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Scope of Study: An attempt to supplement the material usually found in high school general mathematics text books. This report involves compilation of problems in practical mathematics for secondary schools and is designed to promote interest in problems related to a few of the possible fields a student might enter upon graduating from high school. It is planned primarily for those students who will make high school mathematics a terminal course. The course, as planned, will in no way, however, hinder the student who plans to further his education in college. Practical problems from various text books were used in compiling the report, and suggestions or comments from well known mathematicians given.

Findings and Conclusions: Most of the text books used for general mathematics in the secondary schools do not provide enough material for practical problems nor word problems. I feel that a teacher who uses only the regular text book is not giving the student justice. By using problems from several books, mathematics can be practical to most students and very motivating.

ADVISER'S APPROVAL ____________________

A COMPILATION OF PROBLEMS AND SUGGESTIONS TO AID TEACHERS OF GENERAL MATHEMATICS

By

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TO AID TEACHERS OF GENERAL MATHEMATICS

Report Approved:

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I wish to express my sincere appreciation to my daughters, Pamela Renee and Jaqueta Anita, and son, William P. Hytche, Jr., born during the Christmas Holidays, for relinquishing many hours of their fatherly affection and care in order that I might successfully complete this report. It would be very unfair not to include my lovely wife, who is always very inspiring.

Indebtedness and gratitude are acknowledged to Dr. James H. Zant, Professor of Mathematics, who has contributed valuable suggestions and encouragement to the writer in the compilation of this material.

PREFACE

During my first year of high school teaching, I noted the inability of pupils to grasp the abstract meaning of such terms as volume, area, etc. Even though I recognized this to be a very serious problem, I did not give it too much consideration since this was a small school located in a more or less isolated area and many conditions could have been responsible. For the 1956-57 school year, I was employed at a very large high school where existing environmental and economic conditions were excellent. I found the same problem facing me. At this point, I really became concerned.

Being also in the restaurant business in my home town, I have had the pleasure of meeting and conversing with many men in executive positions for some of the state's well-known industries such as Continental Oil Company, Cities Service Oil Company, the banks and many of the department stores. The majority seem to think our students are not getting what they should in general mathematics nor in high school college preparatory mathematics.

I would like to cite a particular case without specific reference to any names. The manager of a department store asked me if I taught mathematics to a certain student. My answer was, "Yes," and I recommended the student very highly. Several days after the manager had hired the student, he called and questioned my recommendation. The manager said the student could not figure simple discounts nor the two per cent sales tax. I began questioning my teaching. In fact, I consulted three very competent individuals in the mathematics teaching field and we came to the conclusion that the author of the text I used made very few provisions for practical problems. Also, I decided, I was not quite resourceful enough during the year of teaching.

In short, I feel that I am one of the students described by Zant when he said:

> Many students who have a thorough knowledge of sequential mathematics do not know the more practical things such as consumer mathematics, simple statistics, the ability to use tables and the like. Hence, we must see that students who are interested in sequential courses in mathematics are also required to make themselves competent in that part of mathematics which is needed by everyone."[1]

There are, however, I am told, few textbooks available which make these practical applications in problems or which relate abstract problems directly to the practical work in which, after all, they will be used. It is my idea, therefore, to make a compilation of some few problems which could be used to achieve the above purpose: to teach mathematics that does not end in the classroom but extends into the branches of industry and business in which they will actually be used. Not all students will attend a college

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[1]James H. Zant, "The Improvement of High School Mathematics Courses as Recommended by the Commission on Post-War Plans," The Mathematics Teacher, Vol. 39 (1946), p. 273.

or university, yet must find employment someplace.

This report should also be quite helpful to the business trades and industrial departments in my school. The following trade and industrial courses are offered: Bookkeeping, Office Practice, General Business, Commercial Laboratory, Mechanical Drawing, Machine Shop, Cabinet Making, Woodwork, Auto Mechanics, Agriculture, and a very good diversified occupation program. Driver Education problems will also be included.

Such a compilation as mentioned is, of necessity, a long task and one which will never really be completed. Real work is rapidly being carried on in the preparation of such texts and teaching methods as are here mentioned.

The purposes of this are not to condemn or criticize the authors of our high school mathematics texts. Neither is it written to degrade the sequential courses such as algebra, geometry and trigonometry. This report is written solely for the purpose of making high school mathematics teachers become aware of some of the more elementary factors involved in the teaching of high school mathematics. I shall attempt to accomplish this by using materials and approaches from different authors.

TABLE OF CONTENTS

CHAPTER I

SUGGESTIONS TO AID TEACHERS OF HIGH SCHOOL MATHEMATICS

High school mathematics should be taught more from a practical than from a theoretical standpoint. The traditional methods of solving problems in which the student is given all conditions and theorems ready-made should be altered to give the student practical experience in discovering conditions and interpreting them. Once he understands the real why of a certain proposition as he will use it on the job, he will be able to reason from that to other conclusions and will have mastered much more knowledge from a little practical mathematics than he could from a great deal of theoretical, abstract mathematics.

