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A COMPARISON OF THE RESULTS OF TEACHING MATHEMATICS WITH AND WITHOUT THE USE OF SUPPLEMENTARY MATERIALS

A Field Study
Presented to
The Faculty of the Graduate School
The University of Nebraska at Omaha

In Partial Fulfillment
of the Requirements for the Degree
Specialist in Education

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by

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Field Project Acceptance

Accepted for the Faculty of the Graduate College of the University of Nebraska at Omaha, in partial fulfillment of the requirements for the degree Specialist in Education.

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7-25-'74
Date

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Chapter 1

INTRODUCTION

Some school boards purchase textbooks but do not purchase the supplementary materials to go along with the textbook because of budget limitations. Teachers are expected to create and provide the necessary materials to supplement the textbook. Many teachers do not have enough time within the day to make adequate materials to supplement the textbook. As a result, the learner who needs additional materials to help him comprehend a lesson suffers.

Some teachers complain about those children who are not able to add, subtract, multiply, and divide. These students are usually cast aside as slow learners, and teacher expectations become low for these children.

Some teachers who use the textbook method teach the material in the textbook; and if the majority of the students understand the lessons, they provide little or no supplementary work to go along with the lessons taught. Those students who fail to understand the lesson are sometimes labeled slow learners and are forced to continue along with the rest of the class.

Some textbooks alone may be confusing to some children. This is because several mathematical operations and concepts are presented in some textbooks without providing ample practice exercises for the students in order that they may apply the concepts taught by the teacher.

I. THE PROBLEM

Statement of the Problem. The purpose of this study was to determine whether the scores on the multiplication post-test were higher for students who used the textbook and supplementary material in Merry-Go-Rounding With Multiplication as compared to students who used the textbook method only.

Hypothesis. Children using the textbook and supplementary material in Merry-Go-Rounding With Multiplication will score higher on the multiplication post-test.

Importance of the Study. Many children need additional material to comprehend a lesson. Any lesson taught from the textbook should be supplemented with independent work exercises for children to do. Oral discussion of a lesson provides the teacher with knowledge of how well the children who respond to questions asked understand what is being taught. Independent work informs the teacher of how well each child in the class understands the lesson taught.

ASSUMPTIONS

1. Children need to concentrate on learning one mathematical operation and its properties at a time.

2. Some textbooks do not provide enough practice exercises to assist the average or slow learner in understanding the mathematical concepts.

3. If children concentrate on mastering one mathematical operation at a time, they will be able to compare the similarities and

differences of mathematical operations.

4. Children learn by doing. Covering pages in the textbook without supplementary materials sometimes makes learning difficult for the average learner. Children need to practice doing what they have been taught.

5. Teachers need materials complimentary to the textbook in use.

6. Teachers do not have enough time to create materials to effectively supplement textbooks.

DEFINITION OF TERMS

For the purpose of this study, the following terms are defined:

Experimental Group. The group who used the textbook and the supplementary material in Merry-Go-Rounding With Multiplication.

Control Group. The group who used the textbook method only.

Mathematical Operations. Mathematical operations are addition, subtraction, division, and multiplication.

Multiplication Properties. The multiplication properties are the associative property, closure property, commutative property, and distributive property.

Associative Property. Edwina Deans defines the term as follows: It means that "numbers may be regrouped for multiplying without changing the product."[1]

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[1] Edwina Deans, Elementary School Mathematics New Directions (Washington: U.S. Government Printing Office, 1963), p. 8.

Closure Property. Edwina Deans, Robert B. Kane, and Robert A. Oesterle define the term as follows: "the product of any two whole numbers are whole numbers."[2]

Commutative Property. The commutative property means that the answer is not affected by the sequence in which two numbers are multiplied.

Distributive Property. Edwina Deans, Robert B. Kane, and Robert A. Oesterle define the term as follows: "the product of a number and the sum of two numbers is the sum of the products of the first number and each of the others."[3]

Multicative Identity Element. The multicative identity element is one. It means that any number multiplied by one equals the number itself.

Multicative Law of Zero. L. Edwin Hirschi defines the Multicative Law of Zero as follows: "The product of any number N and zero is zero."[4]

Deviation of a Score. John W. Best defines the term as follows:

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[2] Edwina Deans, Robert B. Kane, and Robert A. Oesterle, Exploring Mathematics (New York: American Book Company, 1963), p. M4.

[3] Ibid., p. M5.

[4] L. Edwin Hirschi, Building Mathematics Concepts in Grades Kindergarten Through Eight (Pennsylvania: International Textbook Company, 1970), p. 267.

"The deviation of a score is its distance from the mean of the distribution."[5]

Lorge-Thorndike IQ's. Irvin Lorge and Robert Thorndike define the term as follows: "Intelligent quotients are deviation IQ's where the average deviation intelligent quotient for each age group has been set at 16."[6]

LIMITATIONS

This study was confined to one school, Clifton Hill Elementary School. The study was also confined to one grade level, the third grade and to four classrooms.

The Lorge-Thorndike Cognitive Abilities Test was the only criterion used for grouping the third grade classrooms into control and experimental groups. The groups' average deviation of intelligent quotients on the Lorge-Thorndike Cognitive Abilities Test was the only criterion used for grouping the classrooms into groups for comparison.

A degree in elementary education was the only criterion used for selecting teachers to participate in this study. Teacher competency and years of teaching experience were excluded.

This study was limited to the multiplication operation. The other operations--addition, subtraction, and division were excluded.

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[5] John W. Best, Research in Education (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1970), p. 235.

[6] Irvin Lorge and Robert Thorndike, The Lorge-Thorndike Cognitive Abilities Test, Form II (New York: Houghton-Mifflin Company, 1974), p. 28.

METHOD OF INVESTIGATION

1. Third grade classes were selected for the control and experimental groups on the basis of the Lorge-Thorndike Cognitive Abilities Test.

2. Teachers who had met the college requirements for a degree in elementary education were selected to participate in this study.

3. Three qualified persons outside the school wrote a pre-test and post-test in multiplication for third grade children.

4. The test was administered to each class by someone other than the classroom teacher or investigator.

5. A comparison of the scores on the multiplication post-test was made at the end of the second semester.

Chapter 2

THE REVIEW OF THE LITERATURE

During our country's colonial period, reading and writing were considered to be the most important subjects to be taught. According to Herbert F. Spitzer:

> Mathematics as a subject was taught only incidentally if at all in the schools established in colonial times. The Massachusetts Education Act of 1647 ordered the establishment of schools for reading and writing, but did not mention the other member of the three R's. In view of the fact that the desire to maintain religious practices was the driving force behind the enactment of this country's first education laws, the omission of mathematics as a subject for study is not surprising.[1]

Special schools were created for training in ciphering because the Dutch West India Company needed men with such training to take care of the stores.[2] According to Herbert F. Spitzer, "The demand for knowledge of mathematics grew along with the growth of commerce in New England."[3]

Elementary school mathematics of a very simple nature appeared in some grammar schools during the later part of the seventeenth century. Girls were not taught mathematics, but boys entering a trade were

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[1] Herbert F. Spitzer, <u>Teaching Elementary School Mathematics</u> (Boston: Houghton-Mifflin Company, 1967), p. 2.

[2] Charles H. D'Augustine, <u>Multiple Methods of Teaching Mathematics in the Elementary School</u> (New York: Harper and Row, 1968), p. 1.

[3] Spitzer, op. cit., p. 2.

required to learn how to write a column of figures and how to do simple addition and subtraction.[4]

By 1800, the teaching of mathematics became prevalent in the schools. According to Herbert F. Spitzer:

> The importance given to mathematics in the elementary schools of the nineteenth century stemmed from a number of factors. The fact that surveyors, accountants, bookkeepers, and navigators--men who seemed to play key roles in the great enterprises of the times--all knew some mathematics, was undoubtedly partially responsible for the increased importance attached to the subject. The scarcity of instructional materials, especially books, in other subject fields and the generally low educational level of teachers in the elementary schools were other factors which contributed to the assignment of a large amount of the school day to the teaching of mathematics. Although teachers who knew little history and literature could not supply suitable material for their students in these fields, they could readily supply computational exercises and word problems.[5]

The mathematics books of the first twenty years of the nineteenth century were not designed for children below 10 years old. It was considered a symbol of approaching manhood to study mathematics.[6]

The lecture method was used in teaching mathematics. The teacher had the textbook, and the students had sheets of paper tied together for purposes of taking notes.[7]

About 1820, instruction in mathematics was begun as early as the age of five. The method of teaching proceeded from the concrete to the abstract. The content of mathematics texts began to change; topics were better sequenced.[8]

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[4] D'Augustine, op. cit., p. 1.

[5] Spitzer, loc. cit.

[6] Charles H. D'Augustine, Multiple Methods of Teaching Mathematics in the Elementary School (New York: Harper and Row, 1968), p. 2.

[7] Ibid., p. 3.

[8] Ibid.

During the later part of the nineteenth century, several different forces were creating an impact on the mathematics curriculum. The formal discipline advocates made their impact on the mathematics curriculum with extensive mathematics drills. It was thought that mathematics drills would help children to think better. Francis Parker organized a school system that centered its mathematics instruction around learning rules.[9]

The Social Utility Movement came into existence during the early 1900's. This movement was concerned with teaching mathematics according to problems that the average adult encountered daily.[10]

The advocates of the Connectionist theory of learning also had their influence on the mathematics curriculum during the early 1900's. Mathematics was taught as a series of piece-meal experiences imprinted in the brain for mastery through practice.[11]

During the late 1920's a study was made by the Committee of Seven who tried to determine the mental age at which various mathematics topics would be taught. This study influenced the placement of topics for twenty years despite the fact that research gave evidence that when and where topics were placed in the curriculum depended on how they were taught. The child-study movement was influencing the curriculum during the late 1920's, also. Research gave evidence that children learned best by progressing from the concrete to the abstract.[12]

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[9] Charles H. D'Augustine, Multiple Methods of Teaching Mathematics in the Elementary School (New York: Harper and Row, 1968), p. 3.

[10] Ibid.

[11] Ibid.

[12] Ibid.

Research continued to influence the curriculum. Research on the reading levels of children influenced the publication of mathematics texts with a lower reading level. Research also indicated that mathematics was learned best when a spiral approach of presenting mathematics was used over a long period of time.[13] According to Herbert F. Spitzer:

> Investigations of areas such as the everyday use of mathematics, the mental age most receptive to the teaching of operations, the most effective placement of practice, and comparative methods of teaching, led to significant changes in the curriculum. Among other factors which had a marked influence on the mathematics program early in the 20th century were the following: 1) compulsory school attendance, which resulted not only in all children staying in school through the elementary grades, but also in a younger school entrance age; 2) the progressive education movement, with its emphasis on child interests and needs and its use of various activities as a part of instruction; 3) the child study movement; and 4) the development and extensive use of psychological and achievement tests.[14]

The Progressive Movement advocated using meaningful learning experiences to foster learning and motivation. It was believed that the highly motivated child learned more than the less motivated child.[15]

The curriculum was influenced by the Gestalt psychology after 1920. "The organization of learning concentrated on the whole, rather than on the atomistic parts, as advocated by the Connectionists."[16] After 1930 mathematics education began emphasizing the concept that "meaning must be developed along with a skill."[17]

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[13] Ibid.

[14] Herbert F. Spitzer, Teaching Elementary School Mathematics (Boston: Houghton-Mifflin Company, 1967), p. 5.

[15] Charles H. D'Augustine, Multiple Methods of Teaching Mathematics in the Elementary School (New York: Harper and Row, 1968), p. 4.

[16] Ibid., p. 4.

[17] Ibid.

With the advent of the Russian Sputnik came a concern about how well the schools were doing their job; therefore, in 1957 Congress established the National Science Foundation Fund, providing funds for improving the mathematics curriculum, for retraining teachers, and for curriculum research.[18]

Such projects as the Greater Cleveland Mathematics Program, the University of Illinois Arithmetic Project, the Madison Project, and the Minnesota Elementary Curriculum Project came into existence during the mid-century. These projects developed materials for elementary children and elementary teachers.[19] According to Herbert F. Spitzer:

> All materials for the new mathematics program were produced under the direction of mathematics educators who were aware of the shortcomings of the pre-1960 programs, and who attempted to eliminate these shortcomings. The programs developed by the educators emphasized exercises and procedures involving the properties of numbers and geometric shapes and the properties of the number operations, and included precise mathematical terms instead of the general or common terms used in earlier materials. Some geometry and algebra were introduced, along with other material that had not been presented in the pre-1960 programs. Much of the content of older programs was to be presented at a lower grade level in the new programs. Emphasis in mathematics programs today is upon mathematical structures learned in an atmosphere of active inquiry. The student is encouraged to think for himself and to realize that there are often many ways to reach a solution. He meets many basic mathematical ideas very early, and he broadens and deepens these mathematics concepts as long as he continues in the mathematics sequence.[20]

The term "modern mathematics" is not an accurate name for our present elementary school mathematics program. The mathematic content in the modern program was discovered before 1900. "A more precise

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[18] Ibid., p. 6.

[19] Ibid.

[20] Herbert F. Spitzer, Teaching Elementary School Mathematics (Boston: Houghton-Mifflin Company, 1967), pp. 6-7.

expression is revolution mathematics because the curriculum reform contains many of the characteristics one normally associates with a revolution."[21]

Jean Piaget, a Swiss psychologist, has had considerable influence on the mathematics curriculum "since so much of his research has dealt with quantitative concepts of children."[22] Piaget discovered four stages of cognitive development. They are the sensori-motor intelligence, intuitive or pre-operative thought, concrete operations, and formal operations. According to Piaget:

> Sensori-motor intelligence concerns the infants' development from birth to the appearance of language; that is, until about eighteen months. This stage is characterized by the progressive acquisition of the permanence of the object, the child becomes able to find objects after they have been taken out of vision. In the second stage, Intuitive or Pre-operative Thought, children from eighteen months to three or four years of age can participate in some short experiments. During the second part of this stage, the child possesses the notion of conservation of an object, he does not yet believe in the conservation of a collection of objects. Thought at this stage is largely based on perception, and usually one aspect, dimension, or relation is considered at the expense of the others. The third stage, concrete operations, lasts from six to eleven or twelve years. The child now considers two or more dimensions simultaneously instead of successively. Beginning at about eleven or twelve years of age, the child develops abstract thought patterns. The child at this time enters the fourth stage, Formal Operations, when reasoning is executed using pure symbols without the necessity for perceptive data.[23]

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[21] Charles H. D'Augustine, Multiple Methods of Teaching Mathematics in the Elementary School (New York: Harper and Row, 1968), p. 4.

[22] Robert W. Houston, Improving Mathematics Education for Elementary School Teachers (Michigan: Michigan State University, 1968), pp. 39-41.

[23] Ibid., p. 41.

A question being raised by curriculum writers and educators was, "Could these developmental stages be compressed?" Paul Rosenbloom's answer was that it is possible through creative teaching styles to accelerate children's development. Piaget answered, "Oh you Americans, you are in a rush always." His experiments have led to the conclusion that it is not possible to accelerate the pace very much. The child must be biologically ready. "Piaget does not say that education can do nothing, only that education is confined by the child's developmental sequence."[24]

Piaget's cognitive development has implications for teachers. The development of a child's cognitive abilities has tremendous use for the teacher in diagnosing pupil achievement, planning activities, and teaching. The teacher who applies Piaget's method has a powerful instrument for measuring a child's progress.[25]

According to Piaget, the goals of education are:

> The principal goal of education is to create men and women who are capable of doing new things, not simply of repeating what other generations have done. The second goal of education is to form minds which can be critical, which can verify, and not accept everything they are offered.[26]

Jerome Bruner, like Piaget, has had considerable influence on the mathematics curriculum. According to Collier and Lerch:

> J. S. Bruner believes that the basic ideas of mathematics are as simple as they are powerful and that they can be taught in some form to a youngster of any age. He suggests that the early teaching be done with an emphasis upon the intuitive grasps of ideas and upon the

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[24] Ibid.

[25] Ibid.

[26] A. P. Troutman, "Strategies for Teaching Elementary School Mathematics," Arithmetic Teacher, Vol. 243 (October, 1973), p. 426.

use of these basic ideas and that these basic ideas be reinforced and expanded throughout the elementary school program.[27]

According to Leroy Calahan and Vincent Glennon:

> The elementary school mathematics teacher can feel very confident that a readiness program at all grade levels will facilitate subsequent learning. The work of Robert Gagne has indicated the importance of order of acquiring subordinate knowledge in a knowledge hierarchy as an important factor in mathematics learning. This would include readiness built on the acquisition of subordinate knowledge as well as readiness of the student to develop continually higher levels of cognitive and affective functioning in the acquisition of the substantive matter of elementary school mathematics.[28]

It is, therefore, important for teachers to build a background for each skill taught in mathematics because each operational skill is interdependent upon other skills.

Does the ratio of time provided for the development of meaning and the time provided for practice during a class period influence learning in mathematics? Donald Shipp and George Deer, using students at three levels of ability, attempted to determine whether changing the amount of class time spent on developmental activities and on practice work influences achievement as measured by a mathematics achievement test. They concluded:[29]

> 1) There is a trend toward higher achievement when the percent of class time spent on developmental activities is increased.
>
> 2) It would seem that more than 50 percent of class time should be spent on developmental activities.
>
> 3) The conclusions apply to all ability levels.[30]

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[27] Calhoun C. Collier and Harold H. Lerch, <u>Teaching Mathematics in the Modern Elementary School</u> (Toronto: The Macmillan Company, 1969), p. 9.

[28] Leroy G. Calahan and Vincent J. Glennon, <u>Elementary School Mathematics</u> (Washington, D.C.: Association for Supervision and Curriculum Development, 1968), pp. 33-35.

[29] Ibid., pp. 61-62.

[30] Ibid.

> The teacher can be quite sure that student achievement is affected by the ratio of class time spent on developmental activities or drill activities. It appears that at least fifty percent to seventy-five percent of the time should be spent on developmental activities.[31]

Teachers should be concerned with the readability of mathematics textbooks. It is important that students be able to read textbooks with a high degree of competency. With this in thought, teachers should realize that they must teach the reading of mathematics.[32]

What affect does in-service education have on teachers and their students? Research indicates that the resulting increase in the achievement of students and teachers from an in-service program depends on the type of program carried out. Research also indicates that teachers "who are in the process of changing are more likely to effect similar change or growth in the pupils with whom they work."[33]

What place does drill (practice) have in the contemporary mathematics program? Practice has two essential phases according to William Burton: (a) the integrative phase in which perception of the meaning is developed, and (b) the repetitive, or refining, or facilitating phase in which precision is developed."[34] The teacher can be sure that practice is necessary in the instruction of elementary school mathematics.

