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M.Sc. in Mathematics

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ETHICS IN MATHEMATICS

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Supervisor

Assoc. Prof. Dr. Belgin ÖZER

by

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Abdulvhab HVA

ABSTRACT

ETHICS IN MATHEMATICS

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Ethics is a branch of social philosophy that includes organizing concepts that clarify the difference between right behavior and wrong behavior, recommending and defending it. Just as we cannot separate morals from the concepts of life, then we cannot separate morals from science. Every science has an ethical side that forms an essential axis in it, and since mathematics is one of the most comprehensive sciences, it was important to highlight the ethical side in mathematics. In this thesis We will know about the history of the ethics in mathematics and the mathematicians whose written on the need for ethics for application of mathematics. The ethical dimensions of mathematics teaching and its responsibilities will be clarified. Statistics are an important way to clarify information and facts, we will learn about the negative effects of misusing statistics by knowing how to lie using statistics. Mathematicians use advanced mathematics to develop and understand mathematical principles, analyze data, and solve real-world problems, we will know about the moral responsibilities of mathematicians and values and the social responsibility of mathematics. We will also learn about the most prominent scholars of the twentieth century ethics in mathematics.

Key Words: Ethics, Statistics, Mathematicians, Misuse of Statistics.

ÖZET

MATEMATİKTE ETİK

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Etik, doğru davranış ile yanlış davranış arasındaki farkı açıklığa kavuşturan, onu öneren ve savunan kavramları organize etmeyi içeren bir sosyal felsefenin dalıdır. Tıpkı ahlakı yaşam kavramlarından ayıramadığımız gibi, ahlakı da bilimden ayıramayız. Her bilimin içinde temel bir eksen oluşturan etik bir yönü vardır ve matematik en kapsamlı bilimlerden biri olduğundan, matematikte etik yönünü vurgulamak önemlidir. Bu tezde matematikte etik tarihi ve matematiğin uygulanması için etik gereksinimi üzerine yazılan matematikçiler hakkında bilgi sahibi olacağız. Matematik öğretiminin etik boyutları ve sorumlulukları açıklığa kavuşturulacaktır. İstatistikler, bilgi ve gerçekleri açıklığa kavuşturmanın önemli bir yoludur, istatistikleri kullanarak nasıl yalan söyleneceğini bilerek yanlış kullanım istatistiklerinin olumsuz etkileri hakkında bilgi edineceğiz. Matematikçiler matematiksel ilkeleri geliştirmek ve anlamak, verileri analiz etmek ve gerçek dünya problemlerini çözmek için ileri matematik kullanırlar, matematikçilerin ve değerlerin ahlaki sorumluluklarını ve matematiğin sosyal sorumluluğunu bileceğiz. Ayrıca, yirminci yüzyıl matematik etiği alanındaki en tanınmış akademisyenler hakkında bilgi edineceğiz; Grothendieck ve Grigori Perelman.

Anahtar Kelimeler: Etik, İstatistik, Matematikçiler, İstatistiğin Kötüye Kullanımı.

"Dedicated to my family"

ACKNOWLEDGEMENTS

I would like to thank my supervisor, Assoc. Prof. Dr. Belgin ÖZER for her guidance and support throughout the study. I am thankful for his encouragement and motivation. I would like to express my love and gratitude to my family for their support, always best wishes.

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CHAPTER 1

INTRODUCTION

1.1 Ethics in Mathematics

It is the field of applied ethics, which includes inquiring about the ethical aspects of mathematics practice and its applications. It is concerned with the professional responsibilities of mathematicians whose work influences decisions with major consequences. Some mathematicians do not believe that there is an ethical aspect in pure mathematics research, but the experiments that have been conducted in mathematics curricula have proven that it is possible to find real implications for morality. In general, the influence of mathematics makes it difficult to feel the moral impact of it. But to know the moral impact, we can see how all branches of mathematics work in finding solutions to real problems and studying these solutions from an ethical point of view. It is possible for this matter to lead to bad things by achieving goals regardless of method or improving services, and some information about the results can be manipulated. Whereas the criteria for written hypotheses often do not point to a view or reflect the opinion of the body responsible for writing and designing it in a way that is difficult for experts to determine or discover, which leads to some injustice. So, there must be moral standards among those who write these hypotheses so that the hypotheses are written more closely to the objective and do not adopt non-neutral views.

1.2 History of The Ethics in Mathematics

The hypothesis of the moral influence of mathematics belongs to or before Plato, where Plato says that mathematics is a moral science because it teaches unity, harmony, order and tandem. Many mathematicians have written about the importance of ethics in mathematics applications including: Chandler Davis (1988) and Philip Davis (2007). Robin Hirsch (1990, 2007) wrote about ethics in mathematics, community ethics for mathematicians and those interested in them, and ethical principles in research and mathematics education (2005). There is also extensive literature on ethics in mathematics education, including Atwen (2013), Boylan (2013), and D'Ambrosio (1998).

1.3 The Need to Link Ethics and Mathematics

Mathematicians have a decisive influence in various industrial and scientific fields and consequently as a result mathematics influences the decision-making process with big consequences.

Even global warming theory relies mainly on the reliability of mathematical models of climate

1. Everybody has ethics. But, which ethics do we have in mathematics?
2. What does it mean for a mathematician in the university's mathematics department to act ethically?

There are two ethical rules:

1. Whatever you want to do, do it perfectly.
2. Do all you can to help the any person standing in front of you.

Mathematicians have a responsibility to ensure that they use the correct data and best methods to reach the best solutions in matters of consultancy related to professional matters and work.

In general, ethical matters and related issues are shared with people who specialize in the information economy. This includes confidentiality of information, reporting of violations and avoiding conflicts of interest.

1.4 Why Math and Ethics Go Together

Perhaps those interested in the educational side felt the importance of numbers in their work. Most sports freaks may defend their subjects from an unquestionable logical defense. After you find many wrong answers to a problem, you will find the correct answer.

Your discovery of this correct answer will develop mathematical problem-solving skills and may develop special skills to solve logical problems. This development may grow to have a major impact on solving problems related to the real world. It may include the skill of solving problems related to the global economy or the skill of solving the problem of education or literacy. But is it possible that we are already trying to find a correct solution to a wrong issue or are we looking for a solution to an immoral issue and its solution may cause a negative impact on society? Assuming we are looking for a solution to an ethical problem, do we use moral means to reach a solution, or may we resort to deception to find this solution? This was the concern of some

or may we resort to deception to find this solution? This was the concern of some mathematicians, while they affirm their deep love for mathematics and see it as a wonderful language to describe the world and address high-minded minds, but they fear that their singular focus on mathematics will lead to "moral neutrality" in dealing with human issues, and that mathematicians without intend pass this neutrality on to their students while they were teaching.

This leads students to contribute using what they have learned from mathematics to solve social problems regardless of whether they are ethical or not.

"Unless what we teach our students is carefully monitored and examined, applying mathematics to society can be harmful to our humanity," said Ernst, Professor at the University of Exeter.

So, Professor Ernst suggested the following solution: to start teaching ethics and philosophy alongside more primitive mathematics. It indicates that most students who are educated do not undergo any basic ethical course during their studies, their learning of mathematics must be accompanied by a broad knowledge of human moral values, He proposed teaching mathematical computation in addition to utilitarian ethics (an ethical theory based on measuring and maximizing happiness).
Professor Ernst anticipated that the harm associated with learning mathematics would continue unless we begin to integrate courses of moral values during the education stages.

1.5 Should Mathematicians be Teaching Ethics?

Let us ask: Is it necessary for mathematicians to try to teach things other than mathematics? The answer should be: Yes, absolutely.

Teaching mathematics alone may cause collateral damage in moving away from the social or moral issues for which most of the sciences are found. One of the responsibilities of the mathematics teacher is to make the student feel the importance of using what he has learned in serving the community and trying to develop this science with the aim of discoveries beneficial to mankind in the first place, and this summarizes the moral responsibility of the mathematics teacher. The effect of a mathematics teacher on his pupils extends the length of their lives and its effect on

them may be a positive or a negative impact. This will lead them to be beneficial to society or not. By this we see that, in addition to the ethical implications of pure mathematics in the academic system, mathematicians have a great and increasing influence on the world and the way it is changed through what they transfer to us from science. Whenever they are on a high moral level, the mathematics science that will reach us from them will be beneficial to the world. Some studies have indicated that the level of students 'commitment to their educational responsibilities in school and social responsibilities outside the school is much greater if the teachers in the school are committed to teaching the moral values of their students.

so the results of ethics education in schools are increasing with the passage of time, on the one hand it forms a solid ethical basis for the student to make it He thinks ethically before doing anything, and on the other hand, he has a growing sense of responsibility to make decisions based on moral values and social interest.

