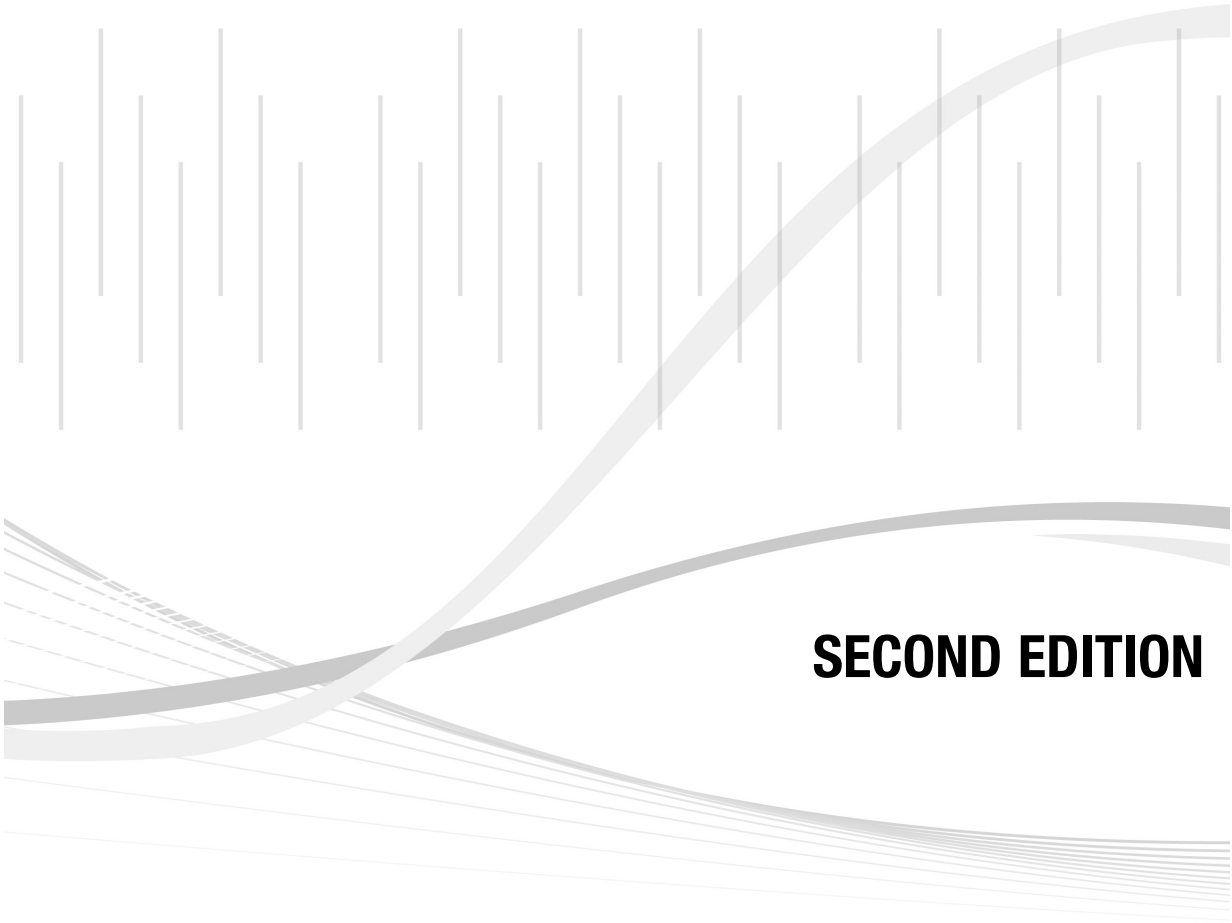
Real-Life Math

ALGEBRA



SECOND EDITION

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How to Use This Series

The *Real-Life Math* series is a collection of activities designed to put math into the context of real-world settings. This series contains math appropriate for pre-algebra students all the way up to pre-calculus students. Problems can be used as reminders of old skills in new contexts, as an opportunity to show how a particular skill is used, or as an enrichment activity for stronger students. Because this is a collection of reproducible activities, you may make as many copies of each activity as you wish.

Please be aware that this collection does not and cannot replace teacher supervision. Although formulas are often given on the student page, this does not replace teacher instruction on the subjects to be covered. Teaching notes include extension suggestions, some of which may involve the use of outside experts. If it is not possible to get these presenters to come to your classroom, it may be desirable to have individual students contact them.

