

## **Contextualization of mathematics as a didactic strategy in the learning of the Mathematics subject in students of the Administration professional career, semester 2022-I, UNASAM-2022**

### **[Contextualización de las matemáticas como estrategia didáctica en el aprendizaje de la asignatura Matemática en estudiantes de la carrera profesional de Administración, semestre 2022-I, UNASAM-2022]**

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#### **Resumen**

El objetivo de la investigación es determinar la influencia de la contextualización de la matemática como estrategia didáctica en el aprendizaje de la asignatura Matemática en estudiantes de la carrera profesional de Administración, semestre 2022-I, UNASAM-2022. La investigación es tipo aplicada, método cuantitativo y diseño cuasi experimental; se aplicaron dos instrumentos: encuesta validados por dos expertos, aplicados a una muestra de 96 estudiantes. Las variables analizadas contextualización de la matemática y aprendizaje de la asignatura de la matemática, en cuya investigación se formuló una hipótesis afirmativa y una hipótesis nula. Después de analizar los resultados, se afirma que sí existe influencia significativa de la contextualización de la matemática como estrategia didáctica en el aprendizaje de la asignatura Matemática, quedando corroborado la hipótesis afirmativa. La verificación de la hipótesis fue hecha aplicando el T de Student. De esta manera se concluye, que existe influencia significativa de la contextualización de la matemática como estrategia didáctica en el aprendizaje de la asignatura Matemática en estudiantes de la carrera profesional de Administración, semestre 2022-I, UNASAM-2022.

**Palabras clave:** Contextualización, estrategia, aprendizaje conceptual, aprendizaje procedimental, aprendizaje actitudinal.

### Abstract

The objective of the research is to determine the influence of the contextualization of mathematics as a didactic strategy in the learning of the Mathematics subject in students of the Administration professional career, semester 2022-I, UNASAM-2022. The research is applied type, quantitative method and quasi-experimental design; Two instruments were applied: survey validated by two experts, applied to a sample of 96 students. The variables analyzed contextualization of mathematics and learning of the subject of mathematics, in whose investigation an affirmative hypothesis and a null hypothesis were formulated. After analyzing the results, it is affirmed that there is a significant influence of the contextualization of mathematics as a didactic strategy in the learning of the Mathematics subject, thus confirming the affirmative hypothesis. The verification of the hypothesis was made by applying the Student's T test. Thus, it is concluded that there is a significant influence of the contextualization of mathematics as a didactic strategy in the learning of the Mathematics subject in students of the Administration professional career, semester 2022-I, UNASAM-2022.

**Keywords:** Contextualization, strategy, conceptual learning, procedural learning, attitudinal learning.

### I. Introduction

As changes are registered in university education, it is necessary and convenient to think that the teaching of mathematics must be contextualized, so that it is of interest to university students, and that they do not see mathematics as an abstract and that we prevent knowledge that is acquired mechanically, and becomes volatile and ephemeral, led by the classroom teacher. The problems posed to the student are verbal statements posed in mathematical terms and strongly linked to the type of operation to be carried out where the context is irrelevant for the understanding and mathematical resolution of the problem. So the vast majority of students limit themselves to guessing, or deciphering the solution through incorrect logic, associated with a pre-established pattern, but they do not use their common sense, without associating their context, that is, so that they can be useful mathematics in practical or experiential life.

When we talk about teaching, we must be thinking how many of us are motivating our students, when teaching our contextualized mathematics classes, as a didactic strategy for learning mathematics in its context; so that the student is naturally motivated, seeing the practical utility of the mathematics that is studied, is a problem that has a decisive influence on the student's performance, mainly affecting their motivation towards learning mathematics, in this case of the mathematical subject and obtain significant learning of mathematics.

The teaching of mathematics has been facing a worrying problem in the Peruvian educational system, the same one that is exacerbated by the current situation (UNASAM is not exempt from this aggravating situation). Thus, it is observed, for example, that the current curricula are committed to teaching based on competencies that, when executing it, are applied by objectives, where the student does not develop basic competencies in their training for their professional life, since These are fundamentally based on repetition and memorization. It is important to highlight that, if adequate methodological teaching strategies are not implemented in mathematics courses, students will not be able to develop significant learning and this will result in poor academic performance and a negative impact on their self-esteem. We must bear in mind that, in many cases, failure to pass basic mathematics courses in the first cycles of university studies determines their permanence in a certain professional career; sometimes even causing retirement or career change.