1.6 Why it is so Hard to Follow Ethics in Mathematics?

The mathematician cannot work completely isolated from society. One of his duties is to think about the ways in which his work will positively affect the lives of others, including those outside the professional community, up to ordinary people.

Anyone who works in the field of mathematics, whether from the academic, industrial, governmental, or any other field is committed to considering the impact of what his work does on the world around him.

With the continuous dealing with artificial intelligence data, coding and financing, mathematical tools and techniques are dealt with to have a significant impact on society and people's lives. The use of mathematical research findings in social life is not without potential harm, as some important emerging ethical issues are not adequately addressed. Because of this, and in the past few years, many articles have adequately addressed. Because of this, and in the past few years, many articles have been written about ethics in mathematics, its importance, and the need to teach it. Therefore, universities and scientific research centers took the matter seriously and started in series of lectures whose content focuses on awareness of the ethics of work mathematics, which led, for example and not limited to, the emergence of the Cambridge University project for mathematical ethics, through which study materials and integrated research were developed on Ethics in mathematics.

Therefore, universities and scientific research centers took the matter seriously and started in series of lectures whose content focuses on awareness of the ethics of work mathematics, which led, for example and not limited to, the emergence of the Cambridge University project for mathematical ethics, through which study materials and integrated research were developed on Ethics in mathematics.

Despite this and despite all the efforts made, there are still some challenges in raising ethical issues with the community of mathematicians.

Those who work in the field of mathematics may not feel a moral responsibility towards the issues of society, and they are satisfied with the saying "This is not my problem", or they may say "We work in the field of mathematics, these issues have nothing to do with mathematics"

In one of the lectures on moral values for mathematics students, one of the students asked the lecturer: What is the relationship of what we take of information in this lecture to mathematics? The lecturer replied with a question: Is it the responsibility of the mathematician to save the lives of marine creatures? The student replied: No, the lecturer said: If we assume the presence of an oil spill from one of the oil transportations pipelines in the sea, this will necessarily cause severe damage to marine life. The solution to this problem begins by specifying the places of leakage in the tube, and this requires measuring the depth of the pipe in the sea and an estimate of the number The openings from which the oil leaks in addition to calculating the area of the pollution spot in the water in addition to estimating the amount of chemicals that will be used in cleaning the water within the field of pollution, all of this cannot be done without the use of mathematical concepts, laws and theories that cannot be dealt with completely except mathematicians or specialists Their specialty includes a branch of mathematics. Consequently, it is never ethical for a mathematician to distance himself from the problems that occur and not try to help find a solution to them based solely on the fact that the problems are far in their apparent form from mathematics. The responsibility here of the mathematician includes a scientific responsibility by not providing the effort to search for a solution, and a moral responsibility by not avoiding helping to solve issues in real life.

A common mistake by some researchers in mathematics is their belief that there must be a mediator between them and the surrounding community. This mediator will study

the social problem and visualize a mathematical solution to it, then communicate with mathematicians to inform them of the mathematical hypotheses or applications needed to solve this problem. At first glance, their view may seem logical, but let us assume that there are not enough resources to seek the help of a scientific body that communicates with the mathematicians' community, or if the mathematician encounters this real problem without anyone knowing it or someone communicating with him and asking him to solve it.

Then it will be the primary moral responsibility of the mathematician to search for a solution to this problem himself and to link its data to mathematical concepts on its own to arrive at the solution. Here the topic goes beyond the question of whether this problem is related to mathematics or not. Rather, the view of this situation must be that we have a problem that requires solution and it is the duty of every person who has heard of it to contribute to solving it, whether it is within its professional and research competence directly or indirectly. One of the things that may separate mathematical research from social issues is the nature of mere mathematical work, which sometimes makes it difficult to use the results of mathematics in real-life issues in real life. This problem requires the mathematician in addition to his hard work to develop mathematical concepts, to have a broad horizon and aspirations with the aim of making mathematics a life course and using his concepts in dealing with social issues and solving real problems, and this cannot be achieved if the mathematician does not have the professional ethics that drives him to Instead of burying scientific research and its results in books, magazines and scientific articles, it seeks to try to link them to reality and practical life. Discussions about the effect of mathematics and its results are still ongoing, and lectures and seminars are held on this subject as many mathematical examples are presented in this field. But in the end, what remains crucial is the moral values of the mathematician and his desire to serve society.

1.7 The Difference Between Ethics in Mathematics and Other Sciences

You may hear someone say, "Your words about ethics in mathematics apply to ethics in any other science, as there is no sense in allocating hadith in mathematics ethics." This may sound at first glance correct, but is there science that has a preference on mathematics as well as the mathematics preferred over Other sciences?

Mathematics is considered one of the oldest sciences and it arose from the need of man to it. The need for a man to count made him a need to invent numbers, and the invention

of numbers was not random but was logically based on the logic of man in thinking, and with the invention of numbers the first seed of mathematics arose, which after its establishment were of the pillars The basic of any new science, if there is a science without arithmetic, then you find it takes care of logic, and the fertile environment of logic is the free-minded mind that mathematics broadens its horizons to think far away correctly.

The influence of mathematics on the rest of science was credited with making the study of the ethics of this science a distinct feature of research in the ethics of the rest of the sciences.

CHAPTER 2

MISUSE OF STATISTICS

2.1 Misinformation in the Statistics

Statistics are an essential part of mathematics, and it's one aspect that can be used to mislead and deceive an observer, which means that deception can be used with statistics to prove a false hypothesis, and it can be used to give wrong information about specific things that influence decision making.

Wrong information may happen in error using statistics, it may be intended for specific motivations and goals, and when statistics are used poorly, this leads to statistical fallacy.

Misuse of statistics or misuse of statistics can lead to completely damaging results while searching for the stage of knowledge, and the correction may take decades and expensive costs.

The problem lies in the ease of falling into misuse of statistics or the ease of believing false statistics, even professional scientists can deceive them no matter how eager to verify everything. It may even come to scientists who deceive themselves by using unreliable statistics and building their research on them, and the reason may be the lack of knowledge of probability theory or the failure to standardize their tests and the results.

2.2 Clarify Misuse of Statistics

Many of the mathematics used in the applications give us conclusions in the form of quantitative data, and usually there is a great difficulty in reaching accurate and fair conclusions in this case with attention and considering the remaining doubts. So, it is easy for a statistician to deceive clients whose understanding of data and inferences is less than hem. Here the ethical responsibility of the statistician arises to work fairly.

2.3 Importance

Statistics are a preliminary means of understanding and give an opportunity for two parties to agree on something, but this is true if and only if the parties agree to a set of

rules that guarantee satisfaction with them, but the misuse of statistics violates these rules. That is, false facts have a negative impact on the progress of science, because they often last for a long time, especially if they are not supported by evidence.

But with evidence at the time, we can stop its harm by proving its wrong when we prove the invalidity of the evidence on which it was based.

2.4 Definition, Limitations, and Context

Misuse of statistics includes the use of numbers in an unjustified or incorrect manner, either intentionally or because of ignorance or due to neglect of conclusions. The results of the statistics may be presented through graphics and charts.

However, there is no official definition of misuse of statistics because the definition faces some challenges

• Statistics usually produce several possibilities or provisional results that cannot be relied upon in deciding because they have errors and error rates.

• There are no fixed methods of statistics that statisticians rely on in obtaining results. Statistical methods are based on assumptions that are rarely fully used.

• The data collection process is usually subject to financial, ethical, professional, or social considerations.

One of the forms of misuse of statistics is lying by using statistics, either by providing false statistical results as correct results or by providing correct results but in a manner that leads to a misunderstanding of these results.
For this reason, many statisticians see the importance of the statistician enjoying moral values, both in his work and in presenting results for decision-making. It is no secret to anyone that it is difficult to determine the culprit in the process of lying by using statistics, because statisticians, opinion polls, scholars and correspondents are often in an advisory rather than executive position. The results of the statistics may be presented using methods such as graphs, pictures or diagrams, making it easier for the recipient of these results to understand and understand them, and to determine the position to make a decision or take a specific procedure. If these results are incomplete or not sufficiently explained by these means, then the recipient will reach conclusions that may be incorrect or unjustified.

2.5 Other Types of Misuse

Other types of misuse of statistics include comparison between two different things, such as the comparison between orange and lemon, so the use of statistical processes has an error from the ground (the average and the regression) and therefore when the results of these statistics are presented, the results will be correct and the graphs are correct but the basis that was made on The basis for calculating the results is false and misleading. And some methods of deception using statistics are by conducting statistics that have nothing to do with a problem to find a solution to this problem, and therefore the results of this statistic will not be useful in finding solutions.

