

PROGRAMMED MATHEMATICS FOR NURSES

SIXTH EDITION

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Programmed Mathematics for Nurses

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Preface

A New Way to Learn the Mathematics of Nursing

Here is an enjoyable way to learn the mathematics of nursing. In numerous tests, we have determined that a relaxed student, using this pleasant new system, can learn to solve the many types of problems that may be encountered in the giving of medications and in the preparation of solutions. Its purpose is to show that the mathematics of nursing is not something to be afraid of, but rather an old friend that we are now using for problems in nursing.

The secret lies in a group of new psychological principles that make up the *reinforced learning system*. These new principles were discovered in psychological experiments conducted in the laboratories of Columbia and Harvard universities, and we acknowledge with warm thanks the debt we owe to the team of professors led by Fred S. Keller and William N. Schoenfeld of the Department of Psychology, Columbia University, and to B. F. Skinner of Harvard University, who over a period of years developed the underlying principles that we applied in creating this new training method.

Unlike an ordinary text that must be studied and memorized, this *reinforced learning* course asks the student to solve a logical series of problems. After responding to each problem, students can immediately check their work against the correct answer.

Each problem is designed to stimulate the student to *think out* the correct answer on the basis of information already learned. Sometimes the student's response will be incorrect. However, because the correct answer is immediately read after making a mistake, learning is quick and easy.

This book presents a wealth of detailed information but, because each concept is broken down into a series of interesting questions and problems, the student will be able to master the most difficult subjects without tedious rote learning.

About the Sixth Edition

Programmed Mathematics for Nurses includes 20 chapters dealing with various aspects of the subjects of units and measurements, and miscellaneous medications and procedures. Three appendixes are also included. At three points in the text you will be given an opportunity to review by means of practice tests.

Included in the sixth edition is a section on IV pumps and also separate chapters on geriatric and antineoplastic medications. Since more and more hospitals are using computers for all types of purposes, the chapter on computers has been completely revised and updated, with a special emphasis on *drug interactions*. In addition, computer printouts for medication orders have been used throughout the book in order to provide direct examples of the types of medication problems that will be encountered in hospital situations.

The apothecaries' system, although no longer taught in most nursing schools, is still used in some hospitals. Therefore, the section on the apothecaries' system has been taken out of the main text and placed in an appendix. Practice tests in the apothecaries' system also appear there.

Don't Worry if You Make Mistakes

Adults learn from their mistakes. Our experience with the reinforced learning system shows that the number of errors a student makes does not necessarily measure ability. As long as you are immediately aware that you have made a mistake, you will quickly learn to make the correct response. Therefore, don't worry if you make errors.

We believe that your reinforced learning course in the mathematics of nursing offers the best and easiest way to learn the subject, and we wish you success in taking the course.

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Abbreviations Used in Prescriptions and Doctors' Orders *Opposite Back Cover*

Table of Most Commonly Used Equivalents *Inside Back Cover*

Fractions**Units and
Measurements****Section 1 Multiplying a Fraction by a Whole
Number**

A fraction represents one number divided by another number. For instance, the fraction $\frac{2}{3}$ represents *2 divided by 3*.

Express each of the following as fractions:

1. $3 \div 5$
2. $1 \div 10$
3. $18 \div 61$
4. $2 \div 9$

Look at the following fraction carefully:

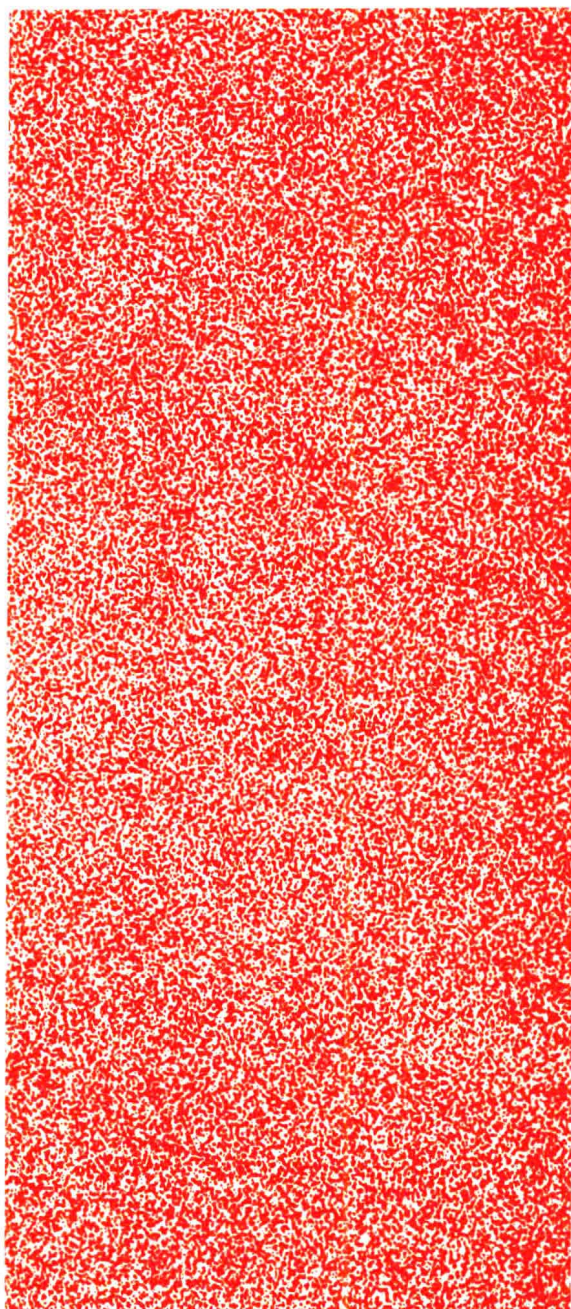
$$\frac{3}{4}$$

The number above the line is called the numerator; the number below the line is called the denominator.

5. What is the numerator of $\frac{3}{4}$?

Remember that the number above the line is called the numerator.

6. What is the numerator of $\frac{9}{13}$?



7. What is the denominator of $\frac{3}{4}$?

Remember that the denominator is the number below the line.

8. What is the numerator of $\frac{16}{41}$?

9. What is the numerator of $\frac{27}{95}$?

10. What is the denominator of $\frac{43}{157}$?

Now let us consider how to multiply a fraction by a whole number.

Notice the two steps for multiplying $\frac{2}{3} \times 6$.

Step 1: Multiply the numerator by the whole number.

$$\frac{2}{3} \times 6 = \frac{12}{3}$$

Step 2: Divide the result by the denominator.

$$\frac{12}{3} = 4$$

That's all there is to it.

To multiply a fraction by a whole number, multiply the numerator by the whole number and divide the new fraction by the denominator.

Multiply each of the following examples.

11. $\frac{1}{3} \times 9$

12. $\frac{1}{2} \times 8$

13. $\frac{2}{3} \times 18$

14. $\frac{2}{9} \times 27$

15. $\frac{4}{5} \times 10$

16. $\frac{1}{6} \times 24$

17. $\frac{3}{8} \times 16$

18. $\frac{2}{7} \times 14$

Passing score is no more than 2 errors. If you failed to achieve a passing score, repeat the section.

Section 2 Simplifying Improper Fractions

Look at the following fraction:

$$\frac{24}{5}$$

Notice that the numerator is larger than the denominator. Whenever the numerator is larger than the denominator, the fraction is known as an *improper fraction*.

Look at the following number.

$$2\frac{1}{2}$$

Whenever a number consists of a whole number and a fraction, it is known as a *mixed number*.

Let us consider the procedures for simplifying an improper fraction.

Look at the following fraction:

$$\frac{25}{4}$$

Bear in mind that $\frac{25}{4}$ represents 25 divided by 4.

1. Can 25 be divided evenly by 4?

Here is how to simplify an improper fraction:

Divide the numerator by the denominator. If the numerator cannot be divided evenly by the denominator, express the result as a mixed number.

Let us try several problems.

Express each of the following improper fractions as mixed numbers.