To accomplish the end stated above, we must have a new treatment of the materials tested in high school mathematics texts. Some problems and discussions which might be used in the sort of course are given in the body of this report, but the list is not complete and will admit of expansion and specialization in different occupational fields. Problems are here compiled for the special fields of Woodwork, Agriculture and Home Making, Business, Chemistry, Physics, Auto Mechanics and Metal Work, including fundamentals of practical mathematics needed in these fields as well as more advanced material.

Let it be fully understood that the present text should be used, but the instructor should supply sufficient practical practice to make sure that the student really learns the needed essentials rather than secures a hazy, fleeting notion of the material gone over.

High school mathematics should be taught so that students will really learn the needed fundamentals. If the student can become interested in his work, he will learn; if he learns, his knowledge is permanent and practical and will stay with him in usable form throughout his life. That is, after all, one of the main purposes of this study.

In a recent report, Zant said:

> The custom prevalent in many of our high schools of putting the bright students in the algebra class merely because they can learn the traditional courses may not be the best for them or for the school. Such practice tends to cut down the efficiency and standards of the general mathematics course and the sequential courses may not fit the needs of the student unless he expects to study more advanced mathematics or some of the subjects which demand such knowledge. In other words, this does not solve the problem. It may merely penalize the bright student simply because he has more than the average intelligence. The thing to do is to strengthen the general mathematics course so that it will actually meet the needs of the non-mathematical scientific student and point out to the students and to their parents that the course has different purposes and goals. The course should not be for "dumbbells" and, which it may not be as rigorously difficult as algebra or geometry, it can if it is well organized and administered, be just as challenging and for many students much more useful.[1]

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[1]James H. Zant, "What Are the Needs of the High School Student?" The Mathematics Teacher, February, 1949, 42:75-78.

The purpose of a course in general mathematics should be to obtain a vital, modern scholarly course in introductory mathematics that may serve to give such careful training in quantitative thinking and expressions as well informed citizens of a democracy should possess. It is of course not asserted that this idea can always be obtained. Our achievements are not the measure of our desires to improve the situation. It is our purpose to present such simple and significant principles of informed geometry, arithmetic, algebra, formal geometry, trigonometry, practical drawing, and statistics along with a few elementary notions of other mathematical subjects, the whole involving numerous and rigorous applications of arithmetic, as the ordinary person is likely to remember and to use. There should be an attempt to teach students things worth knowing and to discipline them rigorously in things worth doing.[2]

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[2]William David Reeves, Mathematics for the Secondary School (New York, 1956), p. 482.

CHAPTER II

FUNDAMENTALS OF ARITHMETIC

Arithmetic, the most commonly used of all the mathematical sciences, is defined as that branch of mathematics which has for its symbols as language Hindu-Arabic numerals 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, and others derived from these. Using these numerals, representations of quantity, size, time and so on may be made. Various operations may be performed on these representations in order to symbolize arithmetically actual working conditions of a problem. These operations fall under four headings: (1) Addition, (2) Subtraction, (3) Multiplication, and (4) Division. These four operations or combinations of them make up arithmetic. The following information and practical exercises are recommended for review purposes only, since one needs a clearer understanding of these fundamentals.

Addition

Addition is the process of uniting two or more numbers representing groups of objects of the same kind. The numbers or things to be added are called <u>addends</u>. The number (or group) obtained by adding two or more numbers is called the <u>sum</u> and represents one large group of similar objects, the quantity of which is equal to that of the component groups. The symbol + is the sign of addition and is called "plus."

Illustrative Problem:

Add the following numbers: 609, 24 and 15.

Solution:	609	
	24	(Addends)
	15	
	648	(Sum)

Illustrative problems in addition:

(1)	(2)	(3)	(4)
54	238	43	35876
49	459	4598	534
16	907	1027	8945
90	113	345	83902
34	620	172	108
27	549	2119	2437

5. Add the following numbers:
   23.54, .008, 39.4, 2.08, 920.005
6. What is the sum of 604 and seven hundred twenty-eight?
7. The monthly output of a shop manufacturing castings was as follows: January, 8,509; February, 9,765; March, 6,564; April, 11,876; May, 15,672; June, 15,300. What was the total output during the six months?
8. In problem 7, what was the output during the first three months? During the last three?
9. Add the following numbers: one and one-sixth, four-sevenths, thirteen and three-eighths.
10. A boy works 3 2/3 hours on one job, 1 3/4 on another, and 2 5/12 on a third, what is the total time

he worked in hours?

Subtraction

The operation of subtraction is defined as the process of taking one number from another number or taking away a number of things from a group of similar things. The number which is subtracted is called the <u>subtrahend</u>. The number from which it is taken is called the <u>minuend</u>. The resulting number or quantity of things is called the <u>remainder</u> or <u>difference</u>. The sign (–) called "minus" written between two numbers indicates subtraction.

