are examined. Skew lines are lines in space which can not be contained in the same plane. Christians are like lines in a plane which may go in different directions. They may head their lives in different directions, but they still have a common ground, their faith. This idea is similar to the one used for angles. Skew lines represent the relation between the Christian and non-Christian who live in the same world, space, but have nothing in common. Other opportunities for integration would be to find the volume of Noah's ark and the ark of the covenant.[33] Still another is given in the following quote.

> Tho we should allow, that a Cube cannot be infinite (because a Body, and therefore a finite Creature): yet a Spirit may; such as is the Infinite God. And therefore no Inconsistence, that there be Three Personalities (each infinite, and all equal), and yet but _One_ Infinite God essentially the same with those Three _Persons_.
>
> I add further, that such Infinite Cube, can therefore be but _One_ and those _Three_ Dimensions can be but three, (not _more_ nor fewer). For if Infinite as to its length (Eastward and Westward), and as to its Breadth (North and South), and as to its Heighth (Upward and

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[33] _Ibid_.

> Downward), it will take up all imaginable space possible, and leave no room either for more Cubes or more Dimensions. And if this infinite Cube were (and shall be) Eternally so, its Dimensions also must be Infinite and Co-Eternal.[34]

The tenth area is coordinate geometry. This deals with the graphs of lines which are also studied in algebra. Reflections study the mapping of points with respect to a line which is treated as a mirror. The image or final point is placed the same distance from the line as is the pre-image or initial point, and they are directly across from one another. This can be used to illustrate Fakkema's view of man as the image of God.[35] As the image has the same characteristics as the pre-image, man should mirror God's characteristics. The same idea is involved with respect to symmetry about a line.

The final area is that of sets and relations. Sets are groups of objects, and relations are groups of pairs of numbers. Sets may be said to be finite if all the elements can be counted. The question may be asked, "Is the set of stars finite or infinite?" An interesting discussion can be had by examining Psalms 147:4 where God is said to count the stars. Since God is infinite, He could count an infinite

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[34] "The Doctrine of the Trinity Briefly Explained," quoted in "Wallis on the Trinity," quoted in Humberd, Religious Bearings, pp. 152-153.

[35] Mark Fakkema, Christian Philosophy and Its Educational Implications, 3 bks. (Chicago: National Association of Christian Schools, 1952-54), bk. I: Christian Philosophy (1952), pp. 13-16.

number so no conclusion may be drawn, but this is an opportunity to consider God's infinity. One-to-one correspondences require the student to be able to match one element from a set with one element of another set without any leftovers. In the Bible there was a one-to-one correspondence between the set of the tribes of Israel and the shewbread in the tabernacle. The intersection of two sets is the set of elements which they both have in common. The intersection of the set of Christians with the set of non-Christians is the null set. The same is true for the intersection of those who serve God with those who serve Mammon. The union of two sets is the set containing all the elements in both sets combined. The union of the set of Christians with the set of non-Christians is the universal set. Much of the integration done using intersection and union could also be done with Venn diagrams. The transitive property says that, if a first quantity is related to a second, and the second is related in the same way to a third, then the first and third are related in the same manner. An integration would be, since God is more powerful than angels, and angels are more powerful than man, then God is more powerful than man.

CHAPTER IV

ALGEBRA

Algebra can be divided into seven major areas. These are sets, measurement, real numbers, polynomials, linear equations and inequalities, systems of linear equations and inequalities, and quadratic equations. The integration of sets was discussed in the chapter on geometry and requires no additional treatment here. The aspects of measurement are not universally included in algebra, but they will be in this paper. Measurement includes the study of linear, square and cubic measurements. Math books point out that virtually every measurement has a certain amount of error due to imperfect measuring devices. This highlights the finiteness of man and can cause the student to appreciate the infinity of God. Relative error is the consideration of the amount of error in a measurement compared to the size of the measurement. This can focus on man's habit of thinking of sin as being more or less sinful depending on its evil relative to murder, for example. Students should be made aware that, although God may attach a greater penalty to some sins than to others, they are all equally worthy of hell.