> Wise use of practice is important and this involves: its use at the appropriate point or stage, in the instructional process; its use with appropriate learning objectives of the program; and also differentiated application to individual children.

Some children may only need a small amount of practice to consolidate

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[31] Ibid., pp. 62-63.

[32] Ibid., p. 62.

[33] Ibid., pp. 69-70.

[34] Ibid., pp. 79-80.

and maintain high-level functioning, while other children may need a greater amount of practice.[35]

What methods should be used for introducing multiplication to children? Roland Gray did a study that involved the investigation of the distributive property in introducing multiplication. Twenty-two classes of third graders who had no previous formal instruction in multiplication were involved in the study. The classes were divided into two groups--Treatment One and Treatment Two.

> Treatment One development explained multiplication in terms of repeated additions and arrays of objects in rows and columns. The lesson provided for practice or drill in memorization of the combinations, but made no mention of the distributive property or its applications.[36]
>
> Treatment Two lessons were identical with the first five Treatment One lessons to insure that both groups had the same basic understandings of multiplication through the combinations with two as a factor. The remaining lessons of the Treatment Two group were designed to introduce and explain all additional multiplication combinations in terms of the distributive property for multiplication.[37]
>
> Roland Gray concluded from the study:
>
> 1. A program of arithmetic instruction which introduces multiplication by a method stressing understanding of the distributive property results superior to methods emphasizing repeated addition and the array.
>
> 2. Knowledge of the distributive property appears to enable children to proceed independently in the solution of untaught multiplication combinations.
>
> 3. Children appear not to develop an understanding of the distributive property unless it is specifically taught.

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[35] Ibid., p. 81

[36] Ibid., p. 87.

[37] Ibid., p. 88.

4. Insofar as the distributive property is an element of the structure of mathematics, the findings tend to support the assumption that teaching for an understanding of structure can produce superior results in terms of pupil growth.[38]

Although much research is needed on the use of mappings, Cartesian products, the use of arrays, and repeated additions; the limited research would give some evidence that, for children of average to above-average intelligence, the use of the distributive property provides some benefits in the acquisition of the multiplication combinations as well as transfer to the following untaught combinations.[39]

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[38] Leroy G. Calahan and Vincent J. Glennon, Elementary School Mathematics (Washington, D.C.: Association for Supervision and Curriculum Development, 1968), p. 88.

[39] Ibid., p. 89.

Chapter 3

PROCEDURE

The third grade was selected for this study because this was the grade in which the formal instruction of multiplication began at Clifton Hill Elementary School. The study was begun the second semester because this was the semester in which the teachers concentrated on teaching multiplication.

Four third grade, self-contained classrooms at the same school consisting of a total of seventy-five students were involved in this study. The classrooms were selected to participate on the basis of the Lorge-Thorndike Cognitive Abilities Test. All of the children in the classrooms were not involved in this study. Only the children who took the Lorge-Thorndike Cognitive Abilities Test, the multiplication pre-test, and the multiplication post-test were involved in this study.

The classrooms were divided into experimental and control groups. The experimental groups used the supplementary material in <u>Merry-Go-Rounding With Multiplication</u> along with the textbook. The Control Groups used the textbook method only. There were two experimental and two control groups--Experimental Group A, Experimental Group B, Control Group A, and Control Group B. Experimental Group A was compared to Control Group A. Experimental Group B was compared to Control Group B.

The third grade classrooms were grouped for comparison into control and experimental groups on the basis of the average deviation intelligent quotient on the Lorge-Thorndike Cognitive Abilities Test. A maximum difference of four points was allowed between two groups' average deviation intelligent quotient. Control Group A's average deviation intelligent quotient was 80.04, and Experimental Group A's average deviation intelligent quotient difference was 83.70. There was an average deviation intelligent quotient difference of 3.66 points between the two groups; therefore, these two groups were grouped for comparison. Control Group B's average deviation intelligent quotient was 86.05, and Experimental Group B's average deviation intelligent quotient was 87.10. There was an average deviation intelligent quotient difference of .95 points between the two groups; therefore, these two groups were grouped for comparison.

Teachers who had met college requirements for a degree in elementary education were selected to participate in this study. Four of the teachers taught the four third grade, self-contained classes. Two of the teachers came from different elementary schools; these teachers administered and graded the multiplication pre-test and post-test. One teacher administered and graded the multiplication pre-test, and one teacher administered and graded the multiplication post-test.

Teachers of Experimental Group A, Control Group A, and Control Group B taught mathematics in the mornings. The teacher of Experimental Group B taught mathematics in the afternoon. An hour per day was spent on mathematics instruction.

The experimental and control teachers did not receive any in-service training in multiplication instruction during the school year. All of the teachers were asked by the investigator to use their usual methods of multiplication instruction. The control teachers were not given any instructional materials to assist them in teaching multiplication. The experimental teachers were asked by the investigator to use the material in Merry-Go-Rounding With Multiplication to supplement the textbook in teaching multiplication. Since there was no teacher's manual to Merry-Go-Rounding With Multiplication, the experimental teachers were asked by the investigator to use their own method of teaching the material in Merry-Go-Rounding With Multiplication.

Three elementary supervisors outside the school wrote a multiplication pre-test and post-test for third grade children. The multiplication pre-test was administered during the early part of the second semester. The multiplication post-test was administered during the later part of the second semester.

A comparison of the scores on the multiplication pre-test and post-test were made at the end of the second semester by the two test administrators. If a child scored higher on the multiplication post-test than on the multiplication pre-test, the child was said to have accelerated a number of points. The accelerated points were a difference between the pre-test score and the post-test score. If a child scored higher on the multiplication pre-test than on the post-test, the child was said to have decelerated a number of points. The decelerated points were the difference between the pre-test score and the post-test score.

At the end of the second semester the points on the pre-test and post-test were obtained for each group. This difference score was divided by the number of people in the group to determine the average acceleration points per student in the class. The control groups and the experimental groups were compared to determine which groups accelerated the most in terms of average acceleration points per student.

Chapter 4

INTERPRETATION OF THE DATA

The multiplication pre-test and post-test consisted of the following sections: Part A--the multicative identity element, Part B--the Multicative Law of Zero, Part C--the commutative property, Part D--the formulation of multiplication equations, and Part E--the recall of multiplication facts. The multicative identity element is one. It means that any number multiplied by one equals the number itself. L. Edwin Hirschi states the Multicative Law of Zero as follows: "The product of any number N and zero is zero."[1] The commutative property means that the answer is not affected by the sequence in which two numbers are multiplied.

The total number of possible points that one could receive on the test was 115. The total number of possible points per section were as follows: Part A--three points, Part B--three points, Part C--seven points, Part D--two points, and Part E--100 points. A copy of the multiplication pre-test and post-test is included as Appendix A.

Students were given the following times to work the following test sections: Part A, Part B, and Part C--ten minutes; Part D--ten minutes; and Part E--15 minutes. It took 35 minutes to complete each test.

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[1] L. Edwin Hirschi, Building Mathematics Concepts in Grades Kindergarten Through Eight (Pennsylvania: International Textbook Company, 1970), p. 267.

The test administrators read the test to each group and re-read sections of the test to individual children who asked for extra assistance. This was done to alleviate the reading impediments that some children encounter when they are required to read various materials.

The following tables give the following information on each student in the study: the sex, the multiplication pre-test score, the multiplication post-test score, and the acceleration or deceleration points. The acceleration and deceleration points are the difference between the multiplication pre-test and multiplication post-test scores.

The tables also give the following information on each group: the total number of points received on the multiplication pre-test and the multiplication post-test, the total number of acceleration and deceleration points. The number of students in the group, the group's average deviation intelligence quotient, and the group's average acceleration points per student are given at the end of each table. According to Irvin Lorge and Robert Thorndike:

> Intelligent quotients are deviation IQ's where the average deviation intelligent quotient for each age group has been set at 100 and the standard deviation has been set at 16. They are, therefore, to be considered as standard scores, directly comparable from age to age, and may be interpreted within the following framework. About 68 percent of all DIQ scores will fall between DIQ's of 84 and 116 (about 2 out of 3). About 14 percent will fall between DIQ scores of 68 and 84, about 14 percent between 116 and 132. About two percent will fall below 68 and two percent above 132.

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[2] Irvin Lorge and Robert Thorndike, The Lorge-Thorndike Cognitive Abilities Test, Form II (New York: Houghton-Mifflin Company, 1974), p. 28.

Table 1

The Multiplication Pre-Test and Post-Test Results and the Acceleration and Deceleration Scores for Each Student in Control Group A

Sex	Pre-Test Score	Post-Test Score	Acceleration Points	Deceleration Points
M	3	47	44	0
M	4	28	24	0
F	12	60	48	0
F	13	107	94	0
F	6	111	105	0
M	36	112	76	0
F	80	113	33	0
F	8	28	20	0
F	10	31	21	0
F	20	30	10	0
F	6	113	107	0
M	2	107	105	0
M	5	102	97	0
M	8	55	47	0
M	13	112	99	0
F	16	91	75	0
M	14	106	92	0
M	9	12	3	0
Total	265	1365	1100	0

There were 18 students in Control Group A. The group's average deviation intelligent quotient was 80.04. The average acceleration points per student was 61.11.

Table 2

The Multiplication Pre-Test and Post-Test Results and the Acceleration and Deceleration Scores for Each Student in Experimental Group A

Sex	Pre-Test Score	Post-Test Score	Acceleration Points	Deceleration Points
F	6	39	33	0
F	27	49	22	0
M	43	45	2	0
F	6	52	46	0
M	4	37	33	0
F	3	106	103	0
F	2	22	20	0
M	11	62	51	0
M	4	30	26	0
F	11	78	67	0
F	35	95	60	0
M	2	21	19	0
F	9	42	33	0
F	23	73	50	0
M	13	85	72	0
F	23	35	12	0
F	4	83	79	0
F	7	26	19	0
M	7	59	52	0
M	3	42	39	0
Total	243	1081	838	

There were 20 students in Experimental Group A. The group's average deviation IQ was 83.70. The average acceleration points per student was 41.90.

Table 3

The Multiplication Pre-Test and Post-Test Results and the Acceleration and Deceleration Scores for Each Student in Control Group B

Sex	Pre-Test Score	Post-Test Score	Acceleration Points	Deceleration Points
M	23	22	0	1
F	36	58	22	0
M	47	100	53	0
M	31	75	44	0
M	17	5	0	12
F	26	64	38	0
M	34	96	62	0
M	30	73	43	0
M	28	61	33	0
M	23	105	82	0
F	71	93	22	0
F	15	67	52	0
F	19	33	14	0
M	19	105	86	0
F	28	18	0	10
M	5	19	14	0
M	7	30	23	0
Total	459	1024	588	23

There were 17 students in Control Group B. The group's average deviation IQ was 86.05. The average acceleration points per student was 35.18.

Table 4

The Multiplication Pre-Test and Post-Test Results and the Acceleration and Deceleration Scores for Each Student in Experimental Group B

Sex	Pre-Test Score	Post-Test Score	Acceleration Points	Deceleration Points
F	20	34	14	0
F	30	89	59	0
F	90	114	24	0
M	4	60	56	0
M	9	81	72	0
F	12	94	82	0
M	13	115	102	0
M	16	91	75	0
M	23	85	62	0
F	6	65	59	0
F	6	64	58	0
F	6	81	75	0
M	20	108	88	0
F	10	93	83	0
F	60	107	47	0
F	9	113	104	0
M	14	28	14	0
F	10	42	32	0
F	10	42	32	0
M	7	65	58	0
Total	375	1571	1196	

There were 20 students in Experimental Group B. The group's average deviation IQ was 87.10. The average acceleration points per student was 58.20.

Control Group A scored higher on the multiplication post-test than Experimental Group A, the group that used the material in Merry-Go-Rounding With Multiplication to supplement the material in the textbook. Control Group A had an average of 61.11 acceleration points per student. Experimental Group A had an average of 41.90 points per student. There was a difference of 19.21 average acceleration points per student between the two groups.

Experimental Group B, the group that used the material in Merry-Go-Rounding With Multiplication to supplement the material in the textbook scored higher on the multiplication post-test than Control Group B. Experimental Group B had an average of 58.20 acceleration points per student. Control Group B had an average of 35.18 acceleration points per student. There was a difference of 23.02 average acceleration points per student between the two groups.

Control Group A had the highest average acceleration points per student. There was a difference of 19.21 average acceleration points per student between Control Group A and Experimental Group A. There was a difference of 25.93 average acceleration points per student between Control Group A and Control Group B. There was a difference of 2.91 average acceleration points per student between Control Group A and Experimental Group B.

Chapter 5

SUMMARY, CONCLUSION, RECOMMENDATIONS

Summary

The purpose of this study was to determine whether the scores on the multiplication post-test were higher for students who used the textbook and supplementary material in Merry-Go-Rounding With Multiplication as compared to students who used the textbook method only. Experimental and control groups were created in order to make a comparison of the results of teaching mathematics with and without the use of the supplementary material in Merry-Go-Rounding With Multiplication.

The hypothesis of the study was that children who used the material in Merry-Go-Rounding With Multiplication would score higher on the multiplication post-test. Control Group A, the group without the material in Merry-Go-Rounding With Multiplication, scored the highest of all the groups on the multiplication post-test. This fact falsified the hypothesis.

Conclusion

From the data in the study and the interpretation of that data it appears that the use of supplementary materials in Merry-Go-Rounding With Mutliplication did not make a difference in students' achievement on the multiplication post-test.

Recommendations

As a result of this study, the following is recommended:

1. That supervisors of mathematics instruction and classroom teachers study further the use of supplementary material.

2. That further research be conducted into the effect that varying amounts of times which are spent on the mathematical processes have on student progress.

3. Colleges of Education may wish to look into the program of mathematics instruction to determine whether or not prospective teachers have received adequate preparation in the use of supplementary materials as an aid to classroom instruction.

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BIBLIOGRAPHY

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APPENDIX A

THE MULTIPLICATION PRE-TEST AND POST-TEST

MULTIPLICATION PRE-TEST

NAME _ _ _ _ _ _ _ _ _ _ _

DATE _ _ _ _ _ _ _ _ _ _ _

ROOM # _ _ _ _ _ _ _ _

PART A

Find the product.

1. 1 x 1 = ____   2. 100 x 1 = ____

Write the correct word in the blank bel

3. One times any number equals the_ _

itself.(zero, number, one)

PART B

Find the product.

1. 1 x 0 = ____   2. 100 x 0 = _____

Write the correct word in the blank bel

3. Zero times any number equals _ _ _

(one, zero, the number)

PART C

1. 2 x 3 = _____   4. 5 x 2 = _______

2. 3 x 2 = _____   5. 2 x 5 = _______

3. 2 x 3 = 3 x ___   6. 5 x 2 = 2 x ____

PART C

Write the correct word in the blank bel

7. The ___________ does not change if the same two numbers are turned around in a problem.

(multiplication, number, answer)

PART D

Read each sentence story, then write a multiplication sentence for each senten story.

1. Three boys went to a park to play together. Each boy brought 2 toys. How many toys did the boys have to play with altogether?

PART D

2. There were 5 boys at Jim's party. There were twice as many girls as boys at the party. How many girls were at the party altogether?

MULTIPLICATION FACTS

Sometimes it helps to organize the multiplication facts into a table. The factors are listed across the top and down the left. You fill in the missing products in the proper boxes.

X	0	1	2	3	4	5	6	7	8	9
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										

Written by: Evelyn Montgomery, Assistant Director of Instruction, Omaha Public Schools
Denise Martin, Elementary Supervisor, Omaha Public Schools
Theodore Meadows, Elementary Supervisor, Omaha Public Schools

MULTIPLICATION POST-TEST

NAME ________________

DATE ________________

ROOM # ______________

PART A

Find the product.

1. 1 x 1 =_____ 2. 1 x 99=_____

Write the correct word in the blank below. (zero, number, one)

3. One times any number equals the

_______itself.

PART B

Find the product.

1. 0 x 1 = ____ 2. 0 x 100 = ____

Write the correct word in the blank

below. (one, zero, the number)

3. Zero times any number equals _______

PART C

1. 5 x 4 = _____ 4. 2 x 6 = _______

2. 4 x 5 = _____ 5. 6 x 2 = _______

3. 5 x 4 = 4 x _____ 6. 2 x 6- 6x_____

Write the correct word in the blank below.

(multiplication, number, answer)

7. The _________does not change if the same two numbers are turned around in a problem.

PART D

Read each sentence story. Write a complete multiplication sentence for each sentence story.

1. Susan had a birthday party. She received 4 gifts from each of her aunts. Súsan has 3 aunts. How many **gifts** in all did she get for her birthday?

2. There are 7 girls in Mrs. Holland's class. There are 3 times as many boys as girls in the class. How many boys are in Mrs. Holland's class?