Illustrations of subtraction:

Subtract 83 from 129.

Solution:	129	(Minuend)
	83	(Subtrahend)
	46	(Difference or Remainder)

Ordinarily we think of subtraction as "taking something away," and in a sense it is. But essentially it is the basic process of regrouping, for if we add 13 and 5 to get 18, then this same grouping also tells us that 5 from 18 leaves 13, or 13 from 18 leaves 5.

Three kinds of questions lead to the process of subtraction:

1. How much is left?
2. How do they differ?
3. How much more is needed?

For example:

1. John has 50¢; he spends 20¢. How much is left?
2. John can buy one baseball for 49¢, another for 75¢. How do they differ in price?
3. John has 25¢. He would like to buy an aeroplane model for 65¢. How much more does he need?

All three types of questions involve the use of the same operation -- subtraction.

Since the subtrahend when added to the remainder gives the original minuend, it is clear that addition and subtraction are "opposite" processes. This suggests a convenient method of proving or checking a subtraction problem.

Example:

268	Minuend
142	Subtrahend
126	Remainder

Check by adding:

142	Subtrahend
126	Remainder
268	Original minuend

Problems in subtraction:

1. From 162 take 149.
2. Subtract 1729 from 2804.
3. 532 - 176
4. $682,418.25 - $75,603.44
5. 9 3/5 - 6 7/10
6. Subtract 17 3/4 from 25 7/8
7. A piece of wood 3 1/8 inches thick was planed down to 3 1/16 inches thick. What thickness of the board was removed?

8. A piece of material 2 yards and 2 feet long was cut from a strip 6 yards long. How much is left in the strip?

9. An electric light meter registers 8,768 watt-hours at one reading, and 9,210 at the next reading; how many watt-hours of electricity were used by the customer between readings?

10. $\begin{array}{r} 9\ 5/6 \\ \underline{-4\ 11/12} \end{array}$

Multiplication

Multiplication is a process of taking one of two given numbers as many times as there are units in the other number, or may be defined as repeated addition. The number which is multiplied or increased is called the multiplicand. The multiplier is the number by which the multiplicand is multiplied. The resultant number or answer is called the product. The sign of multiplication is " X " and is called "times."

The numbers multiplied together are known as the factors. The order in which they are multiplied is immaterial, i. e., 57 X 82 gives the same product as 82 X 57.

Problems in Multiplication:

1. Multiply 865 by 27.
2. Multiply 467 by 12½.
3. Multiply 3½ by 5/6.

4. Three men, A, B, and C, bought a boat for \$300.00. "A" paid 35% of the cost, "B" paid 44%, and "C" 21%. How much did each man pay out?

5. At 305 5/8 pounds per mile, what is the weight of 18 3/4 miles of copper wire?

6. Eight equal distances of 3.875 inches are marked off, end to end, on a piece of work. What is the total distance marked off?

7. In Ponca City, a bricklayer received \$3.40 an hour. How much would a man receive in a year if he worked 225 days of eight hours each?

8. Find the interest on \$600.00 for 4 years at 3%. Hint: I = PRT.

9. Mr. Jones borrowed \$500.00 for 9 months at $3\frac{1}{2}$%. How much does he owe at the end of the 9 months?

10. The diagonal of a square is very nearly 1 5/12 the length of one side. Find the diagonal when one side is 12 inches.

Division

Division is the inverse of multiplication. It is the method of finding how many times one number is contained in another number. The number which is to be divided is called the <u>dividend</u>, and the number which does the dividing is called the <u>divisor</u>. The result obtained is called the <u>quotient</u>. If the divisor goes an inexact number of times into the dividend, the part left over is called the remainder. The symbol of division is ÷ and is called "divided by."

Example of division:

Divide 18 by 7

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                                2   Quotient
Solution:   Divisor      7/   18   Dividend
                              14
                               4   Remainder
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Problems in division:

1. Divide 3 5/8 by 3.
2. Divide 5 by 2.
3. Divide 3.1257 by 1.5.
4. Divide 418 by 3 1/2.
5. How many boards 5/8 in. thick can be stacked under a bench 40 inches high?
6. A bin contains 37.8 pounds of cake flour. How many cups weighing 4.725 pounds each can be filled from the flour in the bin?
7. An automobile wheel makes 4,044 revolutions per minute. How many revolutions does it make each second?
8. How many people will 5 dozen rolls serve at 3 each?
9. A, B, and C are buying a beef together. How much will each have to pay?
10. How many gallons of gasoline will $2.64 buy at 33 ¢ per gallon?

Tables of Measurement

In common practice, certain equivalents are necessary. It is, however, not practical to memorize all of these. They are therefore given in table form in most general mathematics textbooks and may be found in any trade handbook.

Long Measure

12 inches (in. or ")	= 1 foot (ft. or ')
3 feet	= 1 yard (yd.)
5 1/2 yards or	
16 1/2 feet	= 1 rod (rd.)
320 rd. or 5280 ft.	= 1 mile (m.)