All the aforementioned problems are aggravated because adequate didactic strategies are not used for the teaching of Mathematics. If it will be taught in the context of the real world, the learning would be meaningful; this approach has, to a large extent, emerged in opposition to or in response to the movement known as Modern Mathematics. It is true that, when choosing the situations that allow mathematical concepts to be contextualized, many factors inevitably intervene: level of intellectual development of the students, that the situation is motivating, that it is scientifically and socially relevant, etc.

In this sense Núñez and Font (1995), they report that there are also factors of an ideological nature, precisely in the teaching of mathematics, both the choice of a contextualizing methodology, as well as a non-contextualizing one, already responds to implicit ideological options. Díaz and Poblete (2001), addresses this issue from mathematical problems, states that the resolution of a real context problem, realistic or fanciful, requires the mathematization of the given situation, that is, its translation into mathematical language, since in daily life there are, specifically in the environment, situations that can become problems. These can be assigned a mathematical formulation and can become isomorphic to those presented in the school curriculum, favoring the constructive mental activity of the students in the knowledge acquisition processes, and the effective development of the ability to solve types. from problems. As we can see, the problems of both teaching and learning mathematics is the lack of strategies that allow us to make our teaching of mathematics more interesting, generate constant motivation in students, and the proposal is to contextualize mathematics as a learning proposal in administration students.

Given these considerations, we find ourselves in the urgent need to ask ourselves the following question: In what way does the contextualization of mathematics influence as a didactic strategy in the learning of the Mathematics subject in students of the professional career of Administration, semester 2022-I, UNASAM -2022? To give a tentative answer to our research problem, the following research hypothesis was considered: There is a significant influence of the contextualization of mathematics as a didactic strategy in the learning of the Mathematics subject in students of the professional career of Administration, semester 2022-I, UNASAM-2022; that will be verified with the contrasting of the hypothesis.

On the subject of research, there are some research works (correlational and quasi-experimental), relatively related to this work, that is, works on social networks and mathematical learning that will necessarily be taken into account in this research work.

Rodríguez (2021), in his work "Didactic Strategy for the Contextualized Teaching-Learning Process of Discrete Mathematics in Information Technology"-Ecuador. Whose research design was pre-experimental, reaching the conclusion with the application of the method of expert criteria, user criteria and the pedagogical experiment in its pre-experimental variant, consensus was found to ensure that the Didactic Strategy of the teaching process Contextualized learning of the Discrete Mathematics subject in the Information Technologies career is feasible to be applied in institutions of the same nature. Keeping a certain relationship with our proposal. Camero et al. (2019) in their research work "The contextualization of Mathematical Analysis in school Mathematics"-Havana. The objective of the article is to elaborate teaching tasks with a professional pedagogical approach to favor this contextualization. Theoretical methods such as analysis-synthesis, induction-deduction and historical-logical were used. From the empirical methods, interviews with students, graduates of the career and experienced teachers were used, the use of which made it possible to obtain information about the performance of teachers, they concluded that the proposal contributes to the contextualization of the contents of the Mathematical Analysis discipline. in school Mathematics through the professional pedagogical approach.

We consider the findings found in the research work of Mendoza (2019) "Contextualization of the teaching of Mathematics in the Civil Engineering career"- Ecuador, His exploratory quantitative study, used a survey as a data collection tool, reaching to the conclusion that the identification of the main contexts in which the training process of the civil engineer of the ULEAM is performed allowed to establish the essential relationships between these and the contents of Mathematics II. Keeping in relation to our proposal. Another finding of Castaño (2018) Medellín, Colombia, investigated Case study: A Pedagogical Contextualization on Divisibility, its research objective: to carry out a compilation monograph for the contextualization of the teaching of divisibility in basic secondary education. As a result, a compilation monograph is presented that accounts for the proposed objective. The essential aspects of this monograph focus both on the academic, considering a correct mathematical presentation of the divisibility relation and its close consequences, as well as on the didactic, proposing an approach based on the paradigm of social constructivism. In the work of Suárez (2010) of master's thesis "Analysis of the contextualization of mathematics according to the academic model of quality for competitiveness"-Mexico. Whose research objective was: To explore whether by not adequately contextualizing mathematics as established by the new quality academic model for competitiveness, is what is causing poor school performance, which has an impact on school dropout due to failure. in the first semester students, in the CONALEP 035 campus of Lázaro Cárdenas, Michoacán. The methodology used was Qualitative-evaluative and was carried out through observations of class sessions, a teacher self-evaluation, a student interview and a content analysis, as data collection techniques. The results showed that the teachers are not performing the contextualization in the problems; (b) Teachers require advice and guidance on the course, specifically, in the application area of contextualization of the module; (c) Those who teach the module must know and apply the required skills.