1 x 0	5 x 5	3 x 1	4 x 7	0 x 2	1 x 1	9 x 0	3 x 4	5 x 8	2 x 0
2 x 8	7 x 5	2 x 0	6 x 1	2 x 7	8 x 4	3 x 0	2 x 1	4 x 2	3 x 9
0 x 8	5 x 2	8 x 5	6 x 4	9 x 5	9 x 2	0 x 5	8 x 6	3 x 8	1 x 9
4 x 0	5 x 3	7 x 6	9 x 4	3 x 5	9 x 3	0 x 7	0 x 3	8 x 8	5 x 0
9 x 9	3 x 6	7 x 0	8 x 1	4 x 6	6 x 0	0 x 1	7 x 2	3 x 7	6 x 8
4 x 1	2 x 4	9 x 7	1 x 5	9 x 1	6 x 3	8 x 7	1 x 4	1 x 8	2 x 9
5 x 1	4 x 8	5 x 6	7 x 7	7 x 1	3 x 3	2 x 6	8 x 3	7 x 4	8 x 9
3 x 2	0 x 6	4 x 3	4 x 5	2 x 2	5 x 9	1 x 3	6 x 5	5 x 7	0 x 9
6 x 7	6 x 2	7 x 9	4 x 4	2 x 5	1 x 6	7 x 8	4 x 9	8 x 0	6 x 9
1 x 7	2 x 3	5 x 4	9 x 6	8 x 2	7 x 3	9 x 8	1 x 2	0 x 4	6 x 6

Written by: Evelyn Montgomery, Assistant Director of Instruction, Omaha Public Schools
Denise Martin, Elementary Supervisor, Omaha Public Schools
Theodore Meadows, Elementary Supervisor, Omaha Public Schools

APPENDIX B

MERRY-GO-ROUNDING WITH MULTIPLICATION

Merry - Go - Rounding

With Multiplication

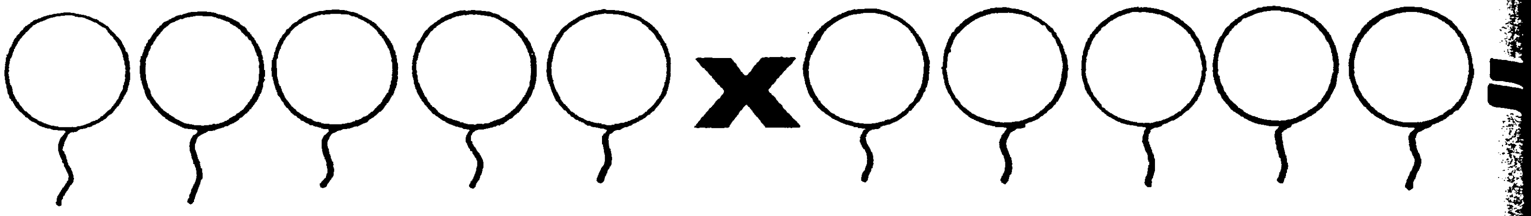
Written by
Eunice Raye Taylor

Merry - Go - Rounding

With Multiplication

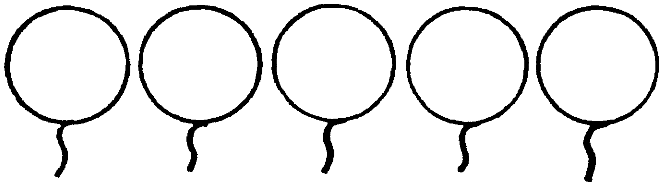
maha Public Schools
ifton Hill
ritten by Eunice Raye Taylor
150-73

MULTIPLICATION LANGUAGE

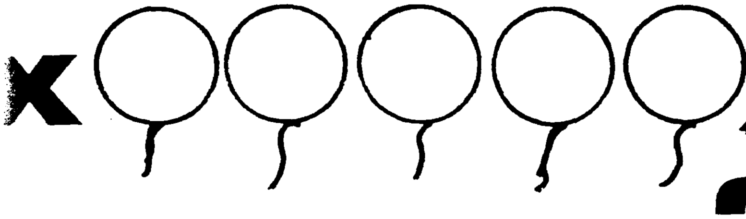


Factor X Factor = Product

5 x 5 = 25



5 Factor

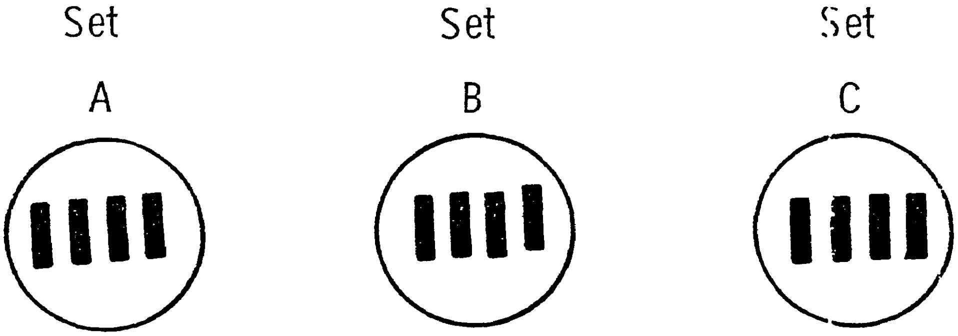


x5 X Factor

25 Product

USING SETS IN MULTIPLICATION

1.

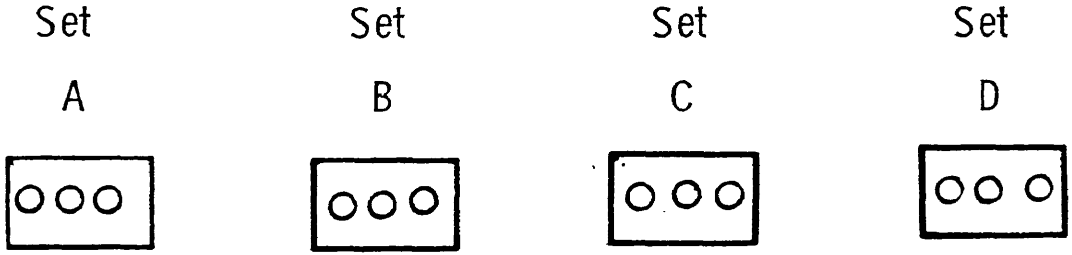


How many sets are there? __________

How many sticks are in each circle? __________

If there are __________ sets and __________ members in each set, then 3 x 4 = __________.

2.



How many sets are there? __________

How many circles are in each square? __________

If there are __________ sets and __________ members in each set, then 4 x 3 = __________.

USING SETS IN MULTIPLICATION

3.

Set A {o, l, m, n}

Set B {p, q, r, s}

Set C {b, c, d, f}

Set D {a, e, g, h}

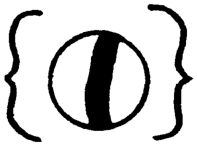
How many sets are there? ____________

How many letters are in each set? ____________

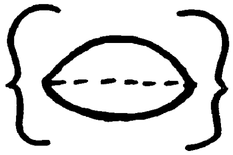
If there are ________ sets and ____________ members in each set, then 4 x 4 = ________________.

4.

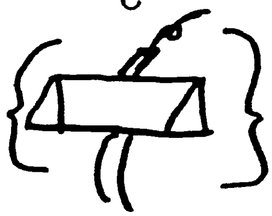
Set A



Set B



Set C



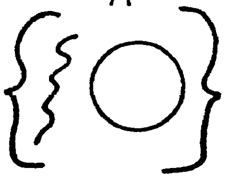
How many sets are there? ___________

How many objects are in each set? ____________

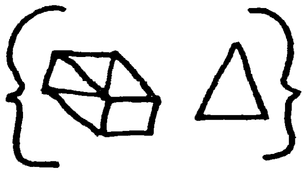
If there are __________ sets and ___________ member in each set, then 3 x 1 = ______________.

USING SETS IN MULTIPLICATION

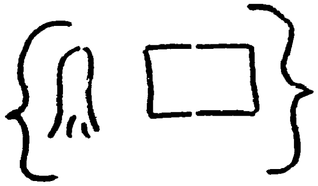
5. Set A



Set B



Set C



How many sets are there?________________

How many members are in each set?______________

If there are ___________ sets and ____________ members in each set, then 3 x 2 = _________________.

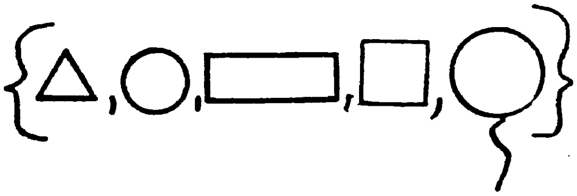
6. Set A

{4, 0, 1, 5, 2}

Set B

{7, 8, 9, 6, 3}

Set C



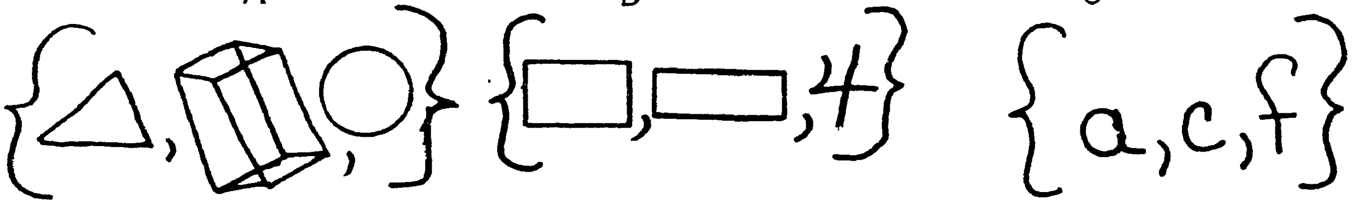
How many sets are there?_________________

How many members are in each set?_____________

If there are ________ sets and ____________ members in each set, then 3 x 5 = ______________

USING SETS IN MULTIPLICATION

7. Set A Set B Set C



How many sets are there?________________

How many members are in each set?______________

If there are __________ sets and ___________ members in each set, then 3 x 3 = _____________.

8. THE EMPTY SET

Set A

$\{\ \}$

How many sets are there?__________________

How many members are in each set?______________

If there is ______ set and ________ members in each set, then 1 x 0 = 0

THINK: One set of nothing equals nothing.

USING SETS IN MULTIPLICATION

9. Set A $\{ \quad \}$ Set B $\{ \quad \}$

How many sets are there? ____________

How many members are in each set? ____________

If there are __________ sets and ____________ members in each set, then 2 x 0 = ______.

THINK: Two sets of nothing equal ____________.

10. Set A $\{ \quad \}$ Set B $\{ \quad \}$ Set C $\{ \quad \}$

How many sets are there? __________

How many members are in each set? __________

If there are _______ sets and ______ members in each set, then 3 x 0 = _____.

THINK: Three sets of nothing equal ______.

USING SETS IN MULTIPLICATION

11. Set A { } Set B { } Set C { } Set D { }

How many sets are there? ____________

How many members in each set? ____________

If there are __________ sets and __________ members in each set, then 4 x 0 = ________.

THINK: Four sets of nothing equal ________.

12. Set A { } Set B { } Set C { } Set D { } Set E { }

How many sets are there? ____________

How many members are in each set? ____________

If there are _________ sets and _______ members in each set, then 5 x 0 = ________.

THINK: Five sets of nothing equal ____________.

USING SETS IN MULTIPLICATION

13. Set A { } Set B { } Set C { } Set D { } Set E { } Set F { }

How many sets are there? __________

How many members are in each set? __________

If there are __________ sets and __________ members in each set, then 6 x 0 = __________.

THINK: Six sets of nothing equal __________.

Therefore, any number times 0 equals ________.

Complete the math sentences below. "A" equals any number.

Remember: A x 0 = 0

4 x 0 = 7 x 0 = 9 x 0 = 5 x 0 = 8 x 0 =

6 x 0 = 3 x 0 = 1 x 0 = 10 x 0 = 11 x 0 =

12 x 0 = 13 x 0 = 14 x 0 = 15 x 0 = 16 x 0 =

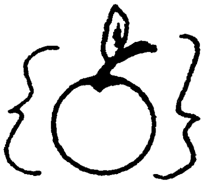
17 x 0 = 18 x 0 = 20 x 0 = 4 x 1 = 5 x 2 =

7 x 3 = 2 x 3 = 4 x 5 = 3 x 7 = 2 x 6 =

6 x 3 = 7 x 4 =

USING SETS IN MULTIPLICATION

14.

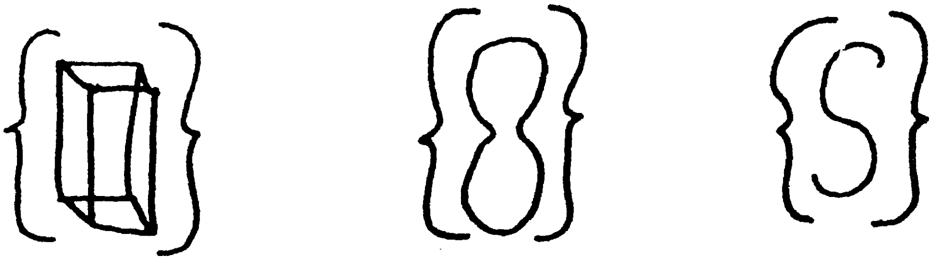


How many sets are there?__________

How many members are in each set?__________

If there is __________ set and __________member in each set, then 1 x 1 = ________.

15.



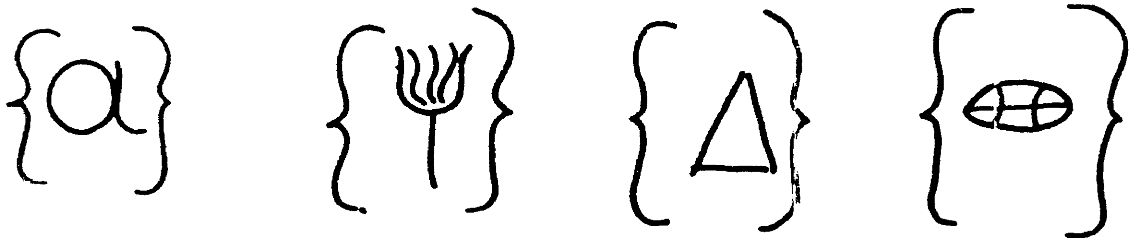
How many sets are there?__________

How many members are in each set?__________

If there are __________ sets and __________ member in each set, then 3 x 1 = ________.

USING SETS IN MULTIPLICATION

16.



How many sets are there? ____________

How many members are in each set? __________

If there are __________ sets and ___________ member

in each set, then 4 x 1 = ________.

Therefore, one times any number equals the _____________ itself.

Example: 1 x a = a

Complete the sentences below.

1 x 10 =

1 x 11 =

1 x 12 =

1 x 15 =

1 x 6 =

1 x 13 =

1 x 18 =

1 x 4 =

1 x 20 =

1 x 19 =

1 x 3 =

1 x 5 =

1 x 8 =

1 x 7 =

1 x 9 =

1 x 14 =

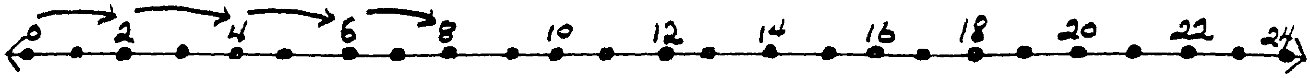
1 x 20 =

1 x 16 =

USING THE NUMBER-LINE IN MULTIPLICATION

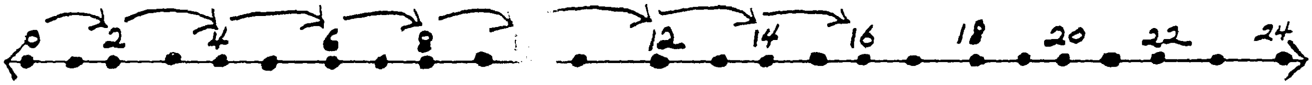
Write the multiplication sentence suggested by each number-line diagram.

a)



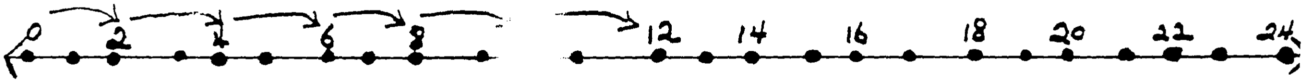
Example: We are working with 2's. The arrows tell you how many moves are made. According to the above number-line, 4 moves were made; so 2 x 4 = 8 because the last arrow landed on 8.

b)



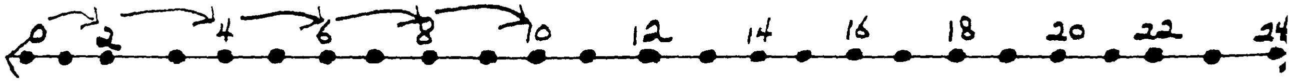
b) **2** X ☐ = ○

c)



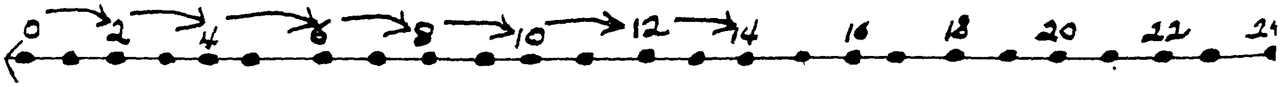
c) **2** X ☐ = ○

d)



d) **2** X ☐ = ○

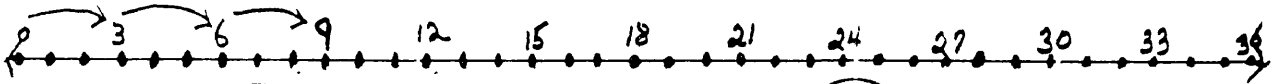
e)



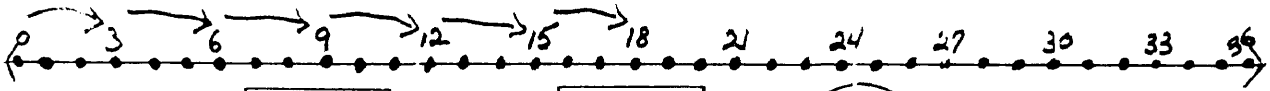
e) **2** X ☐ = ○

USING THE NUMBER-LINE IN MULTIPLICATION

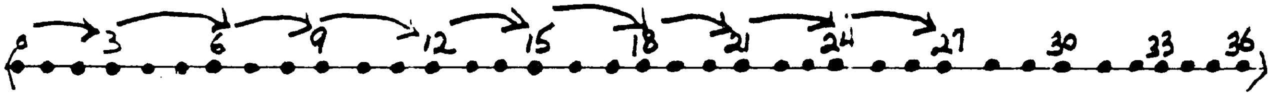
Write the multiplication sentence suggested by each number-line diagram.

a)


a) **3** × ☐ = ○

b)


b) **3** × ☐ = ○

c)


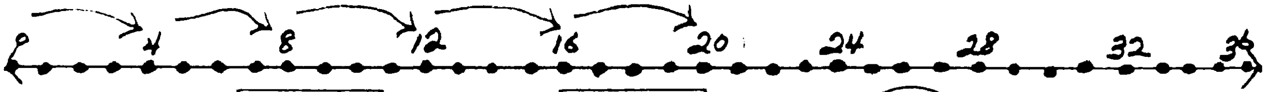
c) **3** × ☐ = ○

d)