Land Measure

7.92 inches	= 1 link
25 links	= 1 rod
4 rods	= 1 chain
80 chains	= 1 mile

Circular Measure

60 seconds (")	= 1 minute (')
60 minutes	= 1 degree ($^{\circ}$)
90 degrees	= 1 right angle
360 degrees	= 1 circumference

Measure of Area or Square Measure

144 square inches (sq. in.)	= 1 square foot (sq. ft.)
9 square feet (sq. ft.)	= 1 square yard (sq. yd.)
30 1/4 square yards	= 1 square rod (sq. rd.)
160 square rods	= 1 acre

Cubic Measure

1,728 cubic inches	= 1 cubic foot
27 cubic feet	= 1 cubic yard
128 cubic feet	= 1 cord (cd.)

Dry Measure

2 pints (pt.	= 1 quart (qt.)
8 quarts	= 1 peck (pk.)
4 pecks	= 1 bushel (bu.)

Liquid Measure

4 gills (gi.)	= 1 pint (pt.)
2 pints	= 1 quart (qt.)
4 quarts	= 1 gallon (gal.)
31 1/2 gallons	= 1 barrel (bbl.)

Avoirdupois Weight

16 drams	= 1 ounce (oz.)
16 ounces	= 1 pound (lb.)
100 pounds	= 1 hundredweight (cwt.)
2,000 pounds	= 1 ton (T.)

Measure of Time

60 seconds (sec.)	= 1 minute (min.)
60 minutes	= 1 hour (hr.)
24 hours	= 1 day
7 days	= 1 week (wk.)
52 weeks	
12 calendar months	= 1 year
365 days	

Rules for Calculating Measurement

1. Circumference of a circle. To find the circumference of a circle, multiply the diameter by 3.1416.
2. To find surface or areas:
   a. The area of a square or rectangle: multiply the length by the width.
   b. The area of a triangle: multiply the length of the base by one-half the height or altitude.
   c. The area of a circle: multiply one-half the circumference by the radius or multiply the square of the radius by 3.1416.

d. The area of a cylinder: multiply the circumference of the base by its length or height, and add the area of both bases or ends.

e. The area of a cone or pyramid: multiply the circumference of the base by one-half the slant height and add the area of the base.

f. Area of a sphere: multiply the square of the diameter by 3.1416, or $4\pi r^2$.

3. To find contents or volumes:

a. Volume of a right prism: multiply the area of the base by the altitude.

b. Volume of a cylinder: multiply the area of the base by the height or length.

c. The volume of a cone or pyramid: multiply the area of the base by one-third the height.

d. The volume of a sphere: multiply the cube of the diameter by 3.1416 and divide by 6, or multiply four-thirds of 3.1416 by the cube of the radius.

Numbers to Remember

1 dozen	= 12 units
1 gross	= 12 dozen - 144 units
1 score	= 20 units
1 quire	= 24 sheets
1 ream	= 20 quire

1 mile	=	5280 feet
1 pose	=	3 feet
1 palm	=	3 inches
1 span	=	10 7/8 inches
1 hand	=	4 inches
1 gal.	=	231 cubic inches
1 cu. ft.	=	7.481 gallons
Pi	=	3.1416

CHAPTER III

BUSINESS

The problems in this chapter have been taken from texts related to the business profession. They represent the various types of problems needed for basic success.

A few basic terms in mathematics as related to business will be discussed because the writer feels that a student should or must understand the terminology before much success is obtained.

Interest

The term interest is used to describe the payment for the use of borrowed money or credit. The interest payment for a sum borrowed depends upon the size of the sum, the length of time it is kept, and the per cent of the borrowed sum which is charged for the use of the money. Hence, in calculating interest there are three factors to consider: principal, time, and rate. The sum of money on which interest is calculated is called the principal. The per cent of the principal to be paid each unit of time is called the rate and the time is the number of units for which interest is calculated. Ordinarily in computing simple interest the unit of time is the year. The amount at any time is the sum of the principal and the interest which has accumulated up to that time.

Percentage

The percentage method of expressing fractional parts is so widely used, not only in business but elsewhere also, and the use and calculation of interest are of such importance that part of this chapter will be devoted to brief descriptive treatments.

The words per cent are a contraction of a Latin phrase per centum and mean "by the hundred," that is, a certain part of every hundred of any thing or denomination. Thus, four per cent means four of every hundred and may signify four cents of every hundred cents, four dollars of every hundred dollars, four persons of every hundred persons, four pounds of every hundred pounds, etc. This may be written $4/100 = 1/25$. Similarly 65 per cent, or as we should write it, 65% means 65 in 100, or $65/100 = 13/20$, etc. Any per cent is therefore a fraction and since the denominator is always 100 it is properly expressed as a decimal fraction. Thus, 4 per cent $= 4/100 = .04$; $65\% = .65$; $12\frac{1}{2}$ per cent $= .125$, etc.