Some conceptions about Contextualization of mathematics, such as Conejo and Ortega (2013), define the context in the mathematical field from problem solving as that: [...] situation in which the problem is immersed. Its main role is to provide the problem solver with enough information to find and interpret the solution. However, in the statements, the context can appear in different ways and even not appear at all. It can also happen that the context, without being explicit in the problem, is assumed to be sufficiently known by the solver. (p. 145).

In this way, the authors show that contextualization should be sent to the problem solver, that is, to the student. That is why a prior diagnosis of the students' knowledge and theoretical scope is relevant when a context is proposed to them, since it is presented in two very different ways, explicit or implicit. In the planning of the context to be considered for the student, its conceptual management must be foreseen, which will imply placing more or less information about the context. In the same way, Barrera, (2009, pp 16) points out that mathematics education, in light of current research, states that learning tasks must: Be designed in contexts that help the student to give meaning to mathematical processes when they are solved issues. That is to say, the approach of real situations is required so that the students associate the equations to be used with the particular case of study. This is the basis of the mathematical didactic efforts to get students to associate their knowledge with a real situation of application.

## II. Materials and Methods

### Type of research

Due to its approach, it is a quantitative investigation (Hernández, Fernández, and Baptista, 2014). The quantitative approach is sequential and probative based on an idea that is delimited and, once delimited, objectives and research questions are derived, the literature is reviewed and a framework or a theoretical perspective is built.

Due to its usefulness, it is an applied type of research (Carrasco, 2009 p 43). Applied research is distinguished by its well-defined immediate practical purposes, that is, it is investigated to act, transform, modify or produce changes in a certain sector of reality; whose purpose is the resolution of a practical problem, through the contextualization of mathematics as a didactic strategy, influences the learning of the Mathematics subject in students of the UNASAM Administration professional career. Due to its depth, it is an Explanatory level investigation. Niño, (2011, p.34) explanatory or causal research responds to the question Why? Through this investigation, the causes are discovered for a certain fact or phenomenon in studies to behave in such a way or its existence or nature is conditioned. The research is explanatory because it tries to explain how the contextualization of mathematics as a didactic strategy influences the learning of the Mathematics subject in students of the professional career of Administration, from UNASAM.

### Research design

The research design can be defined as a schematic structure or organization that the researcher adopts to relate and control the study variables. "It serves as an instrument of direction and restriction for the researcher, in this sense, it becomes a set of guidelines under which an experiment or study will be carried out" (Hernández, Fernández and Baptista, 2014). Statistical methods will be used to analyze the learning of the Mathematics subject in the experimental and control groups.

This study will be quasi-experimental. Cresswell (2009) defines quasi-experimental research as those in which a convenience sample is used, since the researcher must use groups already formed in advance (eg a classroom, an organization, or a family) or volunteers. For this reason, this type of procedure is taken when the subjects to be investigated cannot be randomly assigned. In the Professional Career of Administration, the groups or sections of the mathematics class are made up by the School Administration and no type of randomness can be used among the subjects to be investigated. Already established sections will be taken.

In order to achieve the proposed objectives and to analyze the certainty of the formulated hypothesis, the research design is of an experimental type, specifically quasi-experimental, whose scheme is:

EG: O<sub>1</sub> -----X-----O<sub>2</sub>  
CG: O<sub>3</sub> -----O<sub>4</sub>

Legend:

EG= experimental group

CG= control group

O<sub>1</sub>: Pre-test

O<sub>3</sub>: Pre-test

O<sub>2</sub> : Post test

O<sub>4</sub> : Post test

X: the experiment (Contextualization of mathematics)

### Population

In the present research work, the study population will be considered the students of the Faculty of Administration and Tourism, of the professional Administration career, of the first cycle semester 2022-I, which constitute a population mass of 96 students. They will only be considered as study population, to all those who rendered their qualified practices and their partial exams.

Table 1. Population and sample of the study

Faculty of Management and Tourism	Population (N)	Sample (n)
Students	96	63
Total	96	63

Source: Oficina general de estudios (OGE)

**Sampling**

The determination of the sample size was carried out in a selected way with the non-probabilistic method of the intentional deterministic type. (Hernández, Fernández and Baptista, 2014).