2.6 Sampling Bias

Deception using statistics also includes bias in the collection of statistical samples in a way that affects the results, such as that samples are taken from more than one other category and this results in a biased and non-random sample, as the results will not give a realistic picture of the society from which the statistics were collected. The reason for this may be due to ignorance of the method of collecting statistics, or it may be intended for certain considerations.

2.6.1 Distinction Selection Bias

The bias in sampling is classified as one of the subtypes of selection bias and is called the sample selection bias, although some consider it a separate kind of bias. Although it is generally unacceptable, it can be said that the selection bias mainly addresses the internal validity of the differences or similarities within the studied sample. Consequently, errors resulting from the process of collecting samples in the statistical test cause bias in taking samples, and this causes errors that will be produced in the statistical operations that follow the collection of the statistical sample.

2.6.2 Types of Distinction Selection Bias

Choose from a specific geographic region

For example: conducting a statistical study of children who eat unhealthy foods by collecting samples from elementary school students, in this case the sample taken will be biased because it does not include students who study at home or dropouts. Selecting samples that are underrepresented or over-represented with respect to the rest of the samples. For example: interviewing people on the street at a certain hour

sample, then you would have chosen people from a specific class that is the group that walks in the street at that hour ignoring the opinion of healthy people who did not walk in the street in Time to count or sick people in their homes who cannot take to the street.

Excluding a sample selection group

For example: Suppose the statistic is related to the internal health of studying at the university and the random sample was from an area surrounding the university during the summer vacation period, this sample includes resident students and students who recently migrated and returned to their cities, then the sample will be limited to only resident students and will not consider traveling students Therefore, the results of this statistic will not meet the required results and the results will not be accurate because the sample biased.

2.6.3 The Caveman Effect

One famous example of the topic of selection bias is called "The Cave Effect", Our understanding of the prehistoric lifestyle of the peoples comes from a primary source which is the caves. The paintings in the cave wall that date back forty thousand years ago depicted the lifestyle and living reality of prehistoric peoples, but this source is a biased sample because we limited ourselves to these paintings in Understanding while the other samples represented in drawings on the skins of animals or trees that were washed away and disappeared with the passage of time, it was no longer possible to benefit from them, and therefore we could not understand the living reality of the people who did not live in the caves that period, so statisticians were forced to confine themselves to the wall sculptures in the caves and only study life the peoples who inhabited the caves before history and generalized this study to all the peoples of that.

2.7 Ethics in Statistics

It is very difficult to understand the human reality of a society and to determine the size of the welfare or suffering of a country or a society without statistical study specialized in collecting private information about this society.

Consequently, the incorrect results of the statistical process will lead to the formation of a wrong image and an inappropriate decision for the population of the statistical sample.

Therefore, the moral motivation and moral values of statisticians have a great impact,

pushing statisticians to use the best tools in the statistical process to produce results that are closer to reality and that reflect the real picture of society.

It also includes the moral responsibility of statisticians to stay away from any bias during the statistical process, and the reference to the occurrence of bias in the event he was forced with an explanation of the reason, so that the work is taken to redress the matter In order to reach the closest picture of the reality of the statistical community.

CHAPTER 3

MATHEMATICAL ETHICS: A PROBLEM BASED APPROACH

We will try to understand mathematics on the basis of mathematical ethics and moral mathematics, Where we will try to form an understanding of ethics in mathematics based on the importance of social responsibility and student participation, We will use a problem-solving model and try to draw conclusions about the ethics inherent in mathematics.

3.1 The Ladder Box Problem

3.1.1 Doing the Math

Let us have the following equation:

$$x^4 + 2x^3 - 98x^2 + 2x + 1 = 0$$

And the field of solutions is from the real numbers.

Let us ask, will you try to solve this issue right away, and do you have an inner desire for that? Do you care whether you found the solution?

For most people the answer is no, and you will feel a lack of interest from them, but the challenge is that we reformulate this issue so that the same educational goal is achieved in such a way that the student participates to the extent that he will continue to find the solution.

3.1.2 Ethical Education Goals in Mathematics

We can summarize the aims of education within the following points:

- Thinking outside the box: that is, not limiting the thinking to a limited fixed area and fear of getting out of it

Trying to use math as we work to extract a solution to problems we face in the real world.

- Attempting to show the forms of interaction between algebra and geometry (including linking purely algebraic hypotheses to geometric forms).

- Promote desire and stimulate mathematical diligence among students.

3.1.3 Problem Statement

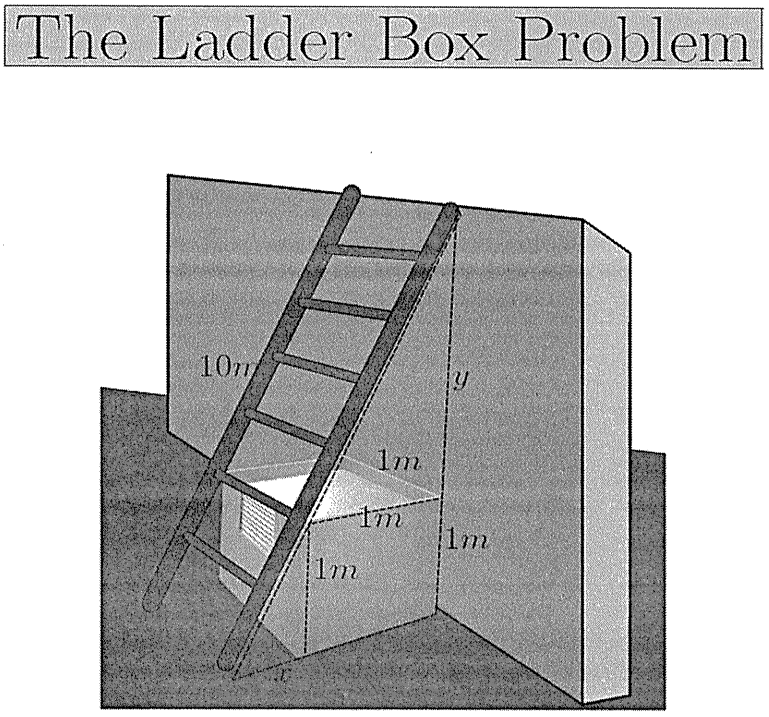

Figure 1.1 The ladder and box.

In the beginning of our research we used a mathematical equation and we said that the challenge is to make ordinary people want or be encouraged to solve it,
Let us take the following issue:

We have a ladder 10 meters long, leaning against the wall, and leaning against it at an acute angle. Under it is a box of 1m x 1m x 1m edge attached to the ladder, and its face is attached to the wall. What is required: find the distance between the bottom of the stairs and the box. Until we start stimulating the human mind to solve, let us ask the following questions and requests to see what we have:

1. How many solutions do you expect to find? And why?
2. Using x for the distance from the bottom of the stairs to the side of the box and using y for the distance from the top of the stairs to the top of the box, draw a 2-dimensional diagram of the physical condition.

3. Using the Pythagorean theorem, what is the equation that combines both x and y.
4. Find a simple relationship that combines x and y by using the triangles in the chart.
5. Here we will notice that when we try to find a mathematical replay:

$$x^4 + 2x^3 - 98x^2 + 2x + 1 = 0$$

6. We also note that the field of the value of X is (from the drawing or calculation)

$$-12 \leq x \leq 10$$

The restricted range for the value of y:

$$-3300 \leq y \leq 3000$$

7. So, we had all the data to solve the equation:

$$x^4 + 2x^3 - 98x^2 + 2x + 1 = 0$$

Here we note the following, either way we try to solve a math equation. But in the first case we presented the student or the ordinary person with an abstract formula and asked for a solution to it. In the second case, we presented him with a matter of real life.

In theory, the first case is easier for the person than the second case, but, the second case is firmer in the mind and closer to understanding and feeling the importance of the issue than the first case.

3.1.4 Problem Solve Statement

We will have two distinct solutions for x, from the graph we find or for x two possible places, both of which are at the bottom of the ladder, one near the box and the other away from the box.

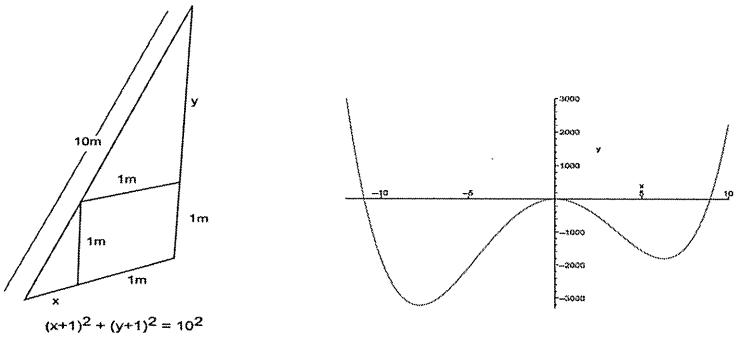

Figure 3.1.4 Diagram of the problem.