The words "per cent" or simply percent are usually represented by the symbol % which is derived from the fractional form as $40/100 = 40\%$. (The percentage symbol should not be confused with or used for the sign or symbol c/o which is sometimes, though not strictly correctly, used as an abbreviation of the words "in care of.")

Problems

A general rule for first few problems: Simple interest equals the principal, multiplied by the rate per year, multiplied by the time expressed as a number of years. The formula I = P x R x T, or I = PRT.

In examples 1 to 10, find the simple interest correct to cents:

1. On $2800 at 5% a. for 2 years b. for 3 yrs.6 mc
2. On $7500 at 4% a. for 1 year b. for 9 mo.
3. On $3600 at 6% a. for 2 years b. for 1 yr.4 mo.
4. On $1525 at 5% a. for 1 year b. for 8 mo.
5. On $2575 at 3½% a. for 1 year b. for 2 yrs.
6. On $1850 at 4½% a. for 1 year b. for 2½ yrs.
7. On $3725 at 2½% a. for 1 year b. for 6 mo.
8. On $4275 at 5½% a. for 1 year b. for 1 yr.3 mo.
9. On $9644 at 3% a. for 1½ yrs. b. for 6 mo.
10. On $9250 at 3½% a. for 1 year b. for 4 mo.
11. A contractor borrowed $2250 for 3 mo. If the rate of interest was 5%,
    a. What was the interest at the end of 3 months?
    b. What was the sum of the principal and interest?
12. The Van Winkle Men's Clothing Store pays $215 a month for rent. Its fuel costs about $25 a month, lights about $21.00 a month, and telephone $7.50 a month. What is the total of these expenses
    a. for a month? b. for the year?

13. In the store are a manager who receives $85 a week, three clerks who are paid $52.50 a week each, and a seamstress who gets $45 a week. How much is a. the weekly bill for wages? b. the monthly expense for wages? c. the annual?

14. For the past year, the taxes paid by this store amounted to $840.00; the amount paid as interest on money was $525.00; insurance was $250.00. What was the total of these items for the year?

15. a. What is the total for the year of all the charges listed in examples 12 to 14? This is the annual overhead.

    b. What is the total monthly overhead?

16. Joe Chamberlin works in a store where a 2% sales tax must be charged on all articles sold. Joe has a tax table but he learned how to charge the tax without using the table. The rule he learned was: For every dollar in the sale, the tax is 2¢. For every 50¢ or less, the tax is 1¢. For a sale of $3.39 he simply figured mentally: 3 x 2¢ = 6¢ and 1¢, making a total of 7¢. Tax must be paid on all purchases above 9¢. Any fraction of a cent of tax must be counted as a whole cent.

    Example: Article costing 10¢, the tax is
    2% of 10¢ = .2¢ or 1¢
    Article costing 15¢, the tax is 2% of 15¢=
    ________ or ________.

17. Using Joe's method (problem 16), find the tax on each of these sales: \$2.26, \$4.55, \$4.79, \$8.50.

18. A company employs 17 laborers at \$6.75 per day, 28 mechanics at \$13.60, 9 teamsters at \$8.50 per day, 2 bookkeepers at \$40 per week, and a superintendent at \$4800 a year. What is the weekly pay roll of the company?

19. A man had on hand in the morning cash in the safe amounting to \$206.20, and in the bank \$1379.30. During the day he received cash in currency amounting to \$909.24 and checks amounting to \$489.36. Cash deposited in the bank, \$604.37. Checks received amounting to \$489.36. Cash deposited in the bank, \$604.37. Checks drawn on the bank account, \$3.97, \$47.86, \$396.25, \$49.83, \$246.97. Cash paid out in bills and coin, \$49.86. Show the condition of the cash and bank accounts in the evening.

20. Find the cost of the following: 348 eggs at 14¢ per dozen; 643 lbs. sugar at 6½¢ per pound; 7750 lbs. coal at \$5.87 per ton.

21. A case of canned fruit containing 48 gal. cost 32¢ a gallon and sold for 15¢ a quart. Find the gain.

22. Add: 5 rd., 4 yds., 2 ft. 6 in., 11 rds. 2 yds. 1 ft. 8 in., 7 rds. 3 yds. 10 in., 12 rds. 1 yd. 2 ft.

23. A milk dealer bought 6 gal. 2 qts. and 1 pt. of milk from one man, 8 gal. and 3 qts. from another, and 12 gals. 2 qts. from a third. At 52¢ a gallon, what did it cost him?

24. A boy bought a watch for $12 and a chain for $4. Later he sold them both for the cost of the watch. What per cent of the cost was the selling price?

25. A dining table cost $75.00. Find the selling price to gain 20%; 25%; 15%; 10%; 40%.

26. If apples cost $2.25 a bushel, and 10% of them spoil, at what price per bushel must the remainder be sold to gain 20% on the entire cost?