**Instrument**

The initial data was collected through a pre-test to identify the level of the students and determine if these students take the subject for the first time or take the subject for the second or third time. This exam was designed following the textbook and the syllable of the subject of Mathematics in the Professional Career of Administration of the National University "Santiago Antúnez de Mayolo". While a post-test was used to show the level of the students at the end of the process. These data showed how the experimental group performed in relation to the control group. The pre and post test were validated through the content validity technique. Litwin (2003) expresses that the evaluation of the content commonly involves an organized review of the contents of the questions to ensure if they contain the contents that they should or should not have. For this, 2 professors who regularly teach at these levels acted as experts to review the relevance and validity of these instruments.

**Techniques for information processing**

- The analysis of the data and its interpretation obtained from the information, the data was organized through a tabulation matrix in Excel and Statistical Product and Service Solution (SPSS).
- Interpretation of the influence of the independent variable on the other dependent variable.
- Determine the degree of generalization of the research results.
- Comparative tables: Systematize the information and contrast the elements of the influence of the Contextualization of mathematics and the learning of the subject of Mathematics.
- Describe the object's characteristics of study.

**III. Results**

In accordance with the objectives set out in this research, the results are shown through the table, which are a reflection of the intervention carried out by the research teacher during the 14 weeks through the pre-test and post-test.

Table 1: Statistical indicators of the pre-test scores of the control and experimental groups in learning mathematics

Statistical indicators	Group	
	Control	Experimental
Sample	22	43
Minimum	2	2
Maximum	11	10
Mean	5.227	4.674
Median	5	4
Mode	6	3
Variance	4.755	3.415
Standard deviation	2.181	1.843
Coefficient of Variation	41.73%	39.43%

In this table it can be seen that there are differences in the measures of centralization or averages between the control and experimental group, being the highest in the control group, whereas in the dispersion of the data the experimental group is more homogeneous than the control group, but the variability is small in both cases.

Table 2. Statistical indicators of the post-test scores of the control and experimental groups in the learning of the Mathematics subject

Statistical indicators	Group	
	Control	Experimental
Sample	22	43
Minimum	4	8
Maximum	14	16
Mean	8.409	12.418
Median	8	13
Mode	8	13
Variance	4.825	2.678
Standard deviation	2.197	1.636
Coefficient of Variation	26.13%	13.17%

This table shows a significant difference in the measures of centralization or averages, highlighting the experimental group, which shows that the contextualization of mathematics as a didactic strategy in the learning of the Mathematics subject in students of the professional career of Administration, has had good results. results in the experimental group. Regarding variability, the difference is not significant between the control group and the experimental group, but when analyzing the coefficient of variation, we can conclude that the learning scores in the experimental group are more homogeneous compared to the learning scores of the control group.

Table 3. Statistical indicators of the pre and post test scores of the control and experimental group in the conceptual learning of the Mathematics subject.

Statistical indicators	Conceptual Learning			
	Control Group		Experimental Group	
	PRE TEST	POS TEST	PRE TEST	POS TEST
Sample	22	22	43	43
Minimum	0	0	0	3
Maximum	9	11	11	17
Mean	4.364	6.364	4.093	12.604
Median	6	6	6	14
Mode	6	6	6	14
Variance	9.195	9.195	7.801	8.007
Standard deviation	3.032	3.032	2.793	2.829
Coefficient of Variation	69.48%	47.64%	68.24%	22.45%

Regarding conceptual learning, we can say that in the control group there is a difference in the arithmetic mean, noting that this difference is not very considerable, however, with respect to the other measures of centralization they are the same. Regarding variability, there is no significant difference between them, but when examining the coefficient of variation we can conclude that the marks in conceptual learning are more homogeneous in the post test. In the conceptual

learning of the experimental group, it is observed that there is a significant difference in the arithmetic mean, being higher in the post test, which shows that the contextualization of mathematics as a didactic strategy in the conceptual learning of the Mathematics subject has had good results in the trial group. Regarding variability, there is no significant difference between them, but when examining the coefficient of variation we can conclude that the marks in conceptual learning are more homogeneous in the post test.

Table 4. Statistical indicators of the pre and post test scores of the control and experimental group in the procedural learning of the Mathematics subject.