Using similar triangles, we find that the simple relationship between x and y is: xy =1

So, by solving the equation and finding the value of x, we will be able to find the value of y:

$$x^4 + 2x^3 - 98x^2 + 2x + 1 = 0$$

$$(x+1)^2 + (y+1)^2 = 10^2$$

$$y = \frac{1}{2}$$

$$(x+1)^2 + \left(\frac{1}{x} + 1\right)^2 = 100$$

$$(x+1)^2+\left(\frac{x+1}{x}\right)^2=100$$

$$x^2+2x+1+\left(\frac{x^2+2x+1}{x^2}\right)=100x^4+2x^3+x^2+x^2+2x+1$$

$$=100x^2x^4+2x^3+98x^2+2x+1=0$$

Using Maple or the TI 83 Graphing Calculator The approximate value for x as:

$x \approx 0.112$m or $x \approx 8.938$m.

Sketch the graph of the quartic over the restricted domain: $-12 \leq x \leq 10$

and the for y :$-3300 \leq y \leq 3000$.

Solve for x in exact form

$$(x+1)^2+(y+1)^2=10xy=1x^2+2x+1+y^2+2y+1$$

$$=100x^2+2(1)+y^2+2(x+y)-100$$

$$=0x^2+2xy+y^2+2(x+y)-100$$

$$=0(x+y)^2+2(x+y)-100=0x+y$$

$$=\frac{-2\mp\sqrt{2^2-4(100)}}{2}x+y=\frac{-2+\sqrt{404}}{2}:x,y>0\therefore x+y$$

$$=-1+\sqrt{101}x+\frac{1}{x}=-1+\sqrt{101}x^2+\left(1-\sqrt{101}\right)x+1=0$$

$$\therefore x_1=\frac{-1+\sqrt{101}+\sqrt{98-2\sqrt{101}}}{2}$$

Or

$$x_1=\frac{-1+\sqrt{101}-\sqrt{98-2\sqrt{101}}}{2}$$

This is the numerical solutions to the equation:

$x^4+2x^3-98x^2+2x+1=0$

In the Real numbers, By isolating the common factor and dividing the polynomial:

$$\therefore \left(x^2+\left(1-\sqrt{101}\right)x+1\right)\left(x^2+\left(1+\sqrt{101}\right)x+1\right)=0$$

CHAPTER 4

AN ETHICAL PROBLEM

4.1 Standard Optimization Problem

ABC produces a popular commercial product that customers and consumers frequently demand across the country, but unfortunately, near this factory there is a place where many turtles live, which is negatively affected by this company's waste.

And in the event the company wants to reduce this harmful effect on animals, the solutions available will cost it a very high price, and given that these turtles do not fall within the environmental protection rules in the country, and therefore there is no law that compels the company to pay huge sums to reduce the damage resulting from production waste . Nevertheless, a local environmental agency monitors the level of pollution caused by this company and displays on social media numbers of high percentages of turtle deaths because of pollution. ABC noticed the reversal of publishing these percentages on sales. The higher the death rate, the lower the amount of sales. Then the corporation's marketing department in addition to a group of mathematical researchers created a function that expresses revenue in the following way:

$$R(x) = 1 + x(lnx)^2; 0 < x \leq 1{,}1 < y < 1.6$$

y = R(x) is expressed in billions of dollars and represents the revenue generated. Since ABC has fixed operating costs of one billion dollars, the profit function, P (x) is given by

$$P(x) = R(x) - 1$$

The problem was presented mathematically as follows:

1.Sketch the graph of $R(x) = 1 + x(lnx)^2; 0 < x \leq 1{,}1 < y < 1.6$

2. Determine the ideal percentage of turtle mortality that would reduce the company's loss, and even reverse the loss process to an increase in profits.

3. Determine the maximum value of the company's income considering the continued publication of the turtle death rate.

4.2 Optimization Problem Solution

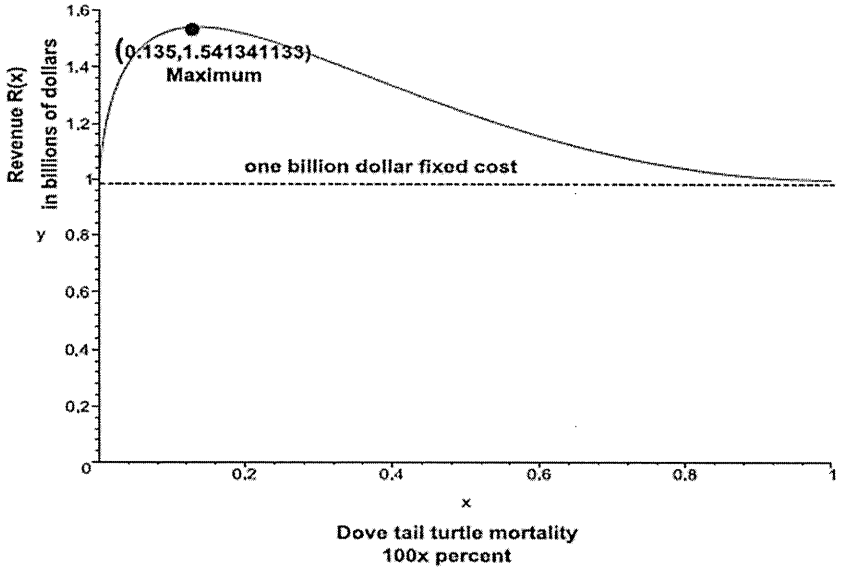

Figure 4.2 Diagram of the problem Solution.

1. For the first point: Sketch the graph of $R(x) = 1 + x(lnx)^2; 0 < x \leq 1, 1 < y <$ 1.6See above graph.

2. For the second point:

$$R'(x) = ln\,(lnx + 2)$$

Setting $R'(x) = 0$ and solving for x gives an optimal value of $x = e^{-2} \approx 0.135$ or 13.5% mortality rate

3.For the third point:

$$R(e^{-2}) = 1 + \frac{4}{e^{-2}} \approx 1.541341133$$

$$P(x) = R(x) - 1 \approx 0.541341133$$

the maximum value of the company's income $ 541,341,133.00

In the previous presentation, we explained a mathematical method for solving the problem, but the basis for this problem was somewhat obscene. If we present it to students, they will basically object to the problem hypothesis. Let us restate this problem in a fashion that inspires social responsibility.

students, they will basically object to the problem hypothesis. Let us restate this problem in a fashion that inspires social responsibility.

4.3 Optimal Social Responsibility

You have been appointed as a mathematics advisor for ABC Corporation. They asked you to help them improve their work and asked you:

1.Sketch the graph of $R(x) = 1 + x(lnx)^2; 0 < x \leq 1{,}1 < y < 1.6$

2. Determine the ideal percentage of turtle mortality that would reduce the company's loss, and even reverse the loss process to an increase in profits.

3. Determine the maximum value of the company's income considering the continued publication of the turtle death rate.

As a successful graduate, you can easily perform mathematical calculations and come up with the solution previously explained, but is your goal in your business to raise money only?

Mathematics is not only abstract science but also includes social and moral responsibilities. Do ethical considerations pay attention in your work, do your attention?

ABC is like any profit company that is concerned only with utilitarian philosophy, so any work they do to improve profits consider it a good business, however, they must realize that returns should also be improved for those who will be affected by their production, and any entity that will be affected negatively by them, including turtles.

Mortality rates for turtles will reach 13.5%, which is morally unacceptable regardless of the profits. While we realize that turtles are not fundamental ethical factors, and environmentalists can work on your behalf to save the turtle, so too can they be considered stakeholders.

Also, the function R (x) will change over time, and the cumulative negative effect will increase over time. Currently, the risks affect only turtles, but over time they will affect humans. Then lawsuits will be filed against the company and Saloon will be required to pay millions for compensation, and will even be legally obliged to return to the starting point, which is to pay the cost necessary to stop the harmful effect of its products on the environment and the turtle. So, is ABC ready? Are they prepared to risk the health of future generations of children, and most importantly for them, are they prepared to face potential lawsuits? Thus, here the moral role appears, Your moral responsibility obliges you not only to implement what is required of you, but also to clarify its direct and indirect impact in the short and long term and to present a comprehensive research in which you talk about all his money related to this issue.