The area of real numbers involves symbolism and properties of real numbers. Ratio is the comparison of two numbers. When the Hebrew women credited Saul with slaying thousands and David ten thousands, they were giving David a ratio of ten to one over Saul. This comparison would help students to see why Saul became jealous. The ratio of the volume of the tabernacle to that of Solomon's temple might also prove enlightening. The number line is nothing more than a time line without the years, where negative numbers represent B.C. After having studied the addition and subtraction of positive and negative numbers, students can have a better grasp of biblical dates.[36] Any number subtracted from infinity is infinity except infinity which gives zero. This could be used to illustrate that only the infinite Son of God could take away an infinite penalty for sin. The multiplication property of zero states that any number times zero is zero. This illustrates the effect of man's sinful nature upon any "good" works which he might do. No matter how many "good" works he might do, they are of no value in the eyes of God until his sin has been forgiven. Subtraction makes counting numbers smaller while addition makes them larger. Fakkema says that man must seek salvation by subtraction of self rather than addition of works.[37] Although number bases may not be studied in algebra, they will be included. The base two system is called the binary system. Leibniz discovered the binary system (every number may be represented

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[36]Eugene R. Lillback, "New Math and Biblical Applications," p. 8.

[37]Mark Fakkema, Christian Philosophy and Its Educational Implications, p. 21.

by ones and zeros). He thought of God as one or unity and void as zero. God created all out of nothing.[38]

The factoring, addition, subtraction, multiplication, and division of polynomials is the fourth area. A polynomial in one variable may have several different terms, each to a different power. Several different polynomials may be composed of varying powers of that same variable. Each term in these polynomials may be expressed in terms of that one variable. Every Christian life should be based solely upon Jesus Christ just as the polynomial is based on its variable. All Christians have one common factor. Different Christians may manifest Christ in different ways in various areas of their lives even as polynomials may have different powers of the same variable in different terms. The high and low powers may represent the fact that Christ can be used to a great or small extent in each area of one's life. The coefficient of each term may represent the great or small amount of talent which God has given in that area of his life. Note that the power of Christ, as represented by the variable and its exponent, can affect an area of the Christian's life more than his natural talent. As two polynomials may be added to obtain one polynomial so two Christians may add their talents and become one in marriage. The non-Christian is like the polynomial where the variable is replaced by zero for even as the

[38]"Essai Philosophique sur les Probabilités Oeuvres," cited by Robert Edouard Moritz, On Mathematics and Mathematicians, (New York: Dover Publications Inc., 1958), p. 163.

polynomial is equal to zero so the non-Christian has nothing good spiritually.

The fifth area is linear equations and inequalities. Slope is the name given to the steepness of a line on a graph. As the number value of the slope increases, so does the steepness. As the value of a Christian's spiritual strength rises, he grows faster, but he may also have a more difficult climb. It is fitting that a horizontal line has a slope of zero for if a Christian does not grow it could be debated as to whether he is a Christian. It is also appropriate that a vertical line has an undefined slope, since only God is perfect spiritually, and His spiritual strength is undefined.

The sixth topic is systems of equations and inequalities. This encompasses their solutions and graphs. Students are taught that to solve a system of equations one must have as many different equations as he has variables. A human life is much like an equation in that its value is determined by what is put in the place of the variable. Unlike an algebra equation, each life has many different variables. Each of these can completely change the life, yet God has solved for the many variables in each equation so that the life will fit His plan. One method of solving an equation of more than one variable is to write all the variables in terms of one variable. If one would have the perfect life, he should rewrite all the decisions in his life in terms of what Christ would do. Every term where Christ is left out would be a zero. The life without Christ would be worth zero or nothing good. Students must learn the difference between an inclusive and an exclusive "or." Lillback uses the choice of Barabbas or Jesus as an example.[39] A more important use of the study might be applied to the question, "Are you going to heaven or hell?"