Statistical indicators	Procedural Learning			
	Control Group		Experimental Group	
	PRE TEST	POS TEST	PRE TEST	POS TEST
Sample	22	22	43	43
Minimum	0	0	0	10
Maximum	13	17	10	17
Mean	5.682	8.409	5.046	13.209
Median	7	10	7	13
Mode	7	10	7	13
Variance	13.561	12.539	9.093	5.312
Standard deviation	3.682	3.541	3.015	2.305
Coefficient of Variation	64.80%	42.11%	59.75%	17.45%

Regarding procedural learning, we can say that in the control group there is a difference in the arithmetic mean, observing that it is not very considerable, however, with respect to the other measures of centralization they are the same. Regarding variability, there is no significant difference between them, but when examining the coefficient of variation we can conclude that the marks in procedural learning are more homogeneous in the post test. In the conceptual learning of the experimental group, it is observed that there is a significant difference in the arithmetic mean, being higher in the post test, which shows that the contextualization of mathematics as a didactic strategy in the conceptual learning of the Mathematics subject has had good results in the trial group. Regarding variability, there is no significant difference between them, but when examining the coefficient of variation we can conclude that the marks in conceptual learning are more homogeneous in the post test.

Table 5. Statistical indicators of the pre and post test scores of the control and experimental group in the attitudinal learning of the Mathematics subject

Statistical indicators	Attitudinal Learning			
	Control Group		Experimental Group	
	PRE TEST	POS TEST	PRE TEST	POS TEST
Sample	22	22	43	43
Minimum	0	0	0	3
Maximum	11	14	9	20
Mean	6.136	10.727	4.604	11.116
Median	6	11	6	11
Mode	6	9	6	11
Variance	12.123	3.351	7.864	10.248
Standard deviation	3.482	1.83	2.804	3.201
Coefficient of Variation	56.75%	17.06%	60.90%	28.80%

In attitudinal learning we can say that in the control group there are differences in the measures of centralization and variability of the pre and post test. Likewise, we can conclude that the attitudinal learning scores are more homogeneous in the post test.

In the attitudinal learning of the experimental group, it is observed that there is a significant difference in the arithmetic mean, being higher in the post test, which shows that the contextualization of mathematics as a didactic strategy in the conceptual learning of the Mathematics subject has had good results in the trial group. Regarding variability, there is a significant difference between them, but when examining the coefficient of variation we can conclude that the notes in attitudinal learning are more homogeneous in the post test.

### General hypothesis of the study

There is a significant influence of the contextualization of mathematics as a didactic strategy in the learning of the Mathematics subject in students of the Administration professional career, semester 2022-I, UNASAM -2022.

### Statistical Hypothesis

Ho: The contextualization of mathematics as a didactic strategy is independent of the learning of the Mathematics subject in students of the Administration professional career, semester 2022-I, UNASAM -2022.

H1: There is a significant influence of the contextualization of mathematics as a didactic strategy in the learning of the Mathematics subject in students of the Administration professional career, semester 2022-I, UNASAM -2022.

### Significance Level

The theoretical significance level is  $\alpha = 0.05$

### Test Statistic

It was performed using the Wilcoxon test for the post test.

### iv. decision rule

Reject H0 when the observed significance "p" of the logistic model coefficients is less than  $\alpha$ .  
Do not reject H0 when the observed significance "p" of the coefficients of the logistic model is greater than  $\alpha$ .

### v. calculations

Table 6. Ranks of the experimental group

		N	Mean rank	Sum of ranks
POS_TEST	- Negative ranks	43b	22,00	946,00
PRE_TEST	Positive ranks	0c	,00	,00
	Draws	0d		
	Total	43		

a. Experimental Group

b.  $PRE\_TEST < POS\_TEST$

c.  $PRE\_TEST > POS\_TEST$

d.  $PRE\_TEST = POS\_TEST$

Table 7. Wilcoxon signed rank test statistics a, b ranges in the experimental group

	POS_TEST - PRE_TEST
Z	-5,747c
Asymp. Sig. (2-tailed)	,000

- a. Experimental group  
b. Wilcoxon signed Ranks Test  
c. Based on negative ranks.