CHAPTER IV

WOODWORK

These related problems in woodwork deal with labor cost, the measuring and the cost of lumber as customarily sold. Wood or lumber is measured by the board foot and sold by the thousand board feet, or M. Certain types of lumber, such as laths, which are sold by the bundle or 100, or molding, which is sold by the foot, are not measured in board feet.

A board foot is a piece of wood containing 144 cubic inches. That is, it is a piece of board 12 inches square and one inch thick. A rule for securing the number of board feet in a plank is as follows: multiply the thickness in inches by the width in feet, and multiply the product by the length in feet.

Sample problem:

A board used in construction work is 2 inches thick, 18 in. wide and 8 feet long. What is the size of the plank in board feet?

Solution: $2 \times 1\frac{1}{2} \times 8 = 24$ board feet (bd. ft.)

Illustrative problems in woodwork:

1. How many board feet are in a stick of lumber one inch thick, 15 in. wide and 18 inches long?

2. If it cost 42 cents a cubic foot to complete a house, what will a building 28 feet wide, 26 feet long, and 12 feet to the eaves cost if the gable and roof cost $54?

3. With no allowance for waste, how many feet of lumber, board measure, will it take to make a watering trough 18 ft. long, $2\frac{1}{2}$ ft. wide and 20 in. deep, outside measurement, with lumber $1\frac{1}{2}$ inches thick?

4. The average width of shingles being four inches and the shingles being laid 4 inches to the weather, how many will be needed to cover one square (100 sq. ft.) of roof?

5. A man wants to build a house. He needs the following bill of lumber:

Sills:	3 pieces, 6" x 8" x 16' long.	192 board feet
	4 pieces, 6" x 8" x 14' long.	_?_ board feet
	6 pieces, 6" x 8" x 12' long.	_?_ board feet
	1 piece, 2" x 4" x 14' long.	_?_ board feet
	1 piece, 2" x 9" x 8' long.	_?_ board feet

6. Joints: 30 pieces, 2" x 9" x 16'long _?_ board feet

18 pieces, 2" x 8" x 12' long	_?_ board feet
13 pieces, 2" x 8" x 6' long	_?_ board feet
27 pieces, 2" x 8" x 16' long	_?_ board feet
27 pieces, 2" x 8" x 12' long	_?_ board feet
27 pieces, 2" x 6" x 16' long	_?_ board feet

7. The total of problems 5 and 6 is __?__ board feet.

8. How much will this lumber cost at $34 per M board feet?

9. The man needs 200 ft. B.M. siding at $65 per M, 1950 ft. of flaring at $44 per M, 125 of flaring for the porch at $52 per M, 6200 shingles for the roof at $11.40 per thousand. What will the material cost?

10. He needs 48 foundation posts at 60¢ each; water tables, cornice, corner boards, etc., $25. Porch column, $10, 16 doors at an average cost of $9.75 each, hardware $61, chimney and plastering, $350; painting $208; tinwork $25.05; the work of the carpenters for thirty days at $12.50 per day. What is the total cost of these items?

11. A kitchen cabinet is to be built. It contains panels as follows: 4 pc. ¼" x 10¼" x 10"; 5 pc. ¼" x 7" x 18"; 2 pc. ½" x 7" x 9"; 1 pc. ¼" x 16" x 19", and 1 pc. ¼" x 6" x 10". How much will this stack cost at 12¢ per sq. ft?

12. The tops of school desks are often made of three pieces. Suppose that one piece is 5 3/8" wide and another 4½" wide. How wide will the third piece have to be cut to make the top 18" wide?

13. A billboard is to be 9' high and 15' long. It is to be built of boards 8" wide, 9' long and 1" thick. If the boards are placed vertically, how many boards

will be required?

14. Cypress costs eight cents per board foot. What will it cost to build an object requiring 87 board feet of lumber?

15. A stack of lumber 7'5" wide and 12' long is composed of sixty layers of one inch boards placed edge to edge. How many board feet does the stack contain? (Consider the boards edge to edge.)

CHAPTER V

ELECTRICITY

Problems are given here in the related mathematics of the fundamentals of electricity. Since the uses of electricity in industry are many and varied, including radio, telephone, home lighting and power, and automobiles, an attempt is made to provide learning and practice in solving several typical industrial problems in electricity. Definitions of other common electrical terms in good usage may be found in any standard trade handbook, so they will not be given. General formulas for these problems will be found in the books listed in the bibliography.

The unit of measure of quantity of electricity is the kilowatt hour. This unit is based on the watt, which is the unit of electrical power or quantity. One kilowatt is one thousand watts. When one kilowatt of electricity flows constantly for one hour, one kilowatt-hour (k.w.h.) of electricity has been consumed. If the amperage and voltage of, for instance, an electric toaster is known, the wattage or power required to operate it is given by the formula "Watts = Volts x Amperes."