CHAPTER 5

RESPONSIBILITIES OF MATHEMATICIANS

5.1 Responsibilities

The mathematician has many responsibilities, including:

- ❖ Work to acquire new knowledge within the various fields, especially those related to their research, and not limit their field of research to books and references imposed on them only.
- ❖ Respecting mathematical abilities and skills wherever they are found, and not reducing any scientific research or effort in the field of mathematics
- ❖ Mathematicians are obligated to enjoy scientific and social transparency. When there is a negative effect of mathematical work on society, they must clarify this, reveal these negative effects, and contribute to its end.

A mathematician can either be helpful or harmful to their students.

The mathematician may treat his students as human beings in search of science, and a positive motivation for him to set an example for them and a source of reinforcement of their information and social values and feel responsibility towards them in also the correct information for them in a social and ethical framework, so he will be sincere in delivering the correct and accurate information to them away from the information dispersed and others Interconnected, which can or negatively affect students' understanding, so the result will be positive for them and will reflect very positively on their human values and their ethical treatment in society. Or he may deal with them as being negative recipients of his lectures, so he does not care to verify the accuracy or accuracy of his information, nor does he care if his students are able to absorb what he gives them information or if the volume of information is greater than their ability

to absorb, and this will have a very significant negative impact Students should start with their dislike of mathematics and end with their dislike of science.

Mathematicians should use advanced mathematics to develop math concepts, analyze statistical data, and invest this to solve real-world problems.

So, the primary tasks of mathematicians:

- ❖ Searching for broader fields of knowledge in pure and applied mathematics, such as algebra, mathematical analysis, and engineering, to develop new theories and rules in mathematics.
- ❖ Generally using mathematical models and formulas to negate or prove theories, whether related to mathematics or other sciences or even social hypotheses.
- ❖ Using mathematical techniques and pure mathematics theories to solve practical problems in the professional, engineering, or other fields.
- ❖ Attention to developing models and statistical and mathematical methods for data analysis.
- ❖ Using mathematical analyzes to interpret data and report conclusions that improve business decisions or make new decisions that raise or reduce the level of work.
- ❖ Follow up on scientific research and professional journals, and communicate with other mathematicians from different countries and cultures, and follow up on scientific conferences, especially related to the field of mathematics, to keep up to date on the latest developments in the field of science.

5.2 Applied Mathematicians and Theoretical Mathematicians

Applied mathematicians Usually it is the task of mathematicians to use mathematical techniques and theories (such as mathematical modeling) to solve practical and real problems.

These mathematicians usually work with scientists and individuals from other scientific classes or from different professions to find the optimal solution to real-world problems. For example, engineers may work with materials scientists and chemists to analyze the effectiveness of new materials produced by material scientists under the supervision of chemists for use in engineering projects. Mathematicians may also find them working with industrial engineers to study the dynamic properties of new machines. They do research to identify mysterious or unexplained math issues and then find a solution to them. Theoretical mathematicians are usually primarily

interested in discovering new relationships and hidden areas in mathematical theories to increase knowledge about them and increase understanding in this field.

Theoretical mathematicians are usually primarily interested in discovering new relationships and hidden areas in mathematical theories to increase knowledge about them and increase understanding in this field.
Although some may not be interested in using theoretical results in practical use, theoretical results remain a means of developing knowledge that will be an important part of many engineering and practical achievements.

Despite the difference between the field of work of applied and theoretical mathematicians, the areas of mathematics remain largely intertwined. In job duties, mathematicians use applied and theoretical knowledge.

It is important to know that most holders of a degree in mathematics or who work to develop mathematical models and theories are not formally called mathematicians, but maybe find them working in professions and fields related to mathematics.

For example, computer programmers and systems analysts, as well as those working in finance or statistics. Computer scientists, astronomers, physicists, economic analysts, operations research analysts and many researchers in other fields use mathematical concepts on a large scale.

5.3 Innovative Mathematicians of 20th Century

5.3.1 Alexander Grothendieck

Grothendieck was born on March 28, 1928 in Germany, but he grew up and lived a long period of his life in France. Grothendieck started his work and research in mathematics early on through functional analysis.

He completed his doctoral thesis between 1949 and 1953 within the same discipline in Nancy, France, and this was supervised by the most prominent mathematics professors at that time Jean Dieudon and Laurent Schwartz. He had great contributions to the science of topology, he contributed to the development of the theory of nuclear spaces as a basis for the distributions of Schwartz and the topological tensor for topological vector spaces, and the application of spaces in the study of linear maps between the areas of topological vectors. And within a few years he became the leading authority

in the field of functional analysis to the extent that his contemporaries of scholars began to compare his influence in this field with the effect of Panache. Despite that, in the field of algebraic engineering and other related fields he had a great impact, it was an example of the comprehensive world in mathematics. In 1955 he began research and work on sheaf theory and homological algebra, a product of his research "Tohoku paper", where he introduced abelian categories and applied their theory to show that sheaf chorology can be defined as certain derived factors in this context. After sheaves had been defined by Jean Leray, methods and sheaf theory had already been introduced in algebraic geometry by Jean-Pierre Serre and others. Grothendieck took them to another and a higher level of abstraction and turned them in his theory for a key organizing principle.

He diverted attention from research of individual varieties to the relative point of view (which are pairs of related classes), and this allowed for universal generalization of many classical stereotypes.

The first major application of his research was the relativistic version of Serre's theory which showing that the chorology of a coherent sheaf It has limited dimensions and is on a full range. His first work result in algebraic geometry was the thesis that Armand Burrell wrote with Serre Theory, and he began planning and implementing a program to reconstruct the foundations of algebraic engineering sciences.

His theories have become one of the best scientific foundations in every field in which he researched, and his expression and artistic depth had a great impact in this, especially that his style was easy for the learner to understand his theories, especially in birational geometry, techniques from number theory.

Also, he was famous for his mastery of abstract approaches in mathematics and his research on presentation and drafting issues.

His influence has extended beyond that and in other branches of mathematics, including the contemporary theory of units D, which elicited negative reactions, as many scholars were seeking to search for more realistic fields and issues, and it became a prominent figure in modern algebraic geometry. Because of his contributions to science, he was considered one of the greatest scholars of the twentieth century. But by looking at the social aspect of his life and while he was in school, he was dissatisfied with the science he received in mathematics, as he saw it as unhelpful and ineffective

information and difficult to use in solving the problems of daily life. He used to see that math textbooks restrict the mind and force him not to think constantly and not give him an opportunity to meditate or be creative.

The books did not give an effective definition of math concepts, he said one day, "the things that would not satisfy me in the math textbooks in school that there is no realistic definition or Serious to the concept of the length of the curve or the surface area or the size of the solid, these concepts were ambiguous to me, so I promised myself that I would fill this gap from the vacuum of knowledge when I had the opportunity to do so". Because of this, he was motivated to change, and his research had a great impact on explaining and clarifying basic concepts in mathematics and on solving reality problems. Through our review of his scientific career, we found that he focused on linking the results of theoretical research with practical benefit from it and not observing one field of mathematics but rather research in various fields to increase knowledge and practical serious benefit from all the research results.

He always used the help of previous scholars and tried to develop in their results to reach wider results, and always leaves the field for those who come after him to follow what he reached and builds his conclusions on it, so what he did was a solid part of the chain of knowledge in mathematic.

5.3.2 Grigori Perelman

A Russian mathematician, he made significant contributions through his research into Riemannian engineering and engineering topology.

One of his accomplishments was that he devoted seven years of his life to solving a very important mathematical problem called Pahore conjecture which no one could solve for more than a hundred years, Grigori Perelman solve it and that was one of the most important scientific events of that time.

2005 was one of important Perillman's years of life. He resigned from the Stiklov Institute, and his friends spoke that he was beginning to feel that mathematical subjects painful to discuss, to a degree some expected that he would abandon mathematics completely. One article talked about Perelman saying he was disappointed by ethical standards in mathematics. But in the end, when Perelman spoke about the topic, he said: "I cannot say that I have the right to be angry, and I cannot say that I am angry.

Other people are not better than me and most of them feel like me, but they do not realize the reason. Most mathematicians are honest and loyal but the problem is that they are all Almost volunteers, and therefore you find that they often tolerate those who are not honest and do not deserve toleration, and this has a great impact on the validity of the moral reality in the scientific community, it allows non-honest to continue and affect negatively those who are honest in this society.

Perelman also said in one of his interviews: "Unfortunately, reality has become the opposite of what logic says, so people who violate ethical standards are no longer considered foreigners, It is people like me who are isolated."