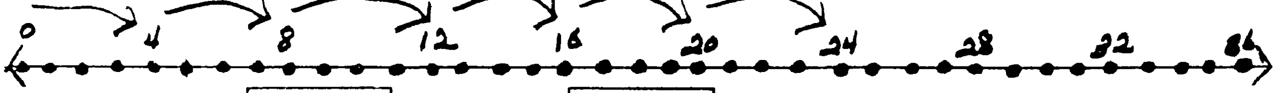

d) **3** × ☐ = ○

a)


a) **4** × ☐ = ○

b)


b) **4** × ☐ = ○

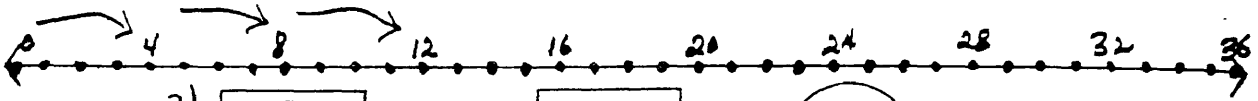
c)


c) **4** × ☐ = ○

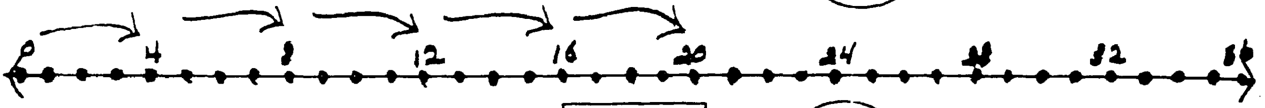
USING THE NUMBER-LINE IN MULTIPLICATION

Write the multiplication sentence suggested by each number-line diagram

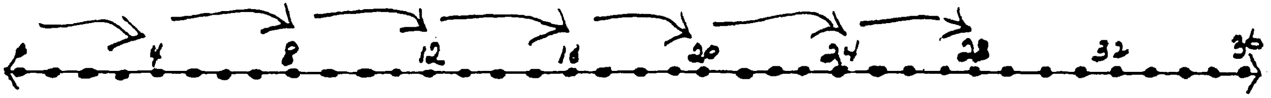
IV

a) 

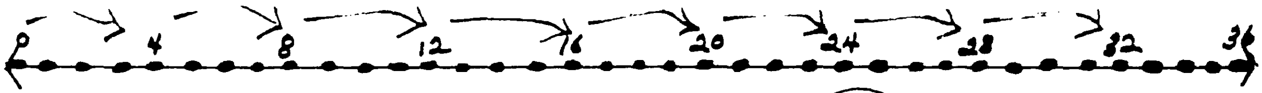
a) **4** × ☐ = ○

b) 

b) **4** × ☐ = ○

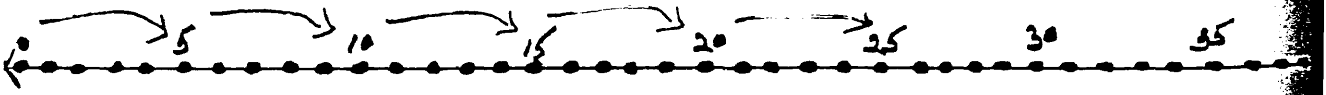
c) 

c) **4** × ☐ = ○

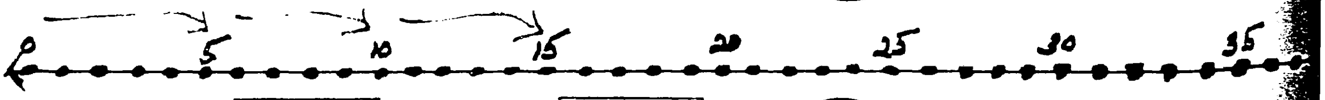
d) 

d) **4** × ☐ = ○

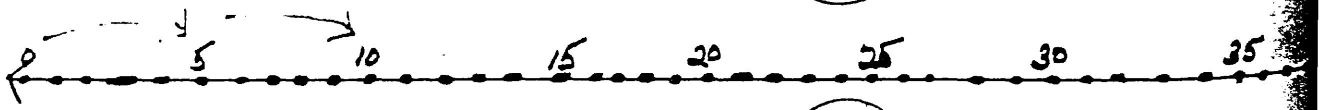
V

a) 

a) **5** × ☐ = ○

b) 

b) **5** × ☐ = ○

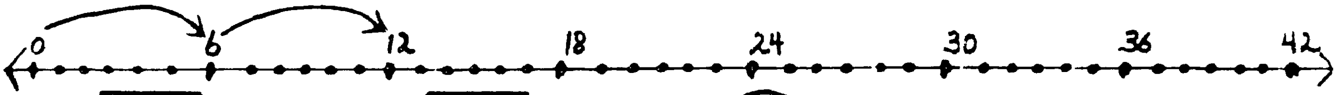
c) 

c) **5** × ☐ = ○

USING THE NUMBER-LINE IN MULTIPLICATION

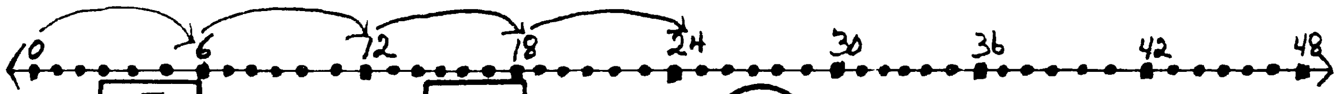
/rite the multiplication sentence suggested by each number-line diagram.

'I a)



a) 6 × ☐ = ○

b)



b) 6 × ☐ = ○

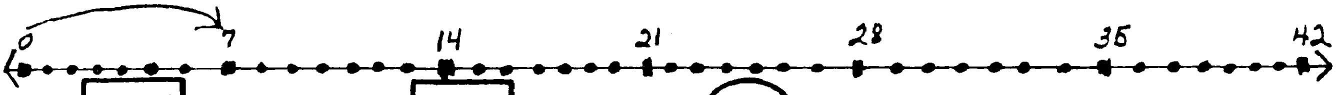
c)

c) 6 × ☐ = ○

d)

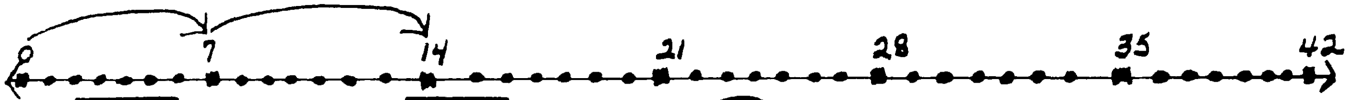
d) 6 × ☐ = ○

'II a)



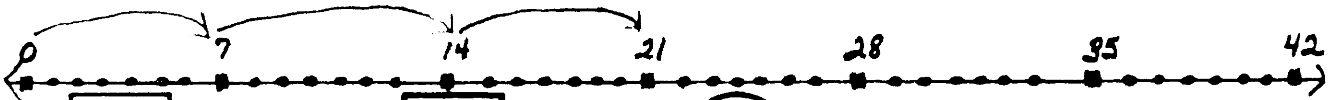
a) 7 × ☐ = ○

b)



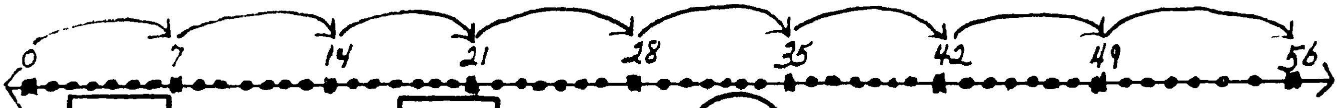
b) 7 × ☐ = ○

c)



c) 7 × ☐ = ○

d)



d) 7 × ☐ = ○

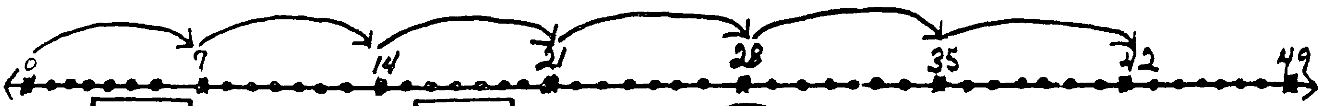
USING THE NUMBER-LINE IN MULTIPLICATION

Write the multiplication sentence suggested by each number-line diagram.

VIII a)

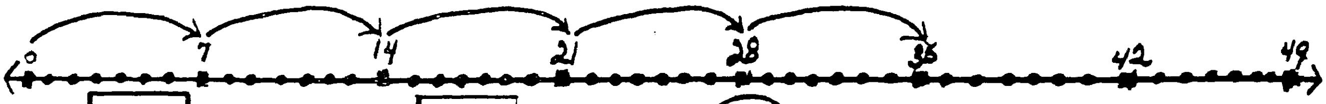
a) **7** × ☐ = ○

b)



b) **7** × ☐ = ○

c)

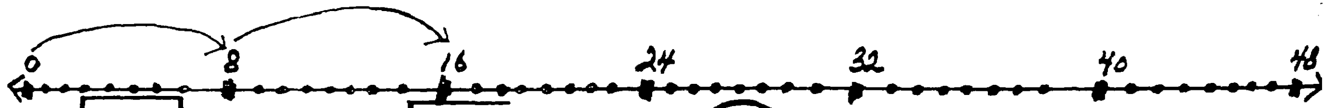


c) **7** × ☐ = ○

d)

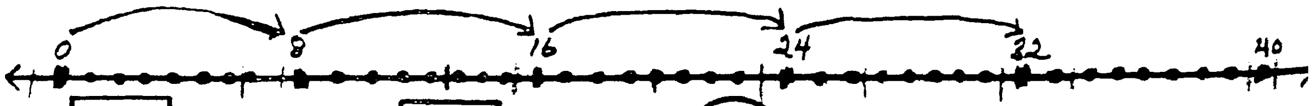
d) **7** × ☐ = ○

IX a)



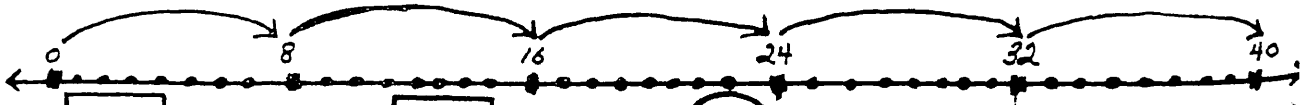
a) **8** × ☐ = ○

b)



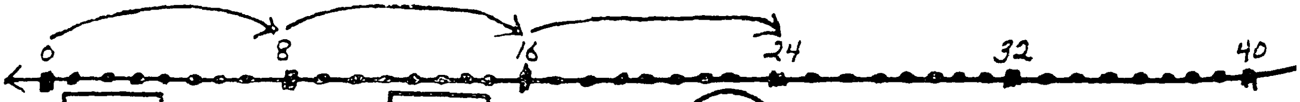
b) **8** × ☐ = ○

c)



c) **8** × ☐ = ○

d)

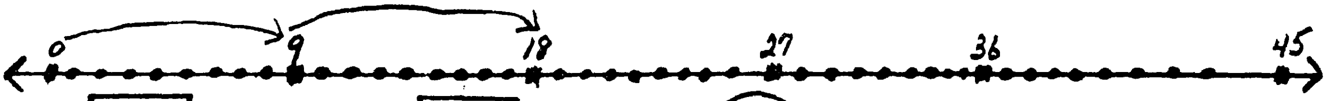


d) **8** × ☐ = ○

USING THE NUMBER-LINE IN MULTIPLICATION

rite the multiplication sentence suggested by each number-line diagram.

a)

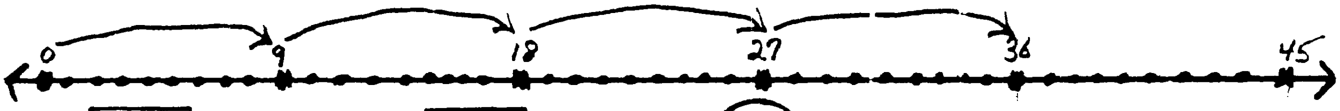


a) $\boxed{9}$ × ☐ = ○

b)

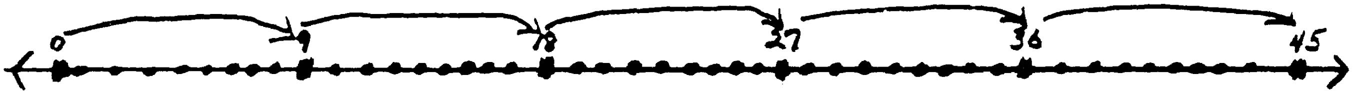
b) $\boxed{9}$ × ☐ = ○

c)



c) $\boxed{9}$ × ☐ = ○

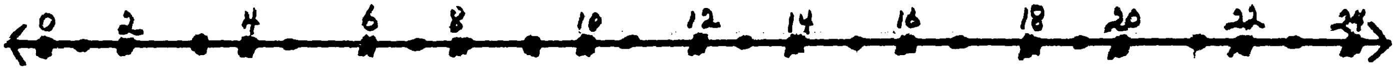
d)



d) $\boxed{9}$ × ☐ = ○

USING THE NUMBER-LINE IN MULTIPLICATION

Use the number-line to help you complete the math sentences.



2 x 1 =
2 x 2 =
2 x 3 =
2 x 4 =

2 x 5 =
2 x 6 =
2 x 7 =
2 x 8 =

2 x 9 =
2 x 10 =
2 x 11 =
2 x 12 =

3 x 1 =
3 x 2 =
3 x 3 =
3 x 4 =

3 x 5 =
3 x 6 =
3 x 7 =
3 x 8 =

3 x 9 =
3 x 10 =
3 x 11 =
3 x 12 =

4 x 1 =
4 x 2 =
4 x 3 =
4 x 4 =

4 x 5 =
4 x 6 =
4 x 7 =
4 x 8 =

4 x 9 =
4 x 10 =
4 x 11 =
4 x 12 =

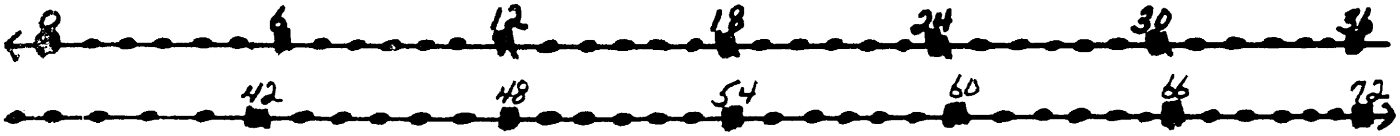
USING THE NUMBER-LINE IN MULTIPLICATION

Use the number-line to help you complete the math sentences.

5 x 1 =   5 x 2 =   5 x 3 =   5 x 4 =

5 x 5 =   5 x 6 =   5 x 7 =   5 x 8 =

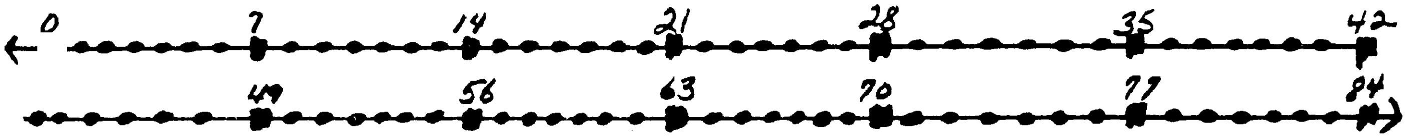
5 x 9 =   5 x 10 =   5 x 11 =   5 x 12 =



6 x 1 =   6 x 2 =   6 x 3 =   6 x 4 =

6 x 5 =   6 x 6 =   6 x 7 =   6 x 8 =

6 x 9 =   6 x 10 =   6 x 11 =   6 x 12 =



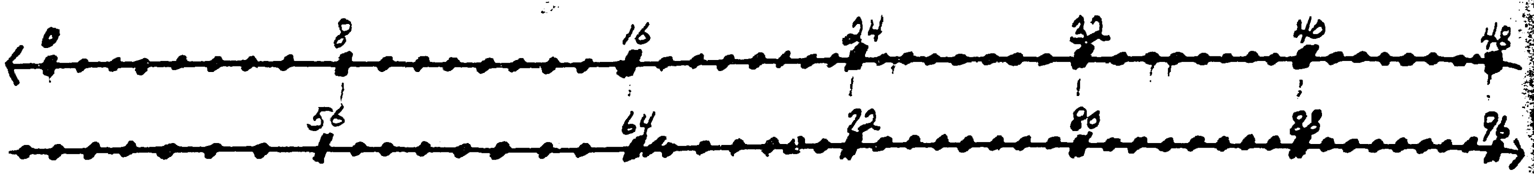
7 x 1 =   7 x 2 =   7 x 3 =   7 x 4 =

7 x 5 =   7 x 6 =   7 x 7 =   7 x 8 =

7 x 9 =   7 x 10 =   7 x 11 =   7 x 12 =

USING THE NUMBER-LINE IN MULTIPLICATION

Use the number-line to help you complete the math sentences.