Problems

1. Suppose that on April 1, 1958, an electric meter read 5,645 KWH, and on May 1, 1958, the reading was 5,978 KWH. What should the amount of the bill have been at the rate of 20¢ per KWH?
2. At 10% discount for each payment before the 12th of the month, find the amount saved in the above problem if the payment is made on time.
3. On March 1, 1958, an electric meter read 1.683 KWH, and on April 1, 1958, the reading was 1,816. The electric light company had the following rates:

First 30 KWH	.....	$ .18 per KWH
Next 30 KWH	.....	.17 per KWH
Next 40 KWH	.....	.16 per KWH
Above 100 KWH	....	.12 per KWH

   What is the amount of the bill?
4. What does it cost to use a 6 ampere, 110 volt electric iron for an hour in your town?
5. What is the cost per hour of operating a 5 ampere, 110 volt toaster in your town?
6. A generator supplies 20 100-watt lamps and 16 40-watt lamps. What is the power load?
7. What is the cost of operation of 4 60-watt electric lamps for 3 hours in your city?
8. What will it cost to burn a 40-watt lamp day and night for 30 days in your home town?

9. An electric fan pulls 60 watts per hour. Find the cost of operation for 7 days and 10 hours at 18¢ per KWH. (24 hr. day)

10. Bring electric light bills from home and check the amount, rate, and consumption of the bill.

11. Read your home meter and figure the cost of electricity for one week.

12. Ohm's Law: E = I R, where E = voltage, I = current in amps, and R = resistance in ohms. Evaluate the formula to find the missing factors.

	E	I	R
13.	?	.55	11
14.	?	.75	9
15.	110	?	220
16.	110	.75	?
17.	220	?	450
18.	6	1.50	?

19. If I = E/R, find I when E is 110 volts and R is 9 ohms.

20. If R = E/I, find R when E is 110 volts and I is 0.5 amps.

21. What current will flow through a toaster using 550 watts at 110 volts?

22. What will be the cost at 8¢ per KWH to run a 4,400 watt heater for 6 hours?

CHAPTER VI

AGRICULTURE AND HOME ECONOMICS

The problems in this chapter are very carefully chosen because most students taking general mathematics will not take the sequential or college preparatory courses. The writer feels that all girls should know the basic fundamentals of home economics.

Since agriculture is one of America's most important occupations, the writer feels that as much emphasis as possible should be placed on the following type of problems.

Problems

1. If a farmer can plow 11 acres in a day with the aid of a gasoline tractor, how many acres can he plow at the same rate in $12\frac{1}{2}$ days?
2. A gasoline-driven one-row corn picker can pick and husk $8\frac{1}{2}$ acres of corn in one day. At this rate, how long will it take to pick and husk a field of corn covering 425 acres?
3. If the cost of labor, gasoline and oil required to run a tractor amounts to about $1.16 an acre, what will it cost to plow 125 acres of land?

4. According to a farmer's records, his costs of producing wheat were as follows:

Item	Cost Per Acre
Plowing and harrowing	$1.78
Seed and drilling	1.24
Cutting	2.60
Threshing	.75
Taxes	1.95
Interest on mortgage	4.95

Find the total cost per acre. . . . .   ?

If his yield is 17.5 bushels per acre and he received $1.90 per bushel for his wheat, what is his profit per acre?

5. In one season Mr. Nelson's farm produced 1800 bu. of wheat worth $1.88 per bushel and 2400 bu. of corn worth $1.85 per bushel; his dairy netted him $750 worth of milk and butter. What was his gross income for the season?

6. The silo on Mr. Sloan's farm is 114 ft. in diameter and 34 ft. high, inside measurements. How many cubic feet of silage does the silo contain when it is 3/4 full?

7. A farmer can buy a gasoline tractor for $875, or for $60 down payment and $52 per month for 18 months in equal installments. How much can he save by paying cash?

8. A farmer bought $850 worth of machinery and equipment. If it depreciated 6% during the first year, what was its value at the beginning of the second?

9. A well was dug to a depth of 85 feet before sufficient water was obtained. The cost of drilling was $1.10 per foot; the well casing cost $52 and a pumping unit including tanks and piping cost $235. What was the total cost of the well?

10. Mr. Burke owned a truck farm of 200 acres near Ponca City, Okla. He had to purchase the following new equipment:

2 plows @	$59.40
2 harrows @	31.90
1 potato planter.	42.75
1 utility truck	210.00
Miscellaneous equipment . .	106.45

a. Find the total cost of his equipment.

b. If the value of the equipment he already owned was $940, what amount of money does Mr. Burke invest in equipment per acre?

11. A family having an income of $2000 a year planned the following budget: rent, 20%; food, 30%; gas, electricity, and telephone, 6%; clothing, 25%; insurance and saving, 10%; the rest for recreation and incidentals. How much is to be spent for each item per year?

12. Mrs. Rogers purchased furniture for $485 on the partial payment plan. She paid $125 down, and the balance in eight monthly installments, with carrying charges of 5% of the original price less the down payment. Find the amount of every monthly payment.