Perelman has had a long history of rejecting awards and recognition and apologizing for positions. He apologized for the position of the head of the Mathematics Academy, and he apologized for the other academic positions and preferred to remain in his place as a contributor to his researchs in mathematics, and as a contributor to his knowledge in teaching mathematics students. As Perelman was not interested in money or fame, he often apologized for meetings or attending honoring parties.

In 2006, Berylema was the first and only scientist to reject fields medal, the one of the highest honorific medals in the field of science. Perelman talked about his ethical social views and said: “As long as I am not clear to some else or well-known to them, I have several options, either to choose to do ugly things, or to choose to be treated like a pet and be silent.

I do not speak or express my opinion. And because I know myself and I will not accept to do something ugly or to be treated like pets, I decided to be very clear, and because telling the truth is annoying to some who are in the decision-making place, I had to resign”.

Perelman's words were considered influential and caused an outcry over moral violations.

CHAPTER 6

HOW TO LIE WITH STATISTICS

6.1 Old Folks Grow Older

The Newsweek once published an article, this article titled with "The Growth of Seniors in the United States". and tried to clarify the matter through the graph showing two men.

under the first one wrote the expected life expectancy of 68.2 years (number was written only) and wrote under the second man an average life expectancy of 34 years between 1879-1889, the article was not clearly annotated and it was very brief. Coincidentally, the first average age was twice the second average age, and this gave several impressions and misconceptions about the article.

Some believed that the rate is continuous and therefore in the future the average life expectancy of a person will reach 136 which is twice the average life expectancy at the time of writing the article. Some also believed that the doubling of age was associated with a doubling of height and weight.

In both cases, the matter is illogical, which led people to laugh and disbelieve the article, even though the information in it is correct.

The deception of people in this case was caused by the lack of information and its shortness in the article, in addition to the ambiguity of the explanation and the lack of information in the diagram or drawing.

6.2 The Crescive Cow

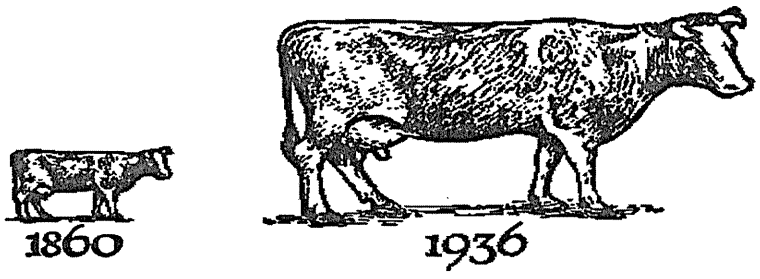

Figure 6.2 The drawing in the news.

In the United States of America, the number of cows reached almost eight million cows in the year 1860, and by 1936 the number had reached more than twenty-five million cows, meaning that the number increased almost three times between the two mentioned years. A newspaper wanted to describe what happened, so it published an article that includes a graph showing a picture of two cows. The first one was written under it 1860,

the second was three times its size, and the first was written under it 1936.

This drawing was the reason for the misunderstanding that occurred for a large number of those who saw the drawing and did not read the article, the impression was that the size of the cows increased three times until 1936 from the size in 1860.

6.3 Record Temperatures in Oklahoma City 1890-1952

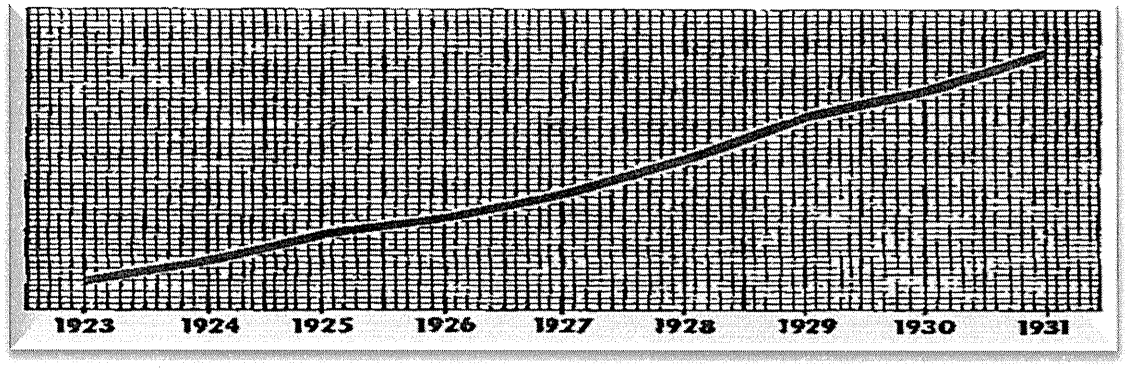

Figure 6.3 The heat graph.

A newspaper published this graph in its magazine claiming that it represents the temperature change in Oklahoma, and it did not put numbers on the chart, but only the puted years. everyone who saw this graph was surprised, as it showed that there is a huge doubling in temperature from year to year. the error in that is the drawing of the chart did not take into consideration the annual average temperatures, but rather he chose a temperature of a particular year and chose a higher temperature than in the following year, and it did not take into account the different temperatures in Oklahoma regions during the seasons of the year. the heat in summer ranges Between 88 to 68 while in the winter it is 29 to 50. Although the scheme was depending in its creation on the temperatures in the city, it never gave correct information about the temperature.

CHAPTER 7

VALUES AND THE SOCIAL RESPONSIBILITY OF MATHEMATICS

7.1 Research in Values of Mathematics

Mathematics is a beautiful and universal real language, the diversity of its fields makes it able to influence various aspects of professional, scientific, and industrial life, and therefore the results of its research have an impact on human aspects.

Consequently, due to the great influence of mathematics, it can no longer be considered devoid of values, in inseparable from cultural and social reality, and its influence is no less than that of the rest of the social sciences.

Our challenge is to determine the value of mathematics.

When we look objectively to mathematics, we will find that the ethics involved in them are of equal harmony.

We find that the logic of mathematics has an impact on philosophical thought as it relates to the logic of philosophy and the beauty of consistency, and you will notice this consistency even in the applications of mathematics through the consistency of the results, their objectivity and their arrangement to arrive to prove a hypothesis or solve a problems.

Research in the values of mathematics requires that the general framework of the research is an ethical framework and the focus of the research is based on moral values, so the researcher in the values of mathematics is based on two rules:

- "Try to reach the results yourself, and do not steal the effort and results of others"
- "Try to do the best that you can do. If you do your best, the results you reach will be very satisfactory to you."

7.2 The Relationship Between Mathematics and Values

The values that mathematicians enjoy are essential in mathematics, and the mathematician Hardy (1941) believes that research in mathematical theories highlights

its beauty, and its beauty lies in its generality and the depth of its content and what it contains of ideas and data.

The mathematicians see the extent of its beauty and consistency of mathematics , they claims that the issues, concepts and methods of finding solutions, results and mathematical theories have their own beauty, depth and elegance.

The least contributions to mathematics cannot be ignored, as these contributions are part of a connected series on which theories that have their own influence and aesthetics will be built with mathematicians.

Consequently, explicit or hidden values in mathematics can be clarified through the contribution they make to solving problems, whether they are scientific or realistic problems, and the value depends on the properties of the evidence it provides and the proven theories that support the solutions and link the accepted hypotheses in mathematics in order to reach the optimal solution.

These values may be the most obvious among the criteria governing the acceptance of knowledge in mathematics.

It is no secret to anyone how many mathematical concepts undergone of differences and historical resistance, but in the end she was able to establish herself in the world of mathematical concepts, for example: negative numbers, complex numbers, abstract algebra, non-Euclidean geometry and the Cantor group theory.

The disagreement was mainly about what should be recognized and considered to be a mathematical concept and what is false.

The evaluation criteria were based on what is common knowledge in the time when these concepts were proposed for evaluation, and given that evaluation criteria are chosen over the history of the development of ideas and the breadth of knowledge, mathematical values appear as values that cannot be imposed or acquired from a fixed source.

7.3 The Values of Social Constructivist Mathematics

One of the basic orientations in social construction is to confront a number of traditional divisions related to mathematics, and this leads to the inability to separate

these fields including separating mathematics philosophy from the history of mathematics, or separating the context of justification from the context of discovery, or the content of mathematics and the mathematical logic eloquence, or The separation of knowledge from objective knowledge in the social sphere. Consequently, the union of these concepts confirms that mathematics is no longer independent of values or interests, and thus has become a basis for assuming social responsibilities.

7.4 Is Mathematics Value Free?

About teaching mathematics, two schools were found to be completely opposed. The first school adopts the traditional or basic approach that aims to teach students mathematical information to the degree that enables them to master a specific set of mathematical knowledge and skills and then evaluate them based on how well students have mastered them, and this type Can be described as a type of "mathematical despotism".