8 x 1 =

8 x 2 =

8 x 3 =

8 x 4 =

8 x 5 =

8 x 6 =

8 x 7 =

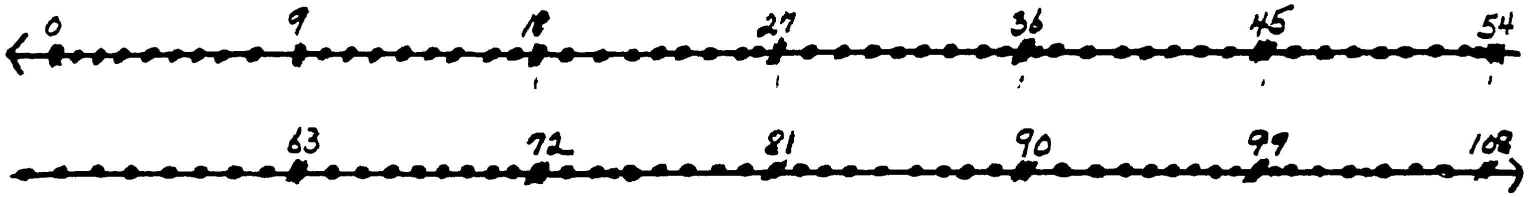
8 x 8 =

8 x 9 =

8 x 10 =

8 x 11 =

8 x 12 =



9 x 1 =

9 x 2 =

9 x 3 =

9 x 4 =

9 x 5 =

9 x 6 =

9 x 7 =

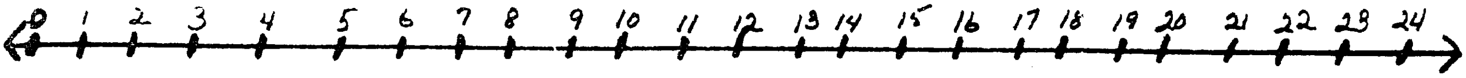
9 x 8 =

9 x 9 =

9 x 10 =

9 x 11 =

9 x 12 =



1
+1

How many 1's do you see?_____________

2 x 1 =

1 x 2 =

1
1
+1

How many 1's do you see?________________

3 x 1 =

1 x 3 =

1
1
1
+1

How many 1's do you see?_________________

4 x 1 =

1 x 4 =

1
1
1
1
+1

How many 1's do you see?_________________

5 x 1 =

1 x 5 =

$$\begin{array}{r}2\\+2\\\hline\end{array}$$

How many 2's do you see? ______________

2 x 2 = ☐

$$\begin{array}{r}2\\2\\+2\\\hline\end{array}$$

How many 2's do you see? ______________

3 x 2 = ☐

2 x 3 = ☐

$$\begin{array}{r}2\\2\\2\\+2\\\hline\end{array}$$

How many 2's do you see? ______________

4 x 2 = ☐

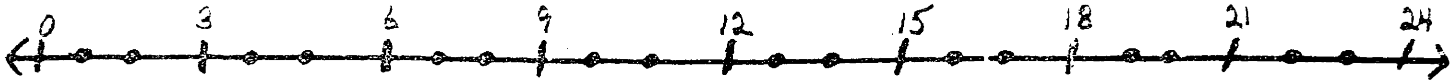
2 x 4 = ☐

$$\begin{array}{r}2\\2\\2\\2\\+2\\\hline\end{array}$$

How many 2's do you see? ______________

5 x 2 = ☐

2 x 5 = ☐



3
+3
____

How many 3's do you see? ____________

2 x 3 =

3 x 2 -

3
3
+3
____

How many 3's do you see? ____________

3 x 3 =

3
3
3
+3
____

How many 3's do you see? ______________

4 x 3 =

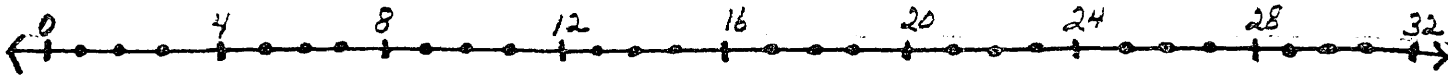
3 x 4 =

3
3
3
3
+3
____

How many 3's do you see? ______________

5 x 3 =

3 x 5 =



4
+4

How many 4's do you see? ____________

2 x 4 =

4 x 2 =

4
4
+4

How many 4's do you see? ____________

3 x 4 =

4 x 3 =

4
4
4
+4

How many 4's do you see? ____________

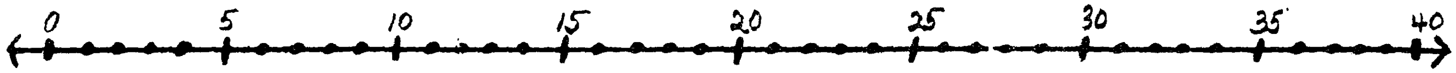
4 x 4 =

4
4
4
4
+4

How many 4's do you see? ____________

5 x 4 =

4 x 5 =



5
+5

How many 5's do you see?______________

2 x 5 =

5 x 2 =

5
5
+5

How many 5's do you see?______________

3 x 5 =

5 x 3 =

5
5
5
+5

How many 5's do you see?______________

4 x 5 =

5 x 4 =

5
5
5
5
+5

How many 5's do you see?______________

5 x 5 =

$$\begin{array}{r}6\\+6\\\hline\end{array}$$

How many 6's do you see? ______________

2 x 6 =

6 x 2 =

$$\begin{array}{r}6\\6\\+6\\\hline\end{array}$$

How many 6's do you see? _____________

3 x 6 =

6 x 3 =

$$\begin{array}{r}6\\6\\6\\+6\\\hline\end{array}$$

How many 6's do you see? ________________

4 x 6 =

6 x 4 =

$$\begin{array}{r}6\\6\\6\\6\\+6\\\hline\end{array}$$

How many 6's do you see? ______________

5 x 6 =

6 x 5 =

7
+7

How many 7's do you see?____________

2 x 7 =

7 x 2 =

7
7
+7

How many 7's do you see?____________

3 x 7 =

7 x 3 =

7
7
7
+7

How many 7's do you see?____________

4 x 7 =

7 x 4 =

7
7
7
7
+7

How many 7's do you see?____________

5 x 7 =

7 x 5 =

8
+8

How many 8's do you see? ______________

2 x 8 =

8 x 2 =

8
8
+8

How many 8's do you see? ______________

3 x 8 =

8 x 3 =

8
8
8
+8

How many 8's do you see? ______________

4 x 8 =

8 x 4 =

8
8
8
8
+8

How many 8's do you see? ______________

5 x 8 =

8 x 5 =

9
+9

How many 9's do you see? ____________

2 x 9 =

9 x 2 =

9
9
+9

How many 9's do you see? ____________

3 x 9 =

9 x 3 =

9
9
9
+9

How many 9's do you see? ____________

4 x 9 =

9 x 4 =

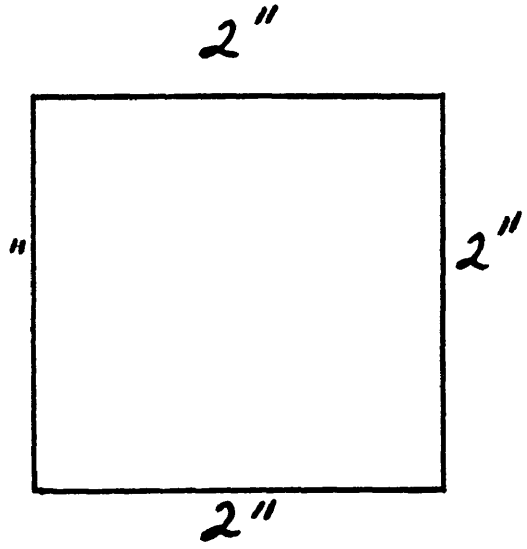
9
9
9
9
+9

How many 9's do you see? ____________

5 x 9 =

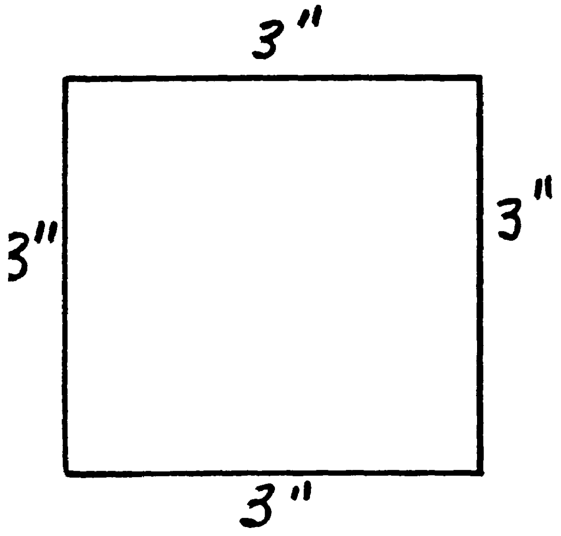
9 x 5 =

Can you find the distance around each of the square figures?



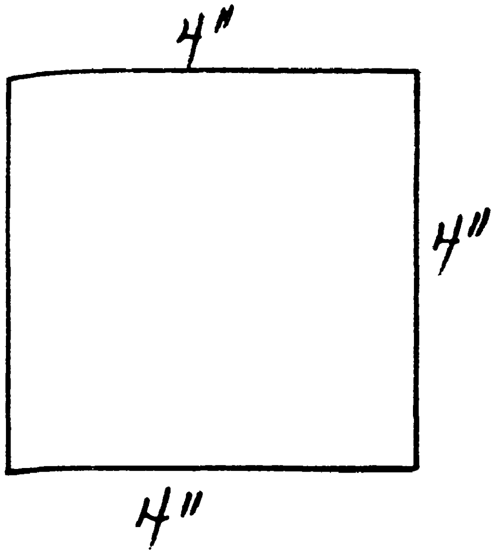
Example: How many inches are on each side? __2__ How many sides are there? __4__ Since there are __2__ inches on each side and there are __4__ sides __2"__ + __2"__ + __2"__ + __2"__ = $\boxed{8}$ inches. Anothe way of solving this problem is by multiplying. Since there are __4__ sides and __2__ inches on each side, __4__ x __2"__ = $\boxed{8}$ inches. Another way of solving this problem is by multiplying the 2 inches by the numl of sides which looks like this: 2" x 4 = $\boxed{8}$ inches. There are 8 inches around the square.

* * * * * * * * * * * * * * *



How many inches are on each side? ______ How many sides are there? ______ Since there are ______ inches on each side and there are ______ sides, ______" + ______" + ______" + ______" = ☐ inches. Another way of solving this problem is by multiplying. Since there are ______ sides and ______ inches on each side, ______ x ______" = ☐ inches. Another way of solving this problem is by multiplying the 3 inches by the num of sides, which looks like this: ______" x ______ = ☐ ir There are ☐ inches around the square.

* * * * * * * * * * * * * * *

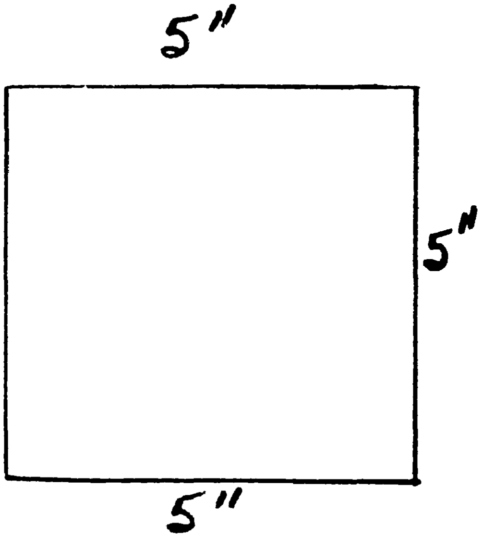


How many inches are on each side? _____________

How many sides are there? _____ Since there are _____ inches on each side and there are _____ sides, _____ + _____ + _____ + _____ = ☐ inches. Another way of solving this problem is by multiplying. Since there are _____ sides and _____ inches on each side, _____ x _____" = ☐ inches. Another way of solving this problem is by multiplying the 4 inches by the number of sides which looks like this: _____" x _____ = ☐ inche

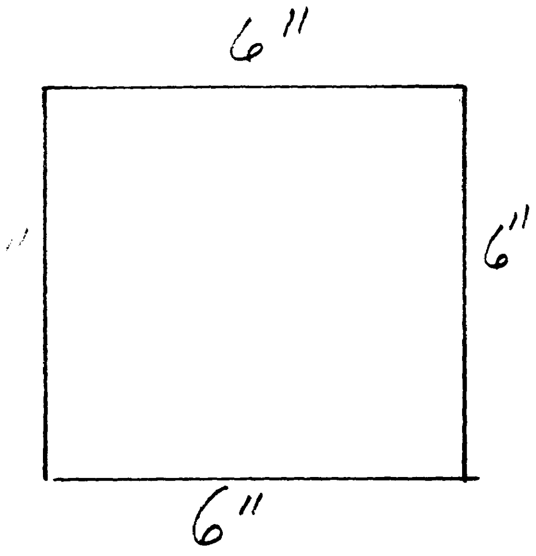
There are ☐ inches around the square.

* * * * * * * * * * * * * * *



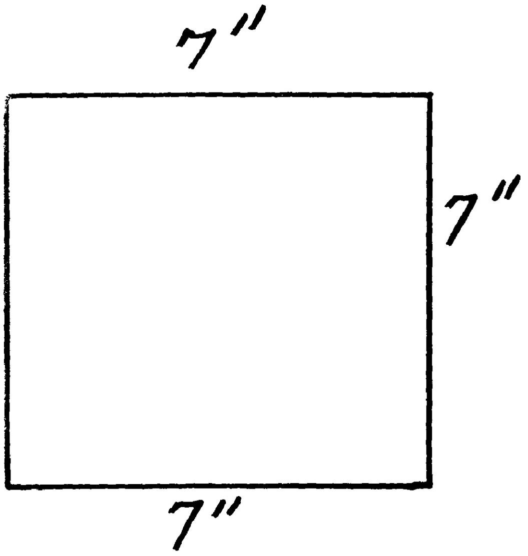
How many inches are on each side? ______ How many sides are there? _____ Since there are _____ inches on each side and there are _____ sides, _____" + _____" + _____' + _____" = ☐ inches. Another way of solving this problem is by multiplying. Since there are _____ sides and _____ inches on each side, _____ x _____" = ☐ inches. Another way of solving this problem is by multiplying the 5 inches by the number of sides which looks like this: _____" x _____ = ☐ inches. There are ______ inches around the square.

* * * * * * * * * * * * * * *



How many inches are on each side? _____ How many sides are there? _____ Since there are _____ inches on each side and there are _____ sides, _____" + _____" + _____" + _____" = ☐ inches. Another way of solving this problem is by multiplying. Since there are _____ sides and _____ inches on each side, _____ x _____" = ☐ inches. Another way of solving this problem is by multiplying the 6 inches by the number of sides which looks like this: _____" x _____ = ☐ inches. There are _______ inches around the square.

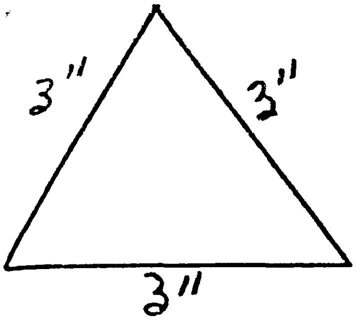
* * * * * * * * * * * * * * *



How many inches are on each side? _____ How many sides are there? _____ Since there are _____ inches on each side and there are _____ sides, _____" + _____" + _____" + _____" = ☐ inches. Another way of solving this problem is by multiplying. Since there are _____ sides and _____ inches on each side, _____ x _____" = ☐ inches. Another way of solving this problem is by multiplying the 7 inches by the number of sides which looks like this: _____" x _____ = ☐ inches. There are _____ inches around the square.

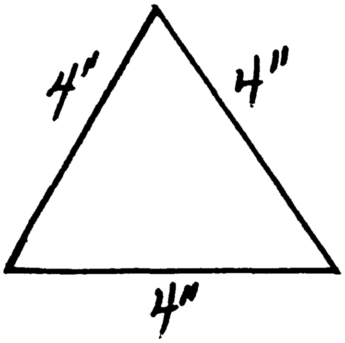
* * * * * * * * * * * * * * *

Can you find the distance around each of the triangles?



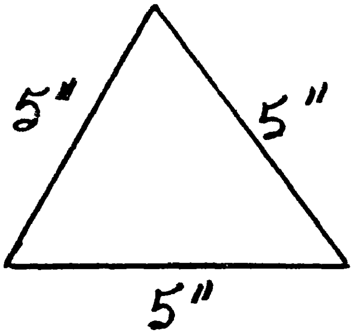
How many inches are on each side? _____ How many sides are there? _____ Since there are _____ inches on each side and there are _____ sides, _____" + _____" + _____" + ☐ inches. Another way of solving this problem is by multiplying. Since there are _____ sides and _____ inches on each side, _____ x _____" = ☐ inches. Another way of solving this problem is by multiplying the 3 inches by the number of sides which looks like this: _____" x _____ = ☐ inches. There are _______ inches around the triangle.

* * * * * * * * * * * * * * *



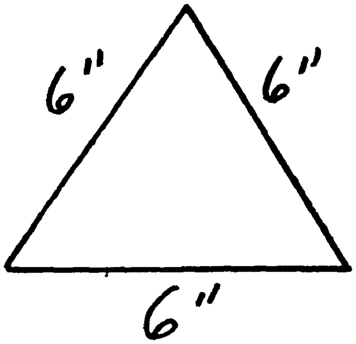
How many inches are on each side? _____ How many sides are there? _____ Since there are _____ inches on each side and there are _____ sides, _____" + _____" + _____" = ☐ inches. Another way of solving this problem is by multiplying. Since there are _____ sides and _____ inches on each side, _____ x _____" = ☐ inches. Another way of solving this problem is by multiplying the 4 inches by the number of sides which looks like this: _____" x _____ = ☐ inches. There are _____ inches around the triangle.

* * * * * * * * * * * * * * *



How many inches are there?____ How many sides are there?____ Since there are ____ inches on each side and there are ____ inches on each side and there are ____ sides, ____" + ____" + ____" = ☐ inches. Another way of solving this problem is by multiplying. Since there are ____ sides and ____ inches on each sid ____ x ____" = ☐ inches. Another way of solving this problem is by multiplying the 5 inches by the numbe of sides which looks like this: ____" x ____ =☐ inche There are ____ inches around the triangle.

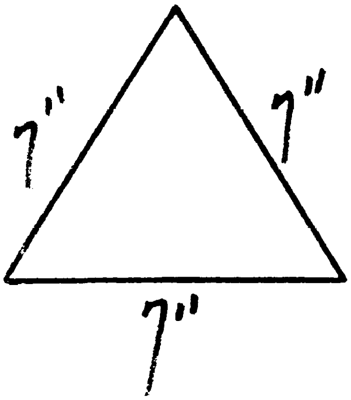
* * * * * * * * * * * * * * *



How many inches are on each side?____ How many side are there?____ Since there are ____ inches on each side and there are ____ sides, ____" + ____" + ____"

☐ inches. Another way of solving this problem is by multiplying. Since there are ____ sides and ____ inche on each side, ____ x ____" =☐ inches. Another way of solving this problem is by multiplying the 6 inches by the number of sides which looks like this:

____" x ____ = ☐ inches. There are ____ inches around the triangle.

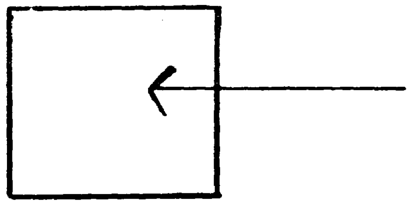


How many inches are on each side?____ How many sides are there?____ Since there are ____ inches on each side and there are ____ sides, ____" + ____" + ____" = ☐ inches. Another way of solving this problem is by multiplying. Since there are ____ sides and ____ inches on each side, ____ x ____" = ☐ inches. Another way of solving this problem is by multiplying the 7 inches by the number of sides which looks like this: ____" x ____ = ☐ inches. There are ______ inches around the triangle.

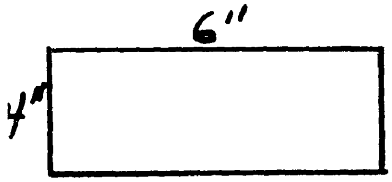
* * * * * * * * * * * * * * *

FINDING THE AREA

" is the symbol for inches. When you multiply inches by inches, you get square inches.

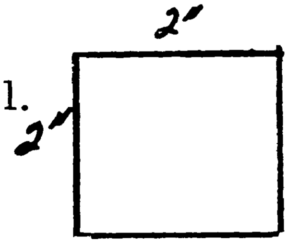


Area (inside the square)



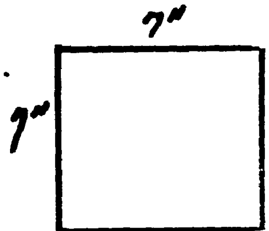
To find the area, you multiply the length by the width.