We have found a significant number of real-world settings for this collection, but it is not a complete list. Let your imagination go, and use your own experience or the experience of your students to create similar opportunities for contextual study.

Introduction

Organization

The book is organized around four themes of interest to students: Sports, Money, Science/Technology, and Travel/Transportation. There are eight topics addressing key algebraic concepts: Literal Equations—Formulas; Ratios, Proportions, and Percents; Data and Graphs; Systems of Equations I and II; Quadratics; Nonlinear Functions; and Miscellaneous topics. There are four activities for each of the eight topics, making a total of 32 student activities.

NCTM Standards

The activities address many of the NCTM standards for grades 9 through 12: algebra, data analysis and probability, problem solving, communication, connections, and representation.

Order of Activities and Time Considerations

The activities are arranged to reflect the order in which algebraic concepts are presented in many textbooks. You can use this resource to enrich a concept presented in your textbook or use the activities as an introduction to a new concept. The activities can be done in any order; however, before students start the Systems of Equations activities, they should have some facility with the concepts presented in the first part of the book.

Because students' ability levels and schools' schedules vary greatly, time suggestions for the activities are not given. Prior to using an activity, review it and decide how much time would be appropriate for your students.

Level of Difficulty

Some activities use more difficult algebraic concepts than others. As a general rule, the activities in the second half of the book are more difficult than those in the first half. The lessons that are less difficult mathematically still involve higher-order thinking skills.

Graphing Calculators and Other Technology

Students should have access to graphing calculators. However, keep in mind that many students have difficulty choosing appropriate settings (e.g., intervals for the x and y axes) for their graphs. Review with them how to choose correct settings prior to using the activities. In addition, many of the lessons ask students to build tables, find lines and curves of best fit, and perform linear, quadratic, and exponential regressions. You may want to review these functions on your specific model of graphing calculator prior to using the activities with your students. It's always tricky to know whether to allow students to construct graphs by hand first and then use their graphing calculators, or to let them use the graphing calculator right from the start. Experiment, and decide which method works best. In some of the activities, students can use spreadsheet, word processing, graphing, and desktop publishing software.

Name _____ Date _____

1. The Grass Is Greener

Imagine you are a baseball coach at a large high school. You are about to write a memo to the athletic director (AD) requesting funding to resod the baseball field. Because the Athletic Department's budget is always very tight, you know that the AD will ask you to carefully document the costs that you submit. Devise and carry out a plan to calculate how much sod you will need for the baseball field. Use the baseball field at your school as a model for making the plan.

Sod Information

- One roll of sod covers 40 square yards.
- The price per roll is $98.

Make a Plan

1. Consult with the other members of your group. Devise a strategy to determine the amount of sod you will need for the baseball field. The formulas below may prove useful (b = base; h = height; s = side; r = radius; N = a central angle measuring $N°$).

   area of a triangle: $\frac{1}{2}bh$ area of a trapezoid: $\frac{1}{2}h(b_1 + b_2)$

   area of a rectangle: bh area of a circle: π^2

   area of a square: s^2 area of a sector: $\frac{N}{360}\pi r^2$

2. On a separate sheet of paper, describe your plan for measuring the baseball field. Then have your teacher approve the plan.
3. Carry out your plan and measure the baseball field.
4. Review the plan you gave to the teacher. Describe any modifications you had to make to your original plan after you started measuring.
5. What are the dimensions of the baseball field?

6. How many square feet of sod will you need?

7. How many rolls of sod will you request?

8. What is the total cost of the sod?

9. On a separate sheet of paper, draft a memo to the athletic director stating your request. Include an enclosure showing how you arrived at your cost.

teacher's page

2. My First Car

Context

money

Topic

literal equations—formulas

Overview

In this activity, students calculate monthly payments for cars they would like to buy.

Objectives

Students will be able to:

- calculate monthly payments using a formula
- evaluate the impact on monthly payments as parameters change

Materials

- one copy of the Activity 2 handout for each student
- classified ads or publications selling cars
- computers with spreadsheet program (optional)

Teaching Notes

- Students can work individually, with a partner, or in small groups for this activity.
- Model using the formula for calculating monthly payments prior to having students use it. You may wish to suggest that students use a spreadsheet for the formula.
- Remind students to change annual percentage rates from percentages to decimals, and point out to them that n is the number of months—not years—of the loan.
- Students could also use online car ads if they have access to the Internet.