While the second school adopted the interactive education approach, which is based on teaching students mathematical information and linking it to the reality of life while opening the field of creativity to students and scientific research to access information, and interactive training on mathematical skills, and the evaluation is a measure of students' mastery of skills on the one hand and their willingness to research in order to reach For information on the other hand.

Educators and mentors set the approach to reforming understanding as a primary goal in the process of teaching mathematics and see constructivism as the philosophical basis for mathematics education.

Some scholars argue that the traditional approach has little value in creating a human context for mathematics, but on the other hand, advocates of constructivism emphasize the child-centered approach to education and the building of mathematical knowledge of the individual. Stehman argues that mathematics is a human activity, saying, "It must be recognized mainly that mathematics itself interferes in the historical, intellectual, social and cultural aspects. But rather than simply specifying the ethical uses of mathematics, we need to teach mathematics in a way that leads you to realize that the ethics related to it are not different in kind. For ethics related to companies or commercial institutions. In other words, it has become impossible to consider mathematics as devoid of values. On the contrary, the diversity in the fields of

mathematics intertwined in various areas of life has made the values of mathematics unlimited and not separate from the social or cultural context in society.

7.5 The Intrinsic Value of Mathematics

The intrinsic value of mathematics lies in what it provides to humankind. It expands the field of cognitive knowledge of the human mind and enhances the capabilities of pure thought. The promotion of mathematics is the enhancement of human moral thought, it is are an exploration of pure thought.

The value of mathematics is not only appreciated by students who graduate from the campus who specialize in mathematics, and the area occupied by the invited mathematicians, but the value of aesthetic mathematics is also appreciated by the audience who taste beautiful art. Example complex mosaics and other beautiful representations.

This would spread a general perception that mathematics has an aesthetic aspect and intrinsic intrinsic value

7.6 The Extrinsic and Social Value of Mathematics

First, among the sciences, mathematics is defined as the king and servant of science. It is the language that formulates modern science. Since the Industrial Revolution, mathematics has been the supporter of scientific applications based on engineering mathematics, technology, and the foundations of modern life.

Secondly, in the field of technology and communication information, which is the primary language of all modern media and knowledge systems, it cannot be neglected that this technology relies mainly on mathematics, so programming orders and cognitive representations on which fundamentally communications and information technology depends, can only be expressed through electronic coding, which Provide by mathematics and mathematical logic.

Third, in the economic field, finance, business, and economic relations depend on a mathematical basis. Money represents the intangible embodiment of the economy, and the commercial basis of society cannot be achieved without it.
Calculating profits, losses, capital, taxes, and commercial financial viability is only by using mathematics and arithmetic. Each of the fields has a tangible effect on daily life and its clear role in the development of human life and its various fields. If

mathematics comes in these areas mentioned mainly, we find that the value of mathematics is a great value in the human, human and cognitive aspect.

The developments that lead humanity to a better beard are those led by mathematics in engineering, technology, and humanities, especially what happened in the past two centuries.

The great personal value of mathematics cannot be overlooked. In addition to the social benefits, mathematics provides people with learners and others with great benefit that can be illustrated by the following points:

1. Mathematics is a broad and fundamental component of human culture

2. Mathematics is the basis of cognitive development

3. Mathematics is a valuable tool for use in society. It benefits the various people who interact with it.

4. Mathematics is a means of achieving an academic degree to enter the field of work or higher education.

From this it must be recognized the great benefit mathematics brings, as we are almost living in a social mathematical world. Without mathematics, we will give up many of the life necessities we enjoy and the tools we rely on as individuals and as a community. So, it can be said that mathematics is the most applied science in all areas of knowledge in our world today.

CHAPTER 8

IS MATHEMATICS HARMFUL?

8.1 The Power of Mathematics

Mathematics is a science rich in knowledge and strong in influence, as its influence continues in education, culture and science in various periods of human history. Mathematics also has a distinguished position in education as it is the only primary subject taught universal for all ages and educational groups.

But behind this clear and bright picture of mathematics is there another hidden image that is evil or harmful? Is the assumption that this image of the power of evil mathematics exists is a moral assumption?

This matter was what some educationalists have argued about, as they pointed out that mathematics, especially mathematics taught in school, has another side with a negative impact on students that leads them to feel frustrated, underestimated or rejected by mathematics.

It is noted that when learners are categorized among citizens in modern society, mathematics reduces the chances of a good life for those who are classified as unsuccessful in them, as scientific success is almost always linked to success in mathematics as a scientific achievement, and the problem is that even for those who are successful in Mathematics, the effect of mathematics on them may be negative, making them only committed to mathematics research and not thinking about ethical ways to solve the problems of society.

Mathematics may be used as a tool in fields devoid of ethics arbitration, such as being exploited in wars, dishonest corporate activities, or in uses that harm the environment and people. Consequently, it may be used in many verbs that treat people as things that can be dispensed with or harm for an interest.

As a result of the above clarifications, it was necessary to search for suitable solutions, and the following solutions were suggested:

Careful follow-up closely to the reasons for student success and failure in order to avoid negative effects in schools and treat them in a timely manner, it is imperative that we be fully aware of the impact of success or failure in mathematics on learners in the long run.

In addition, to avoid the effects of the frustration that mathematics causes on society, it is necessary to clarify the social responsibility of mathematics, by including mathematics ethics within the mathematics curricula taught to students.

When students and mathematicians arrive at the stage to critically demonstrate the uses and applications of mathematics and see the impact of mathematics on play and work, then they will be able to understand the ethical implications and effects of mathematics.

Some people may question the value of mathematics, and for this, everyone who works in mathematics research and science and even mathematics students must clarify their value and importance. Mathematics scholars and students should consider mathematics as a critical friend, in addition to that they have the right to feel praise and pride to being among those who chose to work and research in mathematics.

8.2 Is Mathematics an Untrammeled Good?

The wisdom that prevails in the community of mathematicians, its educational institutions and the whole society in general is that mathematics itself is a great blessing with great benefits for all of humanity.

Scientist Burnett describes mathematics and says: "The study of mathematics is good not only for the mind, but also good for the soul," and he based his statement on Plato.

If someone calls on those interested in the field of mathematics to abandon the non-critical approval of mathematics, and calls them for an answer to the question: Given the actual results and potential costs of distinguishing mathematics in society and education, does mathematics cause any evil or harm? For mathematicians and others, they think that the mere fact of asking this question is more ridiculous than a question.

To educationists it is not so difficult to ask this question, or even to answer it in the affirmative when the impact on disadvantaged students and society is considered (Stanic 1989). Before answering the question and clarifying the potential harm of mathematics, it must be emphasized the great value of mathematics to humanity.

Mathematics has an intrinsic value (such as its value in the field of scientific knowledge), and an intrinsic value represented in its contributing role in professional fields.

Now let us answer the previous question, if you try to search for the harm and damage that math causes, you will find that mathematics has no harm or negative impact on itself, but if the damage occurs, the reason is mainly because someone used math for an immoral purpose or who misused His knowledge of mathematics.

In either case, mathematics will not be the reason for this, but rather the lack of awareness of the ethics of mathematics.

8.3 Features and Characteristics of Mathematics

Let us ask the following question: What are the components of mathematics that contribute to building their great external and fundamental value?

With a simple answer, we say: number and arithmetic, as arithmetic is essential in mathematics, and it is the dominant aspect of education, history, and various aspects of humanity. Mathematics arose as a scientific discipline from about 3000 BC, and since then numbers and accounts have dominated various aspects of life and various branches of science, so the arithmetic was established. It was a person's need for it. From the content of human need, arithmetic arose, and from its mathematics arose.

From the numbers, arithmetic arose, and from the science of mathematics, mathematical concepts began to form, until algorithms, algebra, geometry, and the rest of mathematics were formed. Algebra was the language that scientists translated into their research, so the developers used the results of this research in their inventions that benefited mankind, from calculators to computers and programming languages. As well as other characteristics of mathematics schools, universities, and scientific research that they are represented in the language of mathematics, mathematical sentences, although they contain symbols, they are consistent with the usual verbs.

In general, the use of mathematical terminology in expression has become a regular form of discourse in the academic and educational community and is not limited to mathematicians, but extends to students, researchers, and others, reaching ordinary people. And because keeping pace with development means keeping pace with

mathematics, as long as human development continues, mathematics sciences continue, which forces mathematics students and mathematicians to work hard to keep pace with these sciences and keep up with the language of mathematics permanently.