4" x 6" = $\boxed{24}$ square inches. L = length, W = width



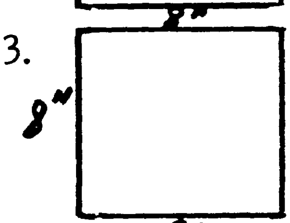
1. L x W = ☐ square inch

☐ x ☐



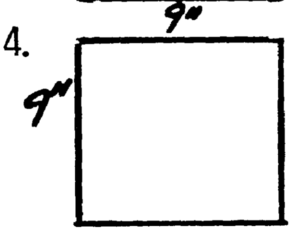
2. L x W = ☐ square inch

☐ x ☐



3. L x W = ☐ square incl

☐ x ☐

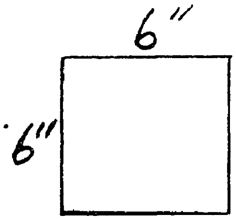


4. L x W = ☐ square inc

☐ x ☐

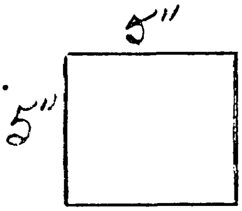
FINDING THE AREA

5.



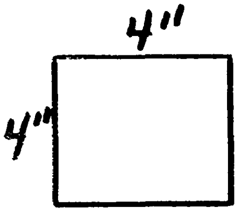
L ☐ X W ☐ = ☐ square inches

6.



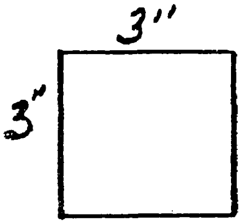
L ☐ X W ☐ = ☐ square inches

7.



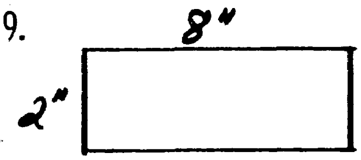
L ☐ X W ☐ = ☐ square inches

8.



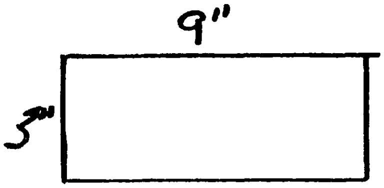
L ☐ X W ☐ = ☐ square inches

9.



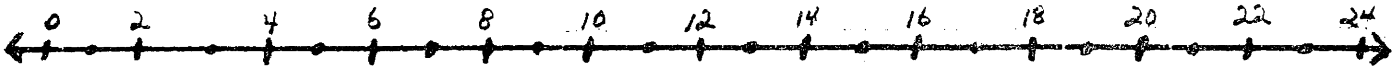
L ☐ X W ☐ = ☐ square inches.

10.



L ☐ X W ☐ = ☐ square inches.

COUNTING BY 2's



2 ____ ____ ____ 10 ____ ____ 16 ____ ____ ____ 24

2 x 1 = one two = ☐ $\begin{array}{r} 2 \\ x1 \\ \hline \end{array}$

2 x 2 = two twos = ☐ $\begin{array}{r} 2 \\ x2 \\ \hline \end{array}$

2 x 3 = three twos = ☐ $\begin{array}{r} 2 \\ x3 \\ \hline \end{array}$

2 x 4 = four twos = ☐ $\begin{array}{r} 2 \\ x4 \\ \hline \end{array}$

2 x 5 = five twos = ☐ $\begin{array}{r} 2 \\ x5 \\ \hline \end{array}$

2 x 6 = six twos = ☐ $\begin{array}{r} 2 \\ x6 \\ \hline \end{array}$

2 x 7 = seven twos = ☐ $\begin{array}{r} 2 \\ x7 \\ \hline \end{array}$

2 x 8 = eight twos = ☐ $\begin{array}{r} 2 \\ x8 \\ \hline \end{array}$

2 x 9 = nine twos = ☐ $\begin{array}{r} 2 \\ x9 \\ \hline \end{array}$

COUNTING BY 3's

3 ____ ____ ____ ____ 18 ____ ____ ____ ____ 33 ____

3 x 1 = one three = ☐ $\begin{array}{r}3\\ \text{x}1\\ \hline\end{array}$

3 x 2 = two threes = ☐ $\begin{array}{r}3\\ \text{x}2\\ \hline\end{array}$

3 x 3 = three threes = ☐ $\begin{array}{r}3\\ \text{x}3\\ \hline\end{array}$

3 x 4 = four threes = ☐ $\begin{array}{r}3\\ \text{x}4\\ \hline\end{array}$

3 x 5 = five threes = ☐ $\begin{array}{r}3\\ \text{x}5\\ \hline\end{array}$

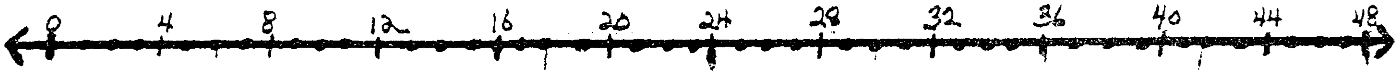
3 x 6 = six threes = ☐ $\begin{array}{r}3\\ \text{x}6\\ \hline\end{array}$

3 x 7 = seven threes = ☐ $\begin{array}{r}3\\ \text{x}7\\ \hline\end{array}$

3 x 8 = eight threes = ☐ $\begin{array}{r}3\\ \text{x}8\\ \hline\end{array}$

3 x 9 = nine threes = ☐ $\begin{array}{r}3\\ \text{x}9\\ \hline\end{array}$

COUNTING BY 4's



4 ____ ____ 16 ____ ____ 28 ____ ____ 40 ____ ____

4 x 1 = one four = ☐

4
x1
____

4 x 2 = two fours = ☐

4
x2
____

4 x 3 = three fours = ☐

4
x3
____

4 x 4 = four fours = ☐

4
x4
____

4 x 5 = five fours = ☐

4
x5
____

4 x 6 = six fours = ☐

4
x6
____

4 x 7 = seven fours = ☐

4
x7
____

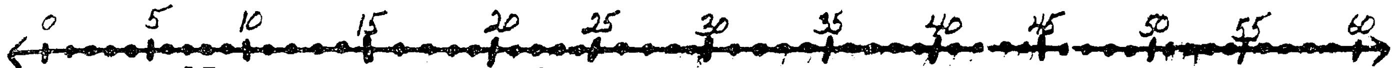
4 x 8 = eight fours = ☐

4
x8
____

4 x 9 = nine fours = ☐

4
x9
____

COUNTING BY 5's



5 ____ 15 ____ ____ 30 ____ ____ ____ 50 ____ ____

5 x 1 = one five = ☐

5
x1
____

5 x 2 = two fives = ☐

5
x2
____

5 x 3 = three fives = ☐

5
x3
____

5 x 4 = four fives = ☐

5
x4
____

5 x 5 = five fives = ☐

5
x5
____

5 x 6 = six fives = ☐

5
x6
____

5 x 7 = seven fives = ☐

5
x7
____

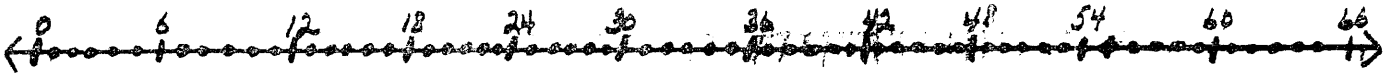
5 x 8 = eight fives = ☐

5
x8
____

5 x 9 = nine fives = ☐

5
x9
____

COUNTING BY 6's



6 ____ ____ ____ 30 ____ ____ ____ 54 ____ ____

6 x 1 = one six = ☐

6
x1

6 x 2 = two sixes = ☐

6
x2

6 x 3 = three sixes = ☐

6
x3

6 x 4 = four sixes = ☐

6
x4

6 x 5 = five sixes = ☐

6
x5

6 x 6 = six sixes = ☐

6
x6

6 x 7 = seven sixes = ☐

6
x7

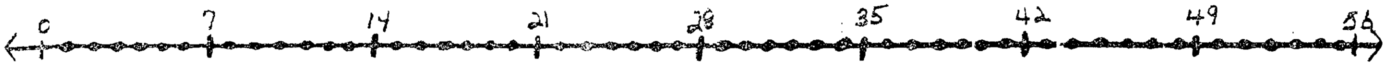
6 x 8 = eight sixes = ☐

6
x8

6 x 9 = nine sixes = ☐

6
x9

COUNTING BY 7's



7 _____ 21 _____ 35 _____ 49 _____ 63

7 x 1 = one seven = ☐

7
x1
____

7 x 2 = two sevens = ☐

7
x2
____

7 x 3 = three sevens = ☐

7
x3
____

7 x 4 = four sevens = ☐

7
x4
____

7 x 5 = five sevens = ☐

7
x5
____

7 x 6 = six sevens = ☐

7
x6
____

7 x 7 = seven sevens = ☐

7
x7
____

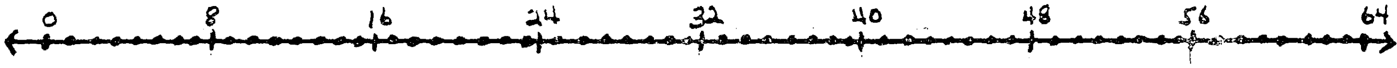
7 x 8 = eight sevens = ☐

7
x8
____

7 x 9 = nine sevens = ☐

7
x9
____

COUNTING BY 8's



8 _____ _____ 32 _____ _____ _____ _____

8 x 1 = one eight = ☐

$\begin{array}{r} 8 \\ \text{x}1 \\ \hline \end{array}$

8 x 2 = two eights = ☐

$\begin{array}{r} 8 \\ \text{x}2 \\ \hline \end{array}$

8 x 3 = three eights = ☐

$\begin{array}{r} 8 \\ \text{x}3 \\ \hline \end{array}$

8 x 4 = four eights = ☐

$\begin{array}{r} 8 \\ \text{x}4 \\ \hline \end{array}$

8 x 5 = five eights = ☐

$\begin{array}{r} 8 \\ \text{x}5 \\ \hline \end{array}$

8 x 6 = six eights = ☐

$\begin{array}{r} 8 \\ \text{x}6 \\ \hline \end{array}$

8 x 7 = seven eights = ☐

$\begin{array}{r} 8 \\ \text{x}7 \\ \hline \end{array}$

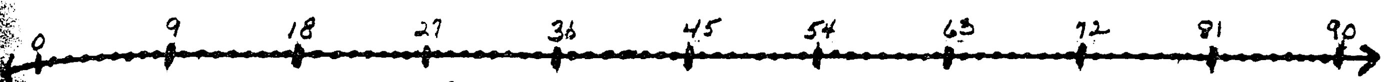
8 x 8 = eight eights = ☐

$\begin{array}{r} 8 \\ \text{x}8 \\ \hline \end{array}$

8 x 9 = nine eights = ☐

$\begin{array}{r} 8 \\ \text{x}9 \\ \hline \end{array}$

COUNTING BY 9's



9 ____ ____ ____ 45 ____ ____

9 x 1 = one nine = ☐

9
x1

9 x 2 = two nines = ☐

9
x2

9 x 3 = three nines = ☐

9
x3

9 x 4 = four nines = ☐

9
x4

9 x 5 = five nines = ☐

9
x5

9 x 6 = six nines = ☐

9
x6

9 x 7 = seven nines = ☐

9
x7

9 x 8 = eight nines = ☐

9
x8

x 9 = nine nines = ☐

9
x9

COUNTING BY 10's

10 ____ ____ ____ 50 ____ ____ ____ 90

10 x 1 = one ten = ☐

10
x1
____

10 x 2 = two tens = ☐

10
x2
____

10 x 3 = three tens = ☐

10
x3
____

10 x 4 = four tens = ☐

10
x4
____

10 x 5 = five tens = ☐

10
x5
____

10 x 6 = six tens = ☐

10
x6
____

10 x 7 = seven tens = ☐

10
x7
____

10 x 8 = eight tens = ☐

10
x8
____

10 x 9 = nine tens = ☐

10
x9
____

WHAT'S THE PATTERN?

Look for a pattern that will help you fill in the blanks.

2, 4, 6, 8, _______, _______, _______, _______, _______, _______.

8, 16, 24, 32, _______, _______, _______, _______, _______, _______.

1, 2, 3, 4, _______, _______, _______, _______, _______, _______.

7, 14, 21, 28, _______, _______, _______, _______, _______, _______.

3, 6, 9, 12, _______, _______, _______, _______, _______, _______.

4, 8, 12, 16, _______, _______, _______, _______, _______, _______.

5, 10, 15, 20, _______, _______, _______, _______, _______, _______.

6, 12, 18, 24, _______, _______, _______, _______, _______, _______.

WHAT'S THE PATTERN?

1 x the number + 2 =

Example:

2, $\boxed{4}$, 6, $\boxed{8}$ 10, $\boxed{12}$

3, ☐ , 7, ☐, 11, ☐

1, ☐ , 5, ☐, 9, ☐

4, ☐, 8, ☐ , 12, ☐

3 x the number + 2 =

1, 6, ☐

2, 9, ☐

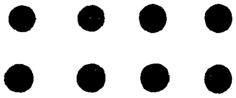
4, ☐

1 x the number + 3 = ☐

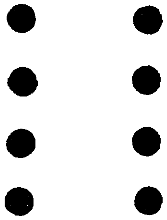
1, ☐, ☐ , ☐ , ☐ ,

3, ☐ , ☐ , ☐ ,

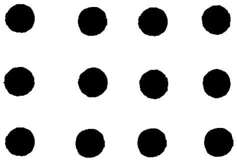
USING ARRAYS IN MULTIPLICATION



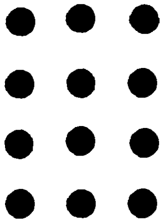
2 x 4 =



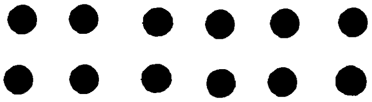
4 x 2 =



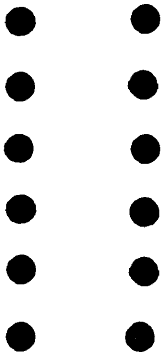
3 x 4 =



4 x 3 =

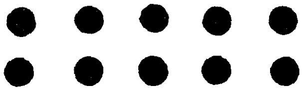


2 x 6 =

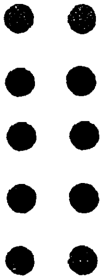


6 x 2 =

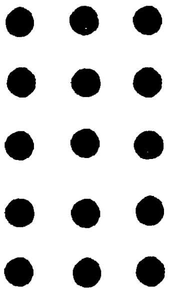
USING ARRAYS IN MULTIPLICATION



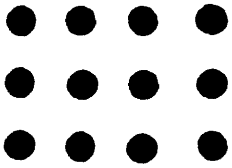
2 x 5 =



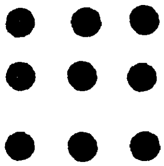
5 x 2 =



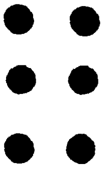
5 x 3 =



3 x 5 =

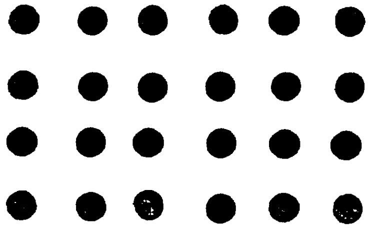


2 x 3 =

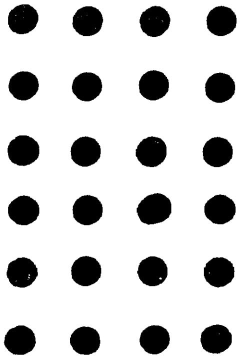


3 x 2 =

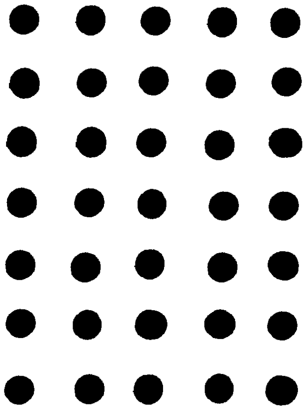
USING ARRAYS IN MULTIPLICATION



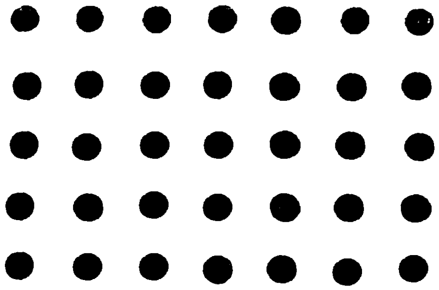
4 x 6 =



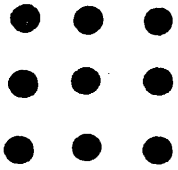
6 x 4 =



7 x 5 =



5 x 7 =



3 x 3 =

1 x 9 =

Can you show with dots that the answer is the same for any two numbers multiplied when the same numbers are reversed?

6 x 3

3 x 6

5 x 4

4 x 5

Complete the math sentences.

2 x 3 = ☐
3 x 2 = ☐

5 x 2 = ☐
2 x 5 = ☐

7 x 4 = ☐
4 x 7 = ☐

8 x 2 = ☐
2 x 8 = ☐

2 x 1 = ☐
1 x 2 = ☐

6 x 2 = ☐
2 x 6 = ☐

7 x 5 = ☐
5 x 7 = ☐

9 x 3 = ☐
3 x 9 = ☐

4 x 3 = ☐
3 x 4 = ☐

6 x 4 = ☐
4 x 6 = ☐

8 x 3 = ☐
3 x 8 = ☐

7 x 3 = ☐
3 x 7 = ☐

MATH SENTENCES

Complete the math sentences.

1 x 1 = ☐

1 x 2 = ☐

1 x 3 = ☐

1 x 4 = ☐

1 x 5 = ☐

1 x 6 = ☐

1 x 7 = ☐

1 x 8 = ☐

1 x 9 = ☐

2 x 1 = ☐

2 x 2 = ☐

2 x 3 = ☐

2 x 4 = ☐

2 x 5 = ☐

2 x 6 = ☐

2 x 7 = ☐

2 x 8 = ☐

2 x 9 = ☐

MATH SENTENCES

Complete the math sentences.