Answers

Answers will vary depending on cars selected.

Extension Activity

Students can investigate other loan types and calculate monthly loan payments.

Name _____ Date _____

2. My First Car

Deciding what type of car to buy is a big decision. Unless you can pay cash for a car, the decision can be made for you by how much you can afford to pay each month. If you borrow money, the amount you pay each month depends on how much you borrow, for how long, and at what interest rate. Work through the questions below to find out how monthly payments change depending on the amount of the loan, the interest rate, and the length of the loan.

The formula for calculating the monthly payment of a loan is given below.

$$m = \frac{A(\frac{r}{12})(1+\frac{r}{12})^n}{(1+\frac{r}{12})^n - 1}$$

In the formula, m = the monthly payment, A = the amount of the loan, r = the annual interest rate (expressed as a decimal), and n = the number of months of the loan.

1. Look through the classified ads section of the newspaper or other publication and choose three different cars to buy. List the three cars and their prices below.

Cars and Prices

Car name			
Price			

2. Use the formula listed above to calculate the monthly payment of the cars you have selected. In this case, let n = 48 months (4 years) and r = 8.25%. List the monthly payments in the table.

Monthly Payments on a 4-Year Loan

Car name			
Monthly payment			

(continued)

teacher's page

13. Only a Matter of Time

Context

sports

Topic

systems of equations

Overview

In this activity, students assume the role of a sportswriter who has been assigned to write an article comparing the performance of men and women in sporting events.

Objectives

Students will be able to:

- analyze and interpret data
- derive linear equations from data
- graph and interpret linear equations
- use data and graphs to draw conclusions

Materials

- one copy of the Activity 13 handout for each student
- graph paper
- graphing calculators
- reference material that contains historical sports information, such as almanacs and sports encyclopedias

Teaching Notes

- Students can work individually or in pairs on this activity.
- Introduce the activity by asking a question such as "Do you suppose there are any athletic events in which men's and women's winning times are the same?" You may want to follow up with a question such as "Is it possible that in the future, women will surpass men in certain athletic events?"
- It's difficult to compare men's and women's sporting events because often all factors are not equal. It is best to consider timed sporting events in which the format and conditions of the event are identical.
- Some students are unsure of how to begin constructing a graph. Make sure those students are clear on how to select axes and appropriate intervals.
- Likewise, when they are using graphing calculators, many students have difficulty choosing appropriate settings for their graphs. Review this procedure prior to using the activity.
- Students should have some familiarity working with lines of best fit and doing linear regressions.

(continued)

Name _____ Date _____

13. Only a Matter of Time

Imagine you have been hired as a sportswriter for a new sports magazine. Your new boss, the magazine's editor, has just reviewed the latest demographic report of its readership and is concerned about the magazine's shortage of female readers. This is a new magazine, and the editor wants to increase readership. He can't afford to let half the market slip away. So the editor assigns you the job of writing an article that highlights female athletes. After doing some initial research, you notice a trend in sporting events in which men and women compete against the clock. You have done your research and have collected a lot of data, and you are now ready to analyze the data to support your article.

The winning times and years for the men's and women's Olympic 100-meter freestyle are listed in the tables below. Use the information to answer the questions that follow.

Men's 100-Meter Freestyle

Year	Time (seconds)
1920	61.4
1924	59.0
1928	58.6
1932	58.2
1936	57.6
1948	57.3
1952	57.4
1956	55.4
1960	55.2
1964	53.4
1968	52.2
1972	51.2
1976	50.0
1980	50.4
1984	49.8
1988	48.6
1992	49.0
1994	48.7
1996	48.7
2000	48.3
2004	48.17

Women's 100-Meter Freestyle

Year	Time (seconds)
1920	73.6
1924	72.4
1928	71.0
1932	66.8
1936	65.9
1948	66.3
1952	66.8
1956	62.0
1960	61.2
1964	59.5
1968	60.0
1972	58.6
1976	55.7
1980	54.8
1984	55.9
1988	54.9
1992	54.6
1994	54.5
1996	54.5
2000	53.83
2004	53.84

Source: www.databaseolympics.com

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