13. If soap is selling at 3 bars for \$.30, find the cost of $1\frac{1}{2}$ dozen bars.

14. A family of four with a weekly income of \$60 allows 35% of its income for food. a. How much do they spend for food per person per week? b. If the wife buys 25 lbs. of fruit and vegetables per week at an average cost of 10¢ per lb., what per cent of her food allowance goes for fruit and vegetables?

15. Mrs. Adams buys an average of 5 qts. of milk per week for her family at 24¢ a qt. If she allows herself three times as much for meat as for milk, how much does she spend a week for meat?

16. What per cent of her \$30 weekly allowance does she spend for meat? (Problem 15)

17. If the round trip railway fare from Ponca City to Chicago is \$46.84, what is the rate per mile? The distance is 723 miles one way.

18. Eggs, milk, lean meat, poultry, and fish are all good protein (muscle building) foods. They also provide energy, aid digestion and supply some of the important minerals and vitamins. These foods are fairly expensive, but they should be included in the diet. Wise buying helps reduce the cost. The following two orders of meat and fish contain about the same food value. Compare the cost.

a.

4 3/4 lbs. prime roast beef @ 86¢
3 lbs. T-bone steak @ 92¢
$4\frac{1}{2}$ lbs. leg of lamb @ 76¢
$3\frac{1}{2}$ lbs. boneless roast of veal @ 74¢
2 lb. fresh fish @ 35¢
$1\frac{1}{2}$ lbs. ham @ 73¢

b.

$2\frac{1}{2}$ lbs. ground meat @ 47¢
$2\frac{1}{2}$ lbs. shoulder chops @ 43¢
$1\frac{1}{2}$ lbs. beef kidney @ 29¢
$3\frac{1}{4}$ lbs. stew meat @ 29¢
3 cans (15 oz.) mackerel @ 20¢

19. Cold-storage eggs have just as much food value as fresh eggs. Mrs. Roberts knows this and always buys cold-storage eggs, which are on the average 5¢ a dozen cheaper. How much does she save in this way in a year on the two dozen eggs a week which she uses?

20. While looking through the lists of August furniture sales, Mrs. Allison saw that broadloom carpet, which had been selling for $4.95 per sq. yd., was marked down 20%. She thought, "If I bought a 9 foot by 12 foot rug for the living room, it would cost $__?__."

21. For their class picnic, the committee figured that they should have about 3 cups of lemonade for each of the 26 students. If they used a 5 gallon container, they could serve __?__ cups of lemonade. Would the container be large enough? (A standard cup holds $\frac{1}{2}$ pint.)

22. Mrs. Allison bought 1095 half-pints of milk each year. Therefore, the yearly order for milk was __?__ gallons.

23. If the half-pints cost Mrs. Allison 10¢ each and she could buy milk by the gallon for 98¢ a gallon, how much could she save by buying it by the gallon for one year?

24. After measuring her windows, Mrs. Roberts decided that her curtains should be at least a yard and 29 inches long. The curtains she liked at the store came in four lengths: 60 inches, 72 inches, 81 inches, and 90 inches. She will need to buy the __?__ inch curtains to cover her windows.

CHAPTER VII

CONCLUSION

According to the Nebraska report we find the following:

> The representatives from industry and business reported that many of their employees who have taken traditional mathematics are unable to handle mathematics in life situations. It seemed to be apparent from their discussion that students of mathematics who have developed a sense of logic and the ability to reason could rapidly acquire the skills necessary for specialized jobs in industry and business.[1]

The writer was not able to find a report as such from Oklahoma business and industries but usually the educational deficiencies exist here as in Nebraska and other surrounding areas.

The purpose of this report as stated previously is not to criticize the authors of our general mathematics texts, but merely to aid the teacher in supplementary work. The writer concludes that:

> A course in general mathematics should be to obtain a vital, modern scholarly course in introductory mathematics and may serve to give such careful training in quantitative thinking and expression as well informed citizens of a democracy should possess.[2]

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[1]"Developing Mathematical Literacy in Nebraska's Youth," prepared under the supervision of Dr. Milton W. Beckman, Teachers College, University of Nebraska, Lincoln, Nebraska, (1953),

[2]Reeves, William David, Mathematics for the Secondary School, Holt and Company (New York, 1956), p. 482.

Students who have material taken from their chosen line of work and who are taught from a practical standpoint cannot help but become interested. This will then not stop with the problems given in class, but will go on into independent research in other books or lines of work. Thus, a thorough grounding in general mathematics from a practical standpoint and by a practical method whenever possible may well be the means of assisting a man to advance rapidly in his trade.

In the bibliography of this report, a list of books has been given which could be of much practical value for reference material in such general mathematics classes as are proposed. No attempt has been made here to have students memorize rows and rows of formulas for solving these problems. The man of industry does not attempt to remember all the mathematical formulas he uses in his daily work but instead knows where he can find them. His knowledge is practical rather than purely academic. He is equipped by means of practical mathematics to reason rather than to report mechanically. Reasoning in general mathematics is what is required today, and as this fact is realized, mathematics will be taught more and more as given here.

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