3 x 1 = ☐

3 x 2 = ☐

3 x 3 = ☐

3 x 4 = ☐

3 x 5 = ☐

3 x 6 = ☐

3 x 7 = ☐

3 x 8 = ☐

3 x 9 = ☐

3 x 0 = ☐

4 x 1 = ☐

4 x 2 = ☐

4 x 3 = ☐

4 x 4 = ☐

4 x 5 = ☐

4 x 6 = ☐

4 x 7 = ☐

4 x 8 = ☐

4 x 9 = ☐

4 x 0 = ☐

MATH SENTENCES

Complete the math sentences.

5 x 1 = ☐

5 x 2 = ☐

5 x 3 = ☐

5 x 4 = ☐

5 x 5 = ☐

5 x 6 = ☐

5 x 7 = ☐

5 x 8 = ☐

5 x 9 = ☐

5 x 0 = ☐

6 x 1 = ☐

6 x 2 = ☐

6 x 3 = ☐

6 x 4 = ☐

6 x 5 = ☐

6 x 6 = ☐

6 x 7 = ☐

6 x 8 = ☐

6 x 9 = ☐

6 x 0 = ☐

MATH SENTENCES

Complete the math sentences.

7 x 1 = ☐

7 x 2 = ☐

7 x 3 = ☐

7 x 4 = ☐

7 x 5 = ☐

7 x 6 = ☐

7 x 7 = ☐

7 x 8 = ☐

7 x 9 = ☐

7 x 0 = ☐

8 x 1 = ☐

8 x 2 = ☐

8 x 3 = ☐

8 x 4 = ☐

8 x 5 = ☐

8 x 6 = ☐

8 x 7 = ☐

8 x 8 = ☐

8 x 9 = ☐

8 x 0 = ☐

MATH SENTENCES

Complete the math sentences.

4 x 0 = ☐

9 x 0 = ☐

2 x 7 = ☐

3 x 3 = ☐

4 x 2 = ☐

5 x 3 = ☐

6 x 2 = ☐

8 x 1 = ☐

9 x 2 = ☐

8 x 3 = ☐

9 x 7 = ☐

9 x 9 = ☐

4 x 4 = ☐

4 x 5 = ☐

6 x 5 = ☐

6 x 4 = ☐

6 x 6 = ☐

9 x 3 = ☐

9 x 4 = ☐

9 x 5 = ☐

9 x 6 = ☐

9 x 8 = ☐

MATH SENTENCES

Complete the math sentences.

1 x 0 = ☐

2 x 2 = ☐

2 x 4 = ☐

3 x 0 = ☐

4 x 0 = ☐

2 x 5 = ☐

5 x 0 = ☐

1 x 6 = ☐

6 x 0 = ☐

7 x 0 = ☐

1 x 8 = ☐

2 x 6 = ☐

8 x 0 = ☐

9 x 0 = ☐

7 x 2 = ☐

1 x 3 = ☐

1 x 4 = ☐

1 x 5 = ☐

MULTIPLICATION GRID

Multiply to fill in the boxes.

X	0	1	2	3	4	5	6	7	8	9
0										
9										
8										
7										
6										
5										
4										
3										
2										
1										

Work each problem and write the answer above the problem; then write the correct symbol in the circle.

Symbols (>, <, =)

Example: $\overset{20}{(4 \text{ x } 5)}$ ⊜ $\overset{20}{(5 \text{ x } 4)}$

(2 x 4) ○ (4 x 2)

(3 x 2) ○ (7 x 4)

(2 x 2) ○ (3 x 4)

(5 x 3) ○ (3 x 5)

(8 x 3) ○ (6 x 4)

(7 x 7) ○ (6 x 7)

(2 x 9) ○ (3 x 9)

(4 x 1) ○ (3 x 4)

(8 x 1) ○ (9 x 5)

(3 x 3) ○ (4 x 7)

(7 x 2) ○ (4 x 5)

(6 x 3) ○ (9 x 4)

(8 x 2) ○ (4 x 4)

(5 x 4) ○ (3 x 7)

(5 x 8) ○ (9 x 5)

(8 x 4) ○ (3 x 9)

(7 x 5) ○ (8 x 4)

(7 x 3) ○ (4 x 7)

(9 x 7) ○ (9 x 8)

(2 x 3) ○ (4 x 5)

Work each problem and write the answer above the problem; then write the correct symbol in the circle.

(5 x 2) ○ (7 x 2)

(3 x 3) ○ (4 x 2)

(2 x 6) ○ (8 x 2)

(8 x 7) ○ (9 x 8)

(3 x 7) ○ (3 x 8)

(6 x 2) ○ (4 x 3)

(5 x 3) ○ (6 x 4)

(4 x 7) ○ (9 x 4)

(7 x 5) ○ (6 x 8)

(7 x 7) ○ (8 x 2)

(4 x 3) ○ (1 x 5)

(4 x 4) ○ (5 x 4)

(9 x 9) ○ (9 x 5)

(2 x 4) ○ (5 x 2)

(2 x 8) ○ (4 x 4)

(7 x 8) ○ (4 x 8)

(5 x 5) ○ (6 x 6)

(2 x 3) ○ (3 x 2)

Complete the math sentences.

2 x ☐ =4

3 x ☐ =18

6 x ☐ =18

9 x ☐ =18

2 x ☐ =18

6 x ☐ =30

5 x ☐ =30

7 x ☐ =42

6 x ☐ =42

1 x ☐ =1

5 x ☐ =25

8 x ☐ =72

9 x ☐ =72

2 x ☐ =2

3 x ☐ =3

4 x ☐ =0

1 x ☐ =0

5 x ☐ =40

8 x ☐ =40

2 x ☐ =14

Complete the math sentences.

3 x ☐ =6

2 x ☐ =10

3 x ☐ =9

4 x ☐ =16

2 x ☐ =16

5 x ☐ =15

2 x ☐ =12

7 x ☐ =21

5 x ☐ =20

4 x ☐ =8

4 x ☐ =12

4 x ☐ =20

3 x ☐ =21

7 x ☐ =14

3 x ☐ =15

8 x ☐ =16

5 x ☐ =10

8 x ☐ =24

Complete the math sentences.

3 x ☐ =12

8 x ☐ =8

7 x ☐ =7

6 x ☐ =6

5 x ☐ =5

3 x ☐ =27

9 x ☐ =27

9 x ☐ =0

8 x ☐ =0

6 x ☐ =0

9 x ☐ =36

4 x ☐ =36

7 x ☐ =35

5 x ☐ =35

6 x ☐ =36

4 x ☐ =36

10 x ☐ =50

5 x ☐ =50

5 x ☐ =45

Complete the math sentences.

Example:

3

(3 x 1) x $\boxed{4}$ = 12

(2 x 2) x ☐ = 12

(2 x 5) x ☐ = 20

(2 x 8) x ☐ = 32

(4 x 2) x ☐ = 56

(6 x 2) x ☐ = 36

(4 x 2) x ☐ = 64

(3 x 7) x ☐ = 42

(6 x 6) x ☐ = 36

(2 x 2) x ☐ = 16

(3 x 3) x ☐ = 18

(4 x 2) x ☐ = 72

(3 x 3) x ☐ = 72

(6 x 1) x ☐ = 54

(8 x 1) x ☐ = 48

(3 x 2) x ☐ = 48

(2 x 4) x ☐ = 80

(3 x 3) x ☐ = 81

(4 x 3) x ☐ = 48

(5 x 2) x ☐ = 40

(3 x 6) x ☐ =54

(2 x 9) x ☐ =54

Complete the math sentences.

Example:

$\overset{20}{(5 \times 4)} \times \boxed{2} = 40$

$(2 \times 4) \times \boxed{} = 40$

$(2 \times 2) \times \boxed{} = 8$

$(3 \times 3) \times \boxed{} = 36$

$(2 \times 3) \times \boxed{} = 12$

$(2 \times 4) \times \boxed{} = 24$

$(5 \times 1) \times \boxed{} = 25$

$(3 \times 1) \times \boxed{} = 9$

$(4 \times 3) \times \boxed{} = 24$

$(6 \times 2) \times \boxed{} = 24$

$(3 \times 2) \times \boxed{} = 36$

$(6 \times 3) \times \boxed{} = 36$

$(3 \times 3) \times \boxed{} = 27$

$(4 \times 2) \times \boxed{} = 16$

$(2 \times 3) \times \boxed{} = 30$

$(2 \times 4) \times \boxed{} = 16$

$(2 \times 4) \times \boxed{} = 32$

$(6 \times 2) \times \boxed{} = 24$

$(2 \times 5) \times \boxed{} = 20$

$(3 \times 4) \times \boxed{} = 12$

$(2 \times 5) \times \boxed{} = 20$

$(3 \times 2) \times \boxed{} = 42$

How many pairs of factors can you think of to complete each of the following problem

☐ x ☐ = 4

☐ x ☐ = 4

☐ x ☐ = 6

☐ x ☐ = 8

☐ x ☐ = 10

☐ x ☐ = 12

☐ x ☐ = 12

☐ x ☐ = 14

☐ x ☐ = 16

☐ x ☐ = 14

☐ x ☐ = 18

☐ x ☐ = 18

☐ x ☐ = 20

☐ x ☐ = 20

☐ x ☐ = 30

☐ x ☐ = 30

☐ x ☐ = 40

☐ x ☐ = 40

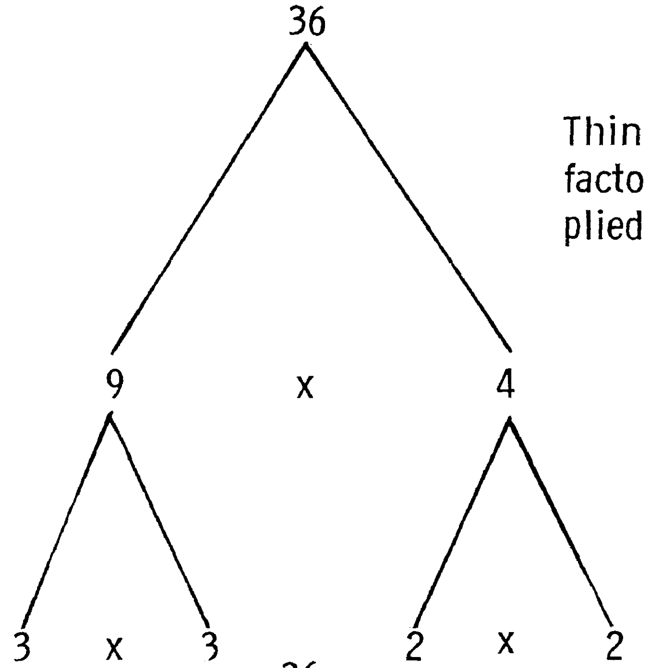
☐ x ☐ = 24

☐ x ☐ = 24

☐ x ☐ = 10

☐ x ☐ = 16

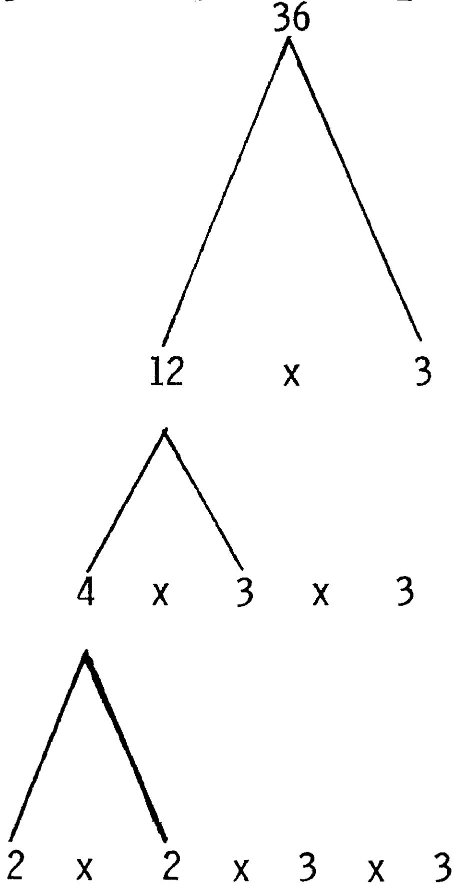
FACTOR TREES



Think: What two factors when multiplied equal 36?

Think: What two factors when multiplied equal 9?

Think: What two factors when multiplied equal 4?

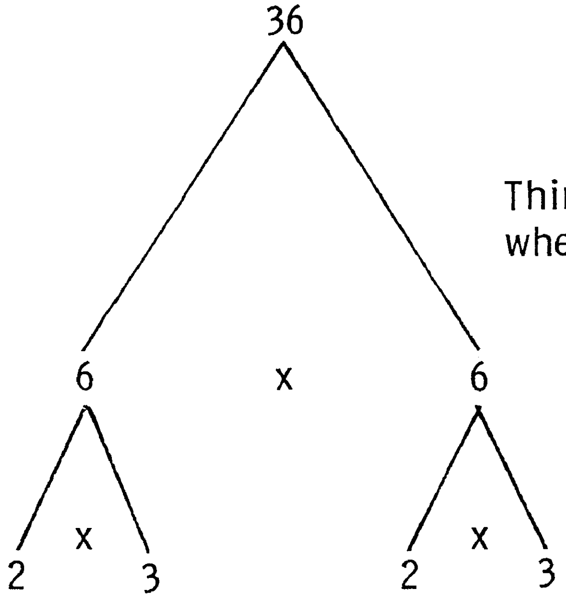


Think: What two factors when multiplied equal 36?

Think: What two factors when multiplied equal 12?

hink: What two factors
hen multiplied equal 4?

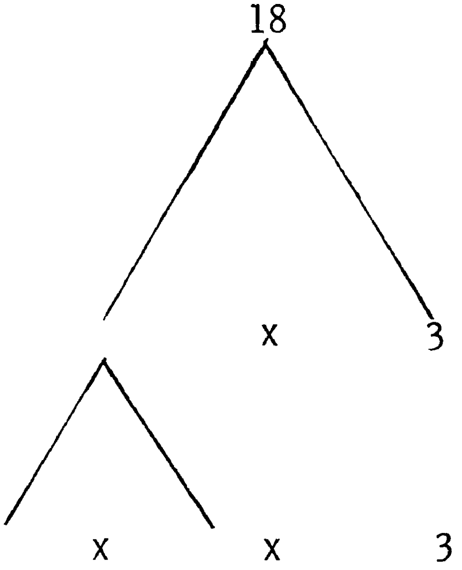
FACTOR TREES



Think: What two factors when multiplied equal 36?

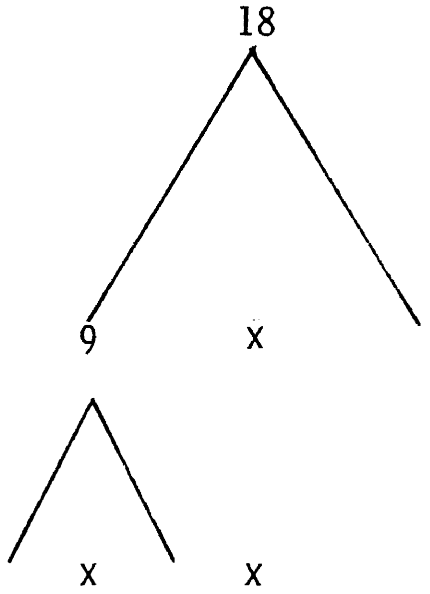
Think: What two factors when multiplied equal 6?

Look at the bottom factors of the factor tree. What numbers appear at the bottom of all "36" factor trees? ________, ________, ________, ________. Are the numbers arranged in the same order? ________ Do you find the same numbers appearing at the bottom of all the factor trees? ________ Does the arrangement of the numbers make a difference in the answer 36? ________



Think: What two factors when multiplied equal 18?

FACTOR TREES

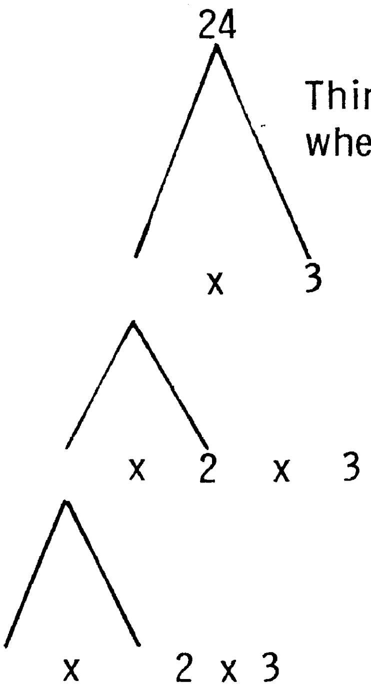


Think: What two factors when multiplied equal 18?

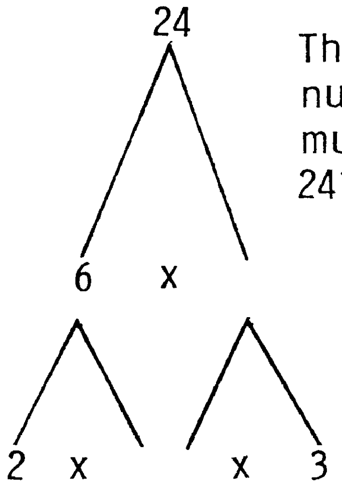
What are the numbers appearing at the end of both "18" factor trees?

________, ________, ________. Are the same numbers appearing at the bottom of both factor trees? ________ Are the numbers arranged in the same order? __________

FACTOR THE NUMBERS



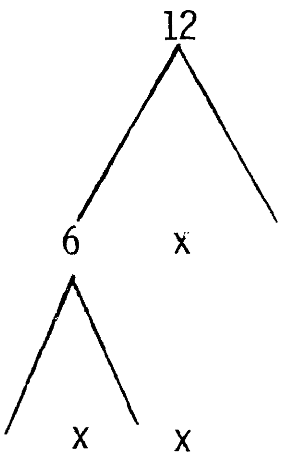
Think: What two numbers when multiplied equal 24?

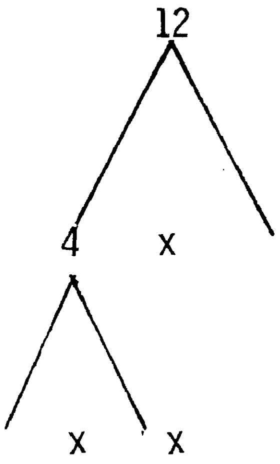


Think: What two numbers when multiplied equal 24?

What numbers appear at the bottom of the "24" factor trees?