#### IV. Conclusions

- It is observed that the probability of the statistic  $p = 0.000$  is much less than 0.05, so the alternative research hypothesis is accepted. Therefore, there is a highly significant difference in the averages obtained by the experimental group between the pretest and the posttest when evaluating the learning variable. Therefore, we can conclude that there is a highly significant influence of the contextualization of mathematics as a didactic strategy in the learning of the Mathematics subject in students of the Administration professional career, semester 2022-I, UNASAM-2022.
- It is observed that the probability of the statistic  $p = 0.000$  is much less than 0.05, so the alternative research hypothesis is accepted. Therefore, there is a highly significant difference in the averages obtained by the experimental group between the pretest and the posttest when evaluating the conceptual learning dimension, for which it is affirmed that there is a highly significant influence of the contextualization of mathematics as a didactic strategy. in conceptual learning, of the Mathematics subject.
- It is observed that the probability of the statistic  $p = 0.000$  is much less than 0.05, so the alternative research hypothesis is accepted. Therefore, there is a highly significant difference in the averages obtained by the experimental group between the pre-test and the post-test when evaluating the procedural learning dimension, for which it is affirmed that there is a highly significant influence of the contextualization of mathematics as a didactic strategy. in procedural learning, of the Mathematics subject.
- It is observed that the probability of the statistic  $p = 0.000$  is much less than 0.05, so the alternative research hypothesis is accepted. Therefore, there is a highly significant difference in the averages obtained by the experimental group between the pretest and the posttest when evaluating the attitudinal learning dimension, for which it is affirmed that there is a highly significant influence of the contextualization of mathematics as a didactic strategy. in attitudinal learning, of the Mathematics subject.

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**Annex 1. Questionnaire****PRE-TEST AND POST-TEST RESEARCH INSTRUMENT**

## Instructions:

This questionnaire refers to the contextualization of mathematics as a didactic strategy in learning the subject of Mathematics, insofar as it refers to conceptual learning and procedural learning.

You have 90 minutes to answer the questionnaire, and consider that the development of the test is not decisive for the course average. It will be helpful as long as you are sincere in your answers.

N°	OPINIONS
<b>Conceptual Learning</b>	
01.	What do you understand by a first degree equation?
02.	What do you understand by a quadratic equation?
03.	What do you understand by a polynomial inequality?
04.	What do you understand by real function of real variable?
05.	What is the demand equation?
06.	What is the supply equation?
07.	What is utility?
<b>Procedural Learning</b>	
08.	In the district of Independencia, only during the month of October, a total of 250 offenses were committed by drivers of public and private service vehicles. If for each infraction carried out by a driver of a public service vehicle, S/ 150 was charged, while for those of the private service S/ 200, managing to accumulate S/ 40,000 for infractions. How many offenses of each type were committed respectively? <b>Resolution:</b> ..... ..... ..... .....

9. The Anderson Company manufactures a product for which the variable cost per unit is S/6 and the fixed cost is S/80,000. Each unit has a selling price of S/10. Determine the number of units that must be sold to obtain a profit of S/ 60,000.

**Resolution:**

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10. If a manufacturer sells  $x$  units of a certain product, its revenues  $I$  and its costs  $C$ , all in soles, are:

$$I = 20x$$

$$C = 2000 + 8x + 0,0025x^2$$

Apply the fact that: Profit = Revenue - Cost to determine how many units you must sell to enjoy a profit of at least 2,400 soles.

**Resolution:**

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11. The monthly cost of driving a rental car depends on the number of kilometers traveled. Manuel found that in May his cost of driving was S/380 for 480 kilometers, and in June, his cost was S/460 for 800 kilometers. Assuming that there is a linear relationship between the monthly cost  $C$  of driving a car and the distance traveled  $d$ .

a) Find the linear function that relates  $C$  and  $d$ .

b) If Manuel wants to make a round trip in July to Chiclayo, 750 km from Lima. What is the monthly cost that I would have to pay?

c) What is the distance traveled if the cost was 397.50 Soles?

**Resolution:**

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12. The company "Sonic" dedicated to the sale of telephone chips, whose fixed costs amount to S/ 18,000, its manufacturing costs of a chip amount to S/ 3 each and it is sold in the market for S/ 6.

- a) Calculate the utility function of the company  
b) Graph the function cost, income, and interpret

**Resolution:**

13. Although the synthetic turf on a stadium field is apparently flat, its surface is shaped like a parabola. This is so that the rain slides off to the sides. If we take the cross section of the field, the surface can be modeled by  $y = -0.000234(x - 80)^2 + 1.5$ , where  $x$  is the distance from the left of the field and  $y$  is the height of the field. What is the width of the field?

**Resolution:**

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