The final area is quadratic equations. In order to draw the graph of a quadratic equation, a student must plot several points to determine its direction. Students must learn to look for key points or actions in people's lives to evaluate their spiritual condition. Even as the algebra student can learn to sketch the general graph of an equation just by looking at the equation and not plotting points, so the wise Christian can sometimes ascertain the direction of a person's life without seeing specific actions. By discerning scriptural principles or points, one can see God's direction for his life though the Bible does not state it.

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[39]Eugene R. Lillback, "New Math and Biblical Applications," p. 11.

CHAPTER V

CONCLUSION

The goal of this paper has been to disprove the hypothesis, "There are no comparisons nor contrasts to be made between biblical and mathematical ideas." Since only one counter example is necessary to disprove any hypothesis, the last two chapters have sufficiently disproven this one. Some additional observations can be made. The ratio of the number of integration areas to the amount of material in a whole course is rather small. Some topics are easier to integrate than others. Infinity is one of the most used ideas for math integration because it is easier to see, while ordinary arithmetic addition is difficult to integrate. An important point to consider is that at least one idea for integration was found for almost every main area. Proof which is one of the most important parts of geometry, has many integration possibilities. Although integration ideas are very sparce in other areas, with time, effort, and education they could be developed.

Several recommendations are to be made. There are two negative considerations. The first is that those who attempt math integration not let it degenerate into a number mysticism. Math does not prove the Bible nor is it the source of theology. The second is that integration must not be something that is placed awkwardly into the curriculum. If it is not done properly, the student must switch mentally from math to Bible and back rather than follow one unified pattern of thought. For this reason, math correlative integration might be easier in a Christian core curriculum. If the curriculum is thought of as being composed of many separate subjects, correlative integration may not be achieved as smoothly as in a core curriculum where the theme is Bible study.

One of the positive uses of correlative integration, other than in the math class, is illustrations or object lessons for Bible teachers. Obviously, it can be useful in the math class. Although the following quote concerning a former math professor at Harvard does not deal totally with math, it illustrates a beneficial use of correlative integration in the math class.

> I recall distinctly a lecture in which he exhibited, in its various aspects, the idea that in mathematical science, and in it alone, man sees things precisely as God sees them, handles the very scale and compasses with which the Creator planned and built the universe; another in which he represented the law of gravitation as coincident with, and demonstrative of, the divine omnipresence; another, in which he made us almost hear the music of the spheres, as he described the grand procession, in infinite space and in immeasurable orbits of our own system and the (so called) fixed stars.[40]

There may be some who would say the examples in this paper are forcing integration in a place where it does not belong.

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[40]Florian Cajori, The Teaching and History of Mathematics in the United States (Washington: Government Printing Office, 1890; Chicago: Library Resources Inc., LAC 10582, 1970), pp. 127-128.

It is true that integration may be done in an awkward manner, if poorly planned, as has been stated. Since integration is an unusual experience for most math teachers, it will seem out of place for a while simply due to the fact that it is a change. These are not strong enough arguments against correlative integration to prevent its use. Deuteronomy 6:6-9, a key verse in many Christian school philosophies, exhorts parents to teach children spiritually by writing truths on the doorposts. This is not any more natural than the examples in this paper. The idea in these verses seems to be that children are to be continually taught spiritually in every possible way. Although correlative integration does not always follow directly from the subject, though it may, it is a useful method of keeping spiritual truths continually before children. This idea is not new, for it was the pattern in some early American textbooks. One final reason for correlative integration is that it shows the students by example that it is important to consider Christ in everything. This final quote was written about college teachers, but it applies to all.

> The function of the teacher is broader than that of providing information, control, and entry into the elite. It also extends beyond that of helping the student realize his own goals and potentialities. It is with some embarrassment that most teachers begin to sense the possibility that some of their students use them as models of what a good historian, or a well-educated man,

> or fine person might be. They use their teachers in the continuous process of formulating and approaching their ideals.[41]

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[41] Conflict, Change, and Learning, quoted in Vilas E. Deane, "Attitudes in the Mathematics Classroom: Teacher and Student," paper written while working on Ph.D., Spring, 1973, p. 6.

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