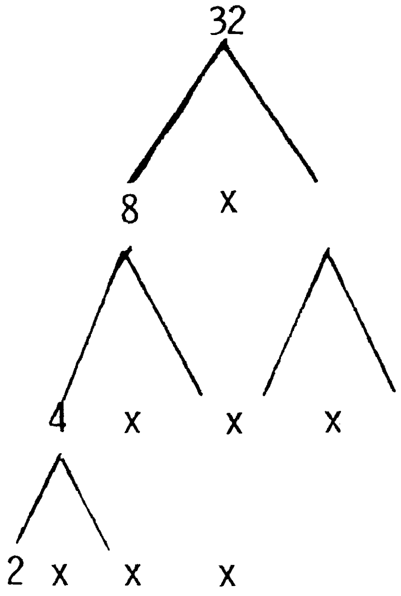
________, ________, ________, ________.

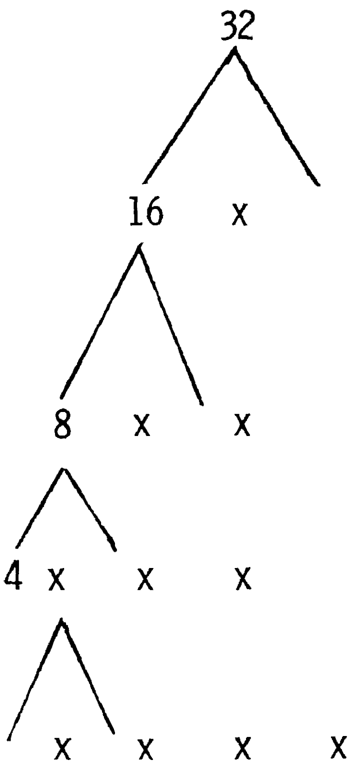




What numbers appear at the bottom of the "12" factor trees?

________, ________, ________.





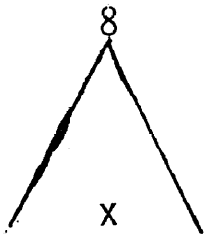
What numbers appear at the bottom of the "32" factor trees?

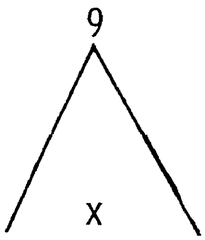
________, ________, ________, ________.

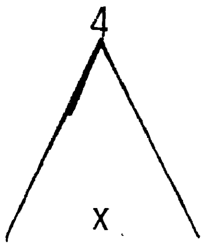
FACTOR TREES

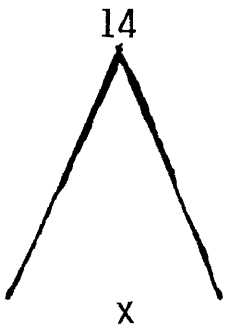
What numbers appear at the bottom of the "24" factor trees?

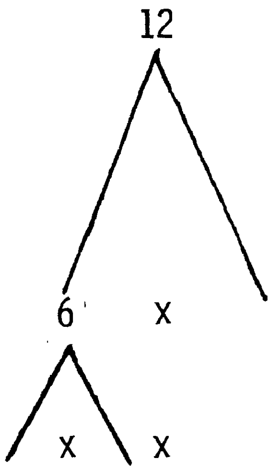
________, ________, ________, ________.

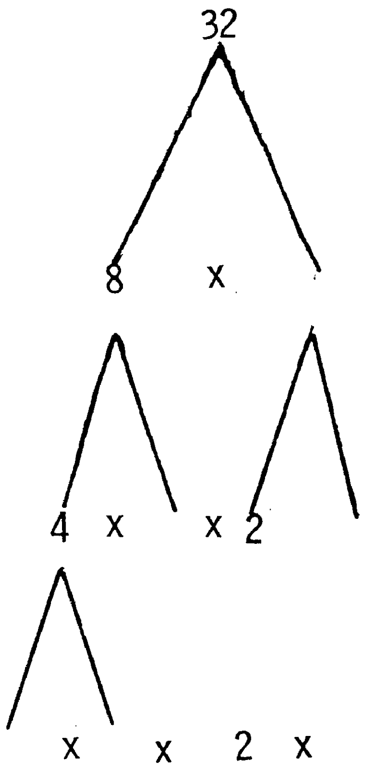




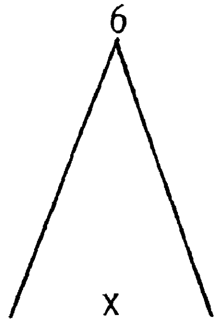


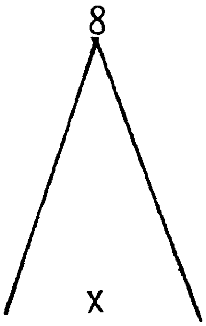


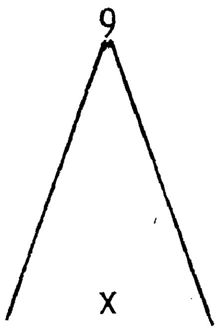


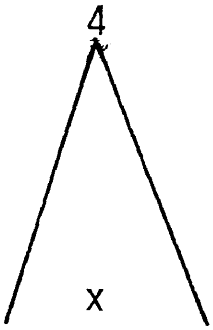


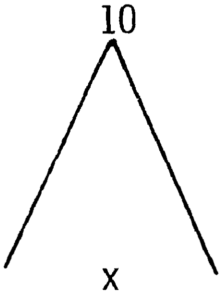
FACTOR TREES

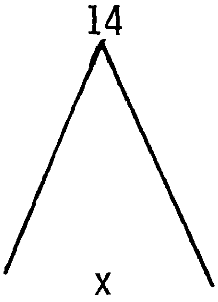


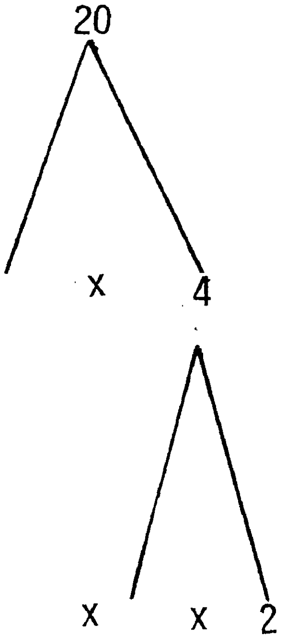


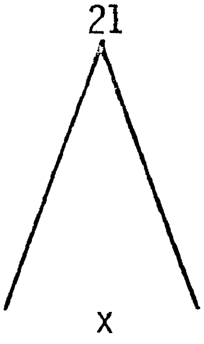


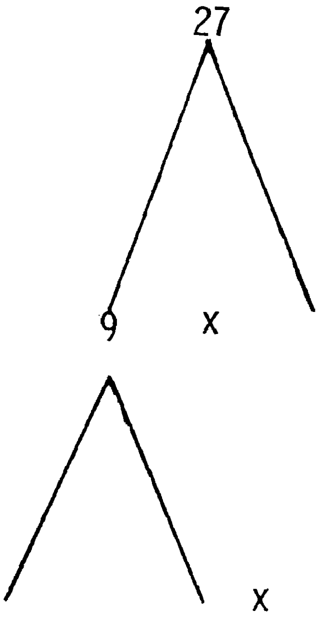


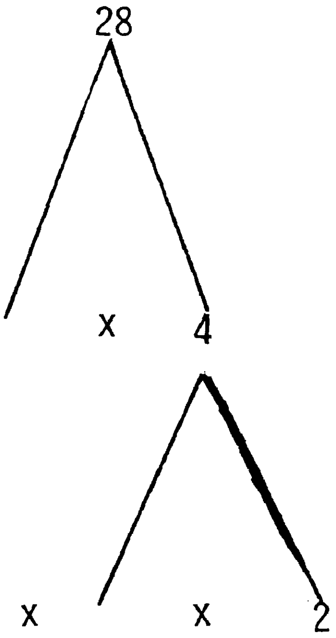












MULTIPLYING TENS AND ONES

tens	ones
2	5

= 20 + 5

$$\begin{array}{r} 25 \\ \underline{\times 3} \end{array}$$

Long Form

$$\begin{array}{rrl} 20 + 5 & & \\ \underline{\qquad \times \ 3} & & \\ 15 & (5 \times 3) & \\ \underline{60} & (20 \times 3) & \\ 75 & & \end{array}$$

tens	ones
4	3

= 40 + 3

$$\begin{array}{r} 43 \\ \underline{\times 2} \end{array}$$

Long Form

$$\begin{array}{rl} 40 \quad + \ 3 & \\ \underline{\qquad \times \ 2} & \\ = & (3 \times 2) \\ \underline{+ \qquad\qquad =} & (40 \times 2) \end{array}$$

tens	ones
5	2

= 50 + 2

$$\begin{array}{r} 52 \\ \underline{\times 4} \end{array}$$

Long Form

$$\begin{array}{rl} 50 \quad + \ 2 & \\ \underline{\qquad \times \ 4} & \\ = & (2 \times 4) \\ \underline{+ \qquad\qquad =} & (50 \times 4) \end{array}$$

tens	ones
3	4

= 30 + 4

$$\begin{array}{r} 34 \\ \underline{\times 5} \end{array}$$

Long Form

$$\begin{array}{rl} 30 \quad + \ 4 & \\ \underline{\qquad \times \ 5} & \\ = & (4 \times 5) \\ \underline{+ \qquad\qquad =} & (30 \times 5) \end{array}$$

MULTIPLYING TENS AND ONES

tens	ones
5	6

= 50 + 6

$$\begin{array}{r} 56 \\ \times 6 \\ \hline \end{array}$$

Long Form

$$\begin{array}{lcccl} 50 & & + & 6 & \\ & & \times & 6 & \\ \hline & & & & = (6 \times 6) \\ + & & & & = (50 \times 6) \\ \hline \end{array}$$

tens	ones
7	2

= 70 + 2

$$\begin{array}{r} 72 \\ \times 3 \\ \hline \end{array}$$

Long Form

$$\begin{array}{lcccl} 70 & & + & 2 & \\ & & \times & 3 & \\ \hline & & & & = (2 \times 3) \\ + & & & & = (70 \times 3) \\ \hline \end{array}$$

tens	ones
3	9

= 30 + 9

$$\begin{array}{r} 39 \\ \times 2 \\ \hline \end{array}$$

Long Form

$$\begin{array}{lcccl} 30 & & + & 9 & \\ & & \times & 2 & \\ \hline & & & & = (9 \times 2) \\ + & & & & = (30 \times 2) \\ \hline \end{array}$$

tens	ones
4	3

= 40 + 3

$$\begin{array}{r} 43 \\ \times 5 \\ \hline \end{array}$$

Long Form

$$\begin{array}{lcccl} 40 & & + & 3 & \\ & & \times & 5 & \\ \hline & & & & = (3 \times 5) \\ + & & & & = (40 \times 5) \\ \hline \end{array}$$

MULTIPLYING TENS AND ONES

tens	ones
7	7

= 70 + 7

$$\begin{array}{r} 77 \\ \underline{x7} \end{array}$$

Long Form

$$\begin{array}{lcr} 70 & + & 7 \\ & x & 7 \\ \hline \end{array}$$

= (7 x 7)

+ ____________ = (70 x 7)

tens	ones
8	2

= 80 + 2

$$\begin{array}{r} 82 \\ \underline{x5} \end{array}$$

Long Form

$$\begin{array}{lcr} 80 & + & 2 \\ & x & 5 \\ \hline \end{array}$$

= (2 x 5)

+ ____________ = (80 x 5)

tens	ones
7	6

= 70 + 6

$$\begin{array}{r} 76 \\ \underline{x4} \end{array}$$

Long Form

$$\begin{array}{lcr} 70 & + & 6 \\ & x & 4 \\ \hline \end{array}$$

= (6 x 4)

+ ____________ = (70 x 4)

MULTIPLYING TENS AND ONES

LONG FORM

Example:

tens	ones
6	4

$= 60 + 4$

$$64 \times 4 = (60 \times 4) + (4 \times 4)$$

$$= \boxed{240} + \boxed{16}$$

$$= 256$$

tens	ones
5	3

$= 50 + 3$

$$53 \times 3 = (50 \times 3) + (3 \times 3)$$

$$= \boxed{} + \boxed{}$$

= ____________

tens	ones
2	4

$= 20 + 4$

$$24 \times 2 = (20 \times 2) + (4 \times 2)$$

$$= \boxed{} + \boxed{}$$

= ____________

tens	ones
3	7

$= 30 + 7$

$$37 \times 3 = (30 \times 3) + (7 \times 3)$$

$$= \boxed{} + \boxed{}$$

= ____________

tens	ones
4	5

$= 40 + 5$

$$45 \times 2 = (40 \times 2) + (5 \times 2)$$

$$= \boxed{} + \boxed{}$$

= ____________

MULTIPLYING TENS AND ONES

LONG FORM

tens | ones
3 | 3 = 30 + 3
33 x3 = (30 x 3) + (3 x 3)
= ☐ + ☐
= ____________

tens | ones
4 | 9 = 40 + 9
49 x 3 = (40 x 3) + (9 x 3)
= ☐ + ☐
= ____________

tens | ones
6 | 2 = 60 + 2
62 x 5 = (60 x 5) + (2 x 5)
= ☐ + ☐
= ____________

tens | ones
8 | 4 = 80 + 4
84 x 4 = (80 x 4) + (4 x 4)
= ☐ + ☐
= ____________

tens | ones
3 | 5 = 30 + 5
35 x 6 = (30 x 6) + (5 x 6)
= ☐ + ☐
= ____________

MULTIPLYING TENS AND ONES

LONG FORM

tens	ones
7	2

= 70 + 2

72 x 3 = (70 x 3) + (2 x 3)

= ☐ + ☐

= ________

tens	ones
4	9

= 40 + 9

49 x 5 = (40 x 5) + (9 x 5)

= ☐ + ☐

= ________

tens	ones
6	4

= 60 + 4

64 x 3 = (60 x 3) + (4 x 3)

= ☐ + ☐

= ________

tens	ones
5	3

= 50 + 3

53 x 5 = (50 x 5) + (3 x 5)

= ☐ + ☐

= ________

tens	ones
2	3

= 20 + 3

23 x 3 = (20 x 3) + (3 x 3)

= ☐ + ☐

= ________

tens	ones
5	4

= 50 + 4

54 x 4 = (50 x 4) + (4 x 4)

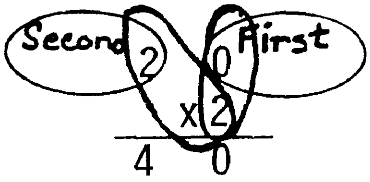
= ☐ + ☐

= ________

MULTIPLYING TENS AND ONES

SHORT FORM

Example:



70 x2	10 x6	20 x5	
30 x2	80 x2	10 x7	20 x6
40 x2	90 x2	10 x8	20 x7
50 x2	10 x3	10 x9	20 x8
10 x2	10 x4	20 x3	20 x9
60 x2	10 x5	20 x4	30 x3

MULTIPLYING TENS AND ONES

SHORT FORM

Example:

$$\begin{array}{r} {}^{2} \\ 4\,\text{FIRST}\,5 \\ \times\ \ 4 \\ \hline 180 \end{array}$$

(5 x 4 = 20 and 20 = 2 tens and 0 ones, so we write the 0 below under the ones column and write the 2 tens above in the tens column. The next step is to multiply 4 x 4 which = 16. Now Add. 2 + 16 = 18.

33 x7	33 x8	22 x7	22 x6
22 x5	33 x5	45 x2	27 x7
49 x4	49 x5	49 x3	49 x6

MULTIPLYING TENS AND ONES

SHORT FORM

21 x4	33 x3	42 x2	54 x2
22 x2	42 x5	42 x3	42 x4
55 x3	55 x4	55 x6	55 x5
64 x2	64 x3	64 x4	64 x5
44 x2	44 x3	44 x4	44 x5
46 x3	46 x4	46 x5	44 x6

MULTIPLYING HUNDREDS, TENS, AND ONES

LONG FORM

442 = 400 + 40 + 2

442 x 2 = (400 x 2) + (40 x 2) + (2 x 2)

= ☐ + ☐ + ☐

= ____________________

512 = 500 + 10 + 2

512 x 1 = (500 x 1) + (10 x 1) + (2 x 1)

= ☐ + ☐ + ☐

= ____________________

426 = 400 + 20 + 6

426 x 3 = (400 x 3) + (20 x 3) + (6 x 3)

= ☐ + ☐ + ☐

= ____________________

MULTIPLYING HUNDREDS, TENS, AND ONES

LONG FORM

123 = 100 + 20 + 3

$$\begin{array}{r} 123 \\ \underline{\text{x}2} \end{array} \quad = \quad \begin{array}{rl} 100 + 20 + 3 & \\ \underline{\qquad\qquad \text{x}2} & \\ 6 & = (3 \text{ x } 2) \\ 40 & = (20 \text{ x } 2) \\ \underline{+ \qquad 200} & = (100 \text{ x } 2) \\ 246 & \end{array}$$

212 = 200 + 10 + 2

$$\begin{array}{r} 212 \\ \underline{\text{x}2} \end{array} \quad = \quad \begin{array}{rl} 200 + 10 + 2 & \\ \underline{\qquad\qquad \text{x}2} & \\ & = (2 \text{ x } 2) \\ & = (10 \text{ x } 2) \\ \underline{+ \qquad\qquad\quad} & = (200 \text{ x } 2) \end{array}$$

324 = 300 + 20 + 4

$$\begin{array}{r} 324 \\ \underline{\text{x}2} \end{array} \quad = \quad \begin{array}{rl} 300 + 20 + 4 & \\ \underline{\qquad\qquad \text{x}2} & \\ & = (4 \text{ x } 2) \\ & = (20 \text{ x } 2) \\ \underline{+ \qquad\qquad\quad} & = (300 \text{ x } 2) \end{array}$$

232 = 200 + 30 + 2

232 x 5 = (200 x 5) + (30 x 5) + (2 x 5)

= $\qquad\qquad$ + $\qquad\qquad$ +

= ____________________

MULTIPLYING HUNDREDS, TENS, AND ONES

LONG FORM

345 = 300 + 40 + 5

345 x 2 = (300 x 2) + (40 x 2) + (5 x 2)

= + +

= ____________________

222 = 200 + 20 + 2

222 x 4 = (200 x 4) + (20 x 4) + (2 x 4)

= + +

= ____________________

333 = 300 + 30 + 3

333 x 4 = (300 x 4) + (30 x 4) + (3 x 4)

= + +

= ____________________

452 = 400 + 50 + 2

452 x 4 = (400 x 4) + (50 x 4) + (2 x 4)

= + +

= ____________________

145 = 100 + 40 + 5

145 x 3 = (100 x 3) + (40 x 3) + (5 x 3)

= + +

= ____________________