Continuous interaction with mathematics and its practice may lead to social habitual obedience, and permanent habitual adherence to strict compliance with the text, whether written or audible, and the reason for this is the choice to always recognize the validity of the assumptions established in mathematics without seeing the proof of the validity of this hypothesis, and this is one of the problems that is exposed She has a mathematics student during his studies, which is the reason why his thinking horizon will not be wide in the future. To avoid this from happening, teaching, and learning mathematics in schools may require the development of mathematical identity, from the age of five or a little later, through:

1. Teaching concepts and terminology in a simple way.

2. Trying to simplify the calculations and the patience of the student and encourage him to master it

3. Make the student get used to asking without fear or shame about any subject and any hypothesis

4. Avoid self-repression and feelings in their mathematical operations in arithmetic and mathematical models.

CHAPTER 9

THE RELATIONSHIP BETWEEN ETHICS AND MATHEMATICS

9.1 Mathematics and Ethical Issues

Mathematics holds the greatest scientific authority among the human sciences as it is one of the oldest scientific tools used constantly in the stages of human thinking, mathematics has reached a stage in which its reality has become a model of truth in science, so the power of mathematics is largely absolute.

Everywhere that there is advanced technology, you will find with it advanced mathematics already exists, and with the increase of artificial intelligence, big data, algorithms, mathematical modeling in chemistry and biology, you will find the role of mathematics greatly increased.

Most fundamentalists who support algebra and the theory of infidels have become unable to be satisfied with only mathematics or claim that their work is limited to mathematics and dispense with the implications of ethics.

Thus, it became clear that a person can practice all branches of mathematics in a way that has profound social implications, for good or bad. Moral questions are possible in any branch of applied and pure mathematics.

For mathematicians, there is no longer an escape from a sense of social responsibility and participation in ethical issues of mathematics.

9.2 levels of Involvement

9.2.1 Level 0: Believing There is no Ethics in Mathematics

This is the stage where many mathematicians are today. They feel that mathematics is devoid of human values and that mathematics is inherently immoral and does not affect social ethics. Rather, they believe that ethical issues lie solely with the one who uses mathematics as a tool to reach a specific goal, and their argument is that mathematics has always existed.

9.2.2 Level 1: Realizing There are Ethical Issues Inherent in Mathematics

The first level of moral awareness in mathematics includes the perception and basic understanding of the comprehensiveness of the mathematician, and that mathematics is part of an ethical social matrix, and this matrix can transfer some moral results to mathematics, which leads one to always reflect on the role of social mathematics and not consider it as a science found in Isolated from anything.

The professional world is a moral world, so all mathematicians must research their individual responsibilities, and be ready to help them solve ethical issues at any time.

Mathematicians with moral responsibility realize that all their research and science encompass social and ethical responsibilities.

9.2.3 Level 2: Doing Something

What can a mathematician do or present to society?

From this question, things start to become complicated. Here, views begin to differ, and long discussions begin. So does the mathematician have to intervene and set conditions for what will be used and applied to the results of his research, Not all moral consequences are bad and undesirable, but there are some consequences that will harm the mathematician. For example, the mathematician may object to a decision or to perform a task, and as a result he is expelled.

On the one hand, it may be better socially in terms of protecting the community from the negative effects of the results of using the world's research in a negative way, but on the other hand, the use of the results in this way may be of benefit that the mathematician did not absorb, which led him to object to the task entrusted to him. This puts the world in a real moral dilemma. There is no solution to this dilemma except for the mathematician to enjoy moral awareness and logical thinking and try as much as possible to get away and not to enter into a position with management that ends with the phrase, "Do this or I will expel you."

9.2.4 Level 3: Taking a Seat at the Tables of Power

The ethical social participation discussed, which includes mathematicians, includes going out of the field of emotional and professional comfort to do a different thing but always within the boundaries of the professional field in which they work. The reason

for this is that once mathematicians engage ethically in societal issues and realize that they need to work to find appropriate ways to respond to ethical concerns, they should be able to change their reality and try to gain a seat in the tables of power.

This means that the mathematician must choose between two things "doing a different job, from the same place" or "moving to a new place and doing a different job."

9.2.5 Level 4: Calling Out the Bad Mathematics of Others

This is through research in advance in cases where mathematics can be used incorrectly or badly, whether in the scientific or professional framework in institutions and organizations that use mathematics outside its moral scope. This matter can only be used by mathematicians to provide a deep perspective on it, analyze and understand mathematics, problems of abuse and proposed solutions to counter mathematical unethical verbs. In general, the bad use of mathematics may come in two ways, under the circumstances in which it is interacted with:

First, when non-mathematicians misuse mathematics, whether intentionally or unintentionally, it is used inappropriately and incorrectly, and it is claimed that it led to incorrect results (although it may appear correct to some non-mathematicians).

Second, when the specialists and workers in the field of mathematics use math in an inappropriate manner for immoral reasons, from that the specialist in mathematics may present the results after hiding some errors or bias during the presentation and presentation of results, or it may give correct arithmetic results for scientific research But it does not bear the desired benefit from it.

CHAPTER 10

ETHICAL CALCULUS

10.1 The Scope of Moral Calculus

ethical calculus refers to the method of determining the course of action through circumstances that have not been explicitly evaluated in the ethical code.

The basic philosophy of moral computation is the evolution of the study of ethics, and it combines elements of natural selection with systems of self-regulation.

According to the moral calculus, the moral course of action is an absolute path, but it is not based on a fixed moral law. Ideal ethics, when within certain constraints, is the best course of action for an individual. Moral computation is in some respects like moral relativism. Moral computation finds its causes in circumstances, while moral relativity depends on the cultural and social context of moral judgment. Ethical calculus and integration are a form of dynamic, moral tyranny.

10.2 Examples

Scientist Francis Hutcheson devoted an essential part of his work to investigating the origin of ideas, beauty, and virtue in humans to try to develop a mathematical equation that collects them. The formula included formulas as follows:

$M = b * a$

moral importance of any agent = benevolence of the agent * ability of the agent

In another example, the philosopher Jeremy Bentham has attempted to calculate the amount of pleasure that a procedure cause. He believes that the moral right and wrong for human action or action is the amount of pain or pleasure that results from it. The felicific calculus and moral integration can determine the moral state of any action studied.

CHAPTER 11

CONCLUSION

In this thesis I have attempted to summarize the relationship between ethics and mathematics, explaining the close correlation between them by setting a clear definition of ethics in mathematics and then discussing its importance and detailed explanation about the misuse of statistics while clarifying their impact and citing some examples related to them.

In addition to how to solve moral problems and clarify their priorities in addition to clarifying the responsibility of mathematicians and the relationship between ethics and mathematics

And touching the biography of two mathematicians ,Then we explained how to lie using statistics with several illustrative examples, and then explain why ethics is difficult, Then explain the value and social responsibility of mathematicians, and answered the question: Is mathematics harmful?

References

[1] Shan, S. Bailey, P. (1991). Multiple factors: Classroom mathematics for equality and justice. *Stoke-on-Trent: Trentham*.

[2] De Millo, R. A., Lipton, R. J., Perlis, A. J. (1979). Social processes and proofs of theorems and programs. *Communications of the ACM*, **22**(5), 271-280.

[3] Steele, J. M. (2005). Darrell Huff and Fifty Years of" How to Lie with Statistics". *Statistical Science*, 205-209.

[4] Wilder, C. (2008). *Point, The Techniques and Habits of Successful Presenters*. John Wiley.

[5] Sullivan, S. Hannis, M. (2017). Mathematics maybe, but not money. *Accounting, Auditing & Accountability Journal*.

[6] Dworkin, G. (1982). The Journal of Mathematical Ethics: A Proposal. In *Philosophical (The) Forum Boston, Mass* (Vol. 13, No. 4, pp. 413-415).

[7] Ernest, P. (2012). What is our first philosophy in mathematics education? *For the Learning of Mathematics*, **32**(3), 8-14.

[8] Franklin, J. H. (1998). One America in the 21st Century: Forging a New Future. The President's Initiative on Race: The Advisory Board's Report to the President.

[9] Belbase, S. (2010). Images, Anxieties and Attitudes toward Mathematics. *Online Submission*.

[10] Bell, E. T. (1951). *Mathematics, queen, and servant of science* (No. QA21. B44 1951.).

[11] Bird, S. J. (2014). Social responsibility and research ethics: not either/or but both. *Professional Ethics Report*, **27**(2).

[12] Ernest, P. (2018). The Ethics of Mathematics: Is Mathematics Harmful? In *The philosophy of mathematics education today* (pp. 187-216). Springer, Cham.

[13] Ernest, P. (2016). The collateral damage of learning mathematics. *Philosophy of Mathematics Education Journal*, 1-24.

[14] Buxton, L. (1981). *Do you Panic about Math's? coping with math's anxiety*. Heinemann Educational Books.