2. $\frac{31}{5}$

3. $\frac{25}{8}$

4. $\frac{53}{9}$

5. $\frac{49}{8}$

6. $\frac{79}{11}$

7. $\frac{81}{8}$

8. $\frac{53}{7}$

9. $\frac{15}{8}$

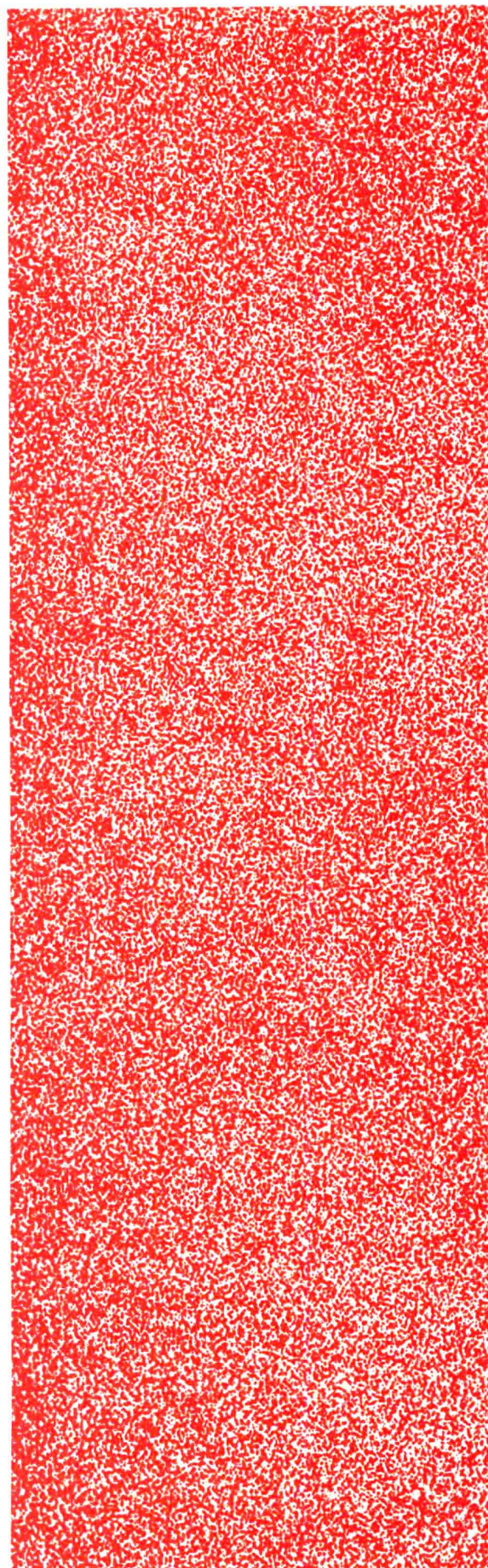
10. $\frac{26}{5}$

Read the following carefully:

$$\frac{3}{8} \times 5 = \frac{15}{8} = 1\frac{7}{8}$$

Whenever you are multiplying fractions, if the result is an improper fraction, divide the numerator by the denominator. If the numerator of the result cannot be evenly divided by the denominator, express the result as a mixed number.

Let us try several problems.



Multiply the following numbers.

11. $\frac{2}{3} \times 10$

12. $\frac{5}{7} \times 9$

13. $\frac{3}{8} \times 5$

14. $\frac{5}{12} \times 7$

15. $\frac{6}{11} \times 5$

16. $\frac{3}{8} \times 9$

Passing score is no more than 2 errors.

Section 3 Multiplying Two Fractions

To multiply two fractions, multiply their numerators and also multiply their denominators.

For example:

$$\frac{1}{2} \times \frac{3}{4} = \frac{1 \times 3}{2 \times 4} = \frac{3}{8}$$

Let us try a few problems.

Multiply each of the following fractions.

1. $\frac{5}{6} \times \frac{1}{3}$

2. $\frac{7}{4} \times \frac{1}{8}$

3. $\frac{8}{9} \times \frac{1}{5}$

4. $\frac{3}{5} \times \frac{1}{7}$

5. $\frac{1}{4} \times \frac{3}{5}$

6. $\frac{5}{7} \times \frac{6}{11}$

7. $\frac{1}{3} \times \frac{11}{9}$

8. $\frac{7}{13} \times \frac{2}{3}$

Passing score is no more than 1 error.

Section 4 Simplifying Fractions

Read the following example carefully.

$$\frac{7}{8} \times \frac{5}{4} = \frac{35}{32} = 1\frac{3}{32}$$

Whenever the result of multiplying two fractions is an improper fraction, the result is simplified by changing it to a mixed number.

1. Simplify $\frac{35}{32}$ by changing it to a mixed number.

2. Multiply and simplify $\frac{11}{4} \times \frac{3}{7}$.

Multiply each of the following fractions and express the answers as mixed numbers.

3. $\frac{27}{4} \times \frac{1}{5}$

4. $\frac{17}{5} \times \frac{3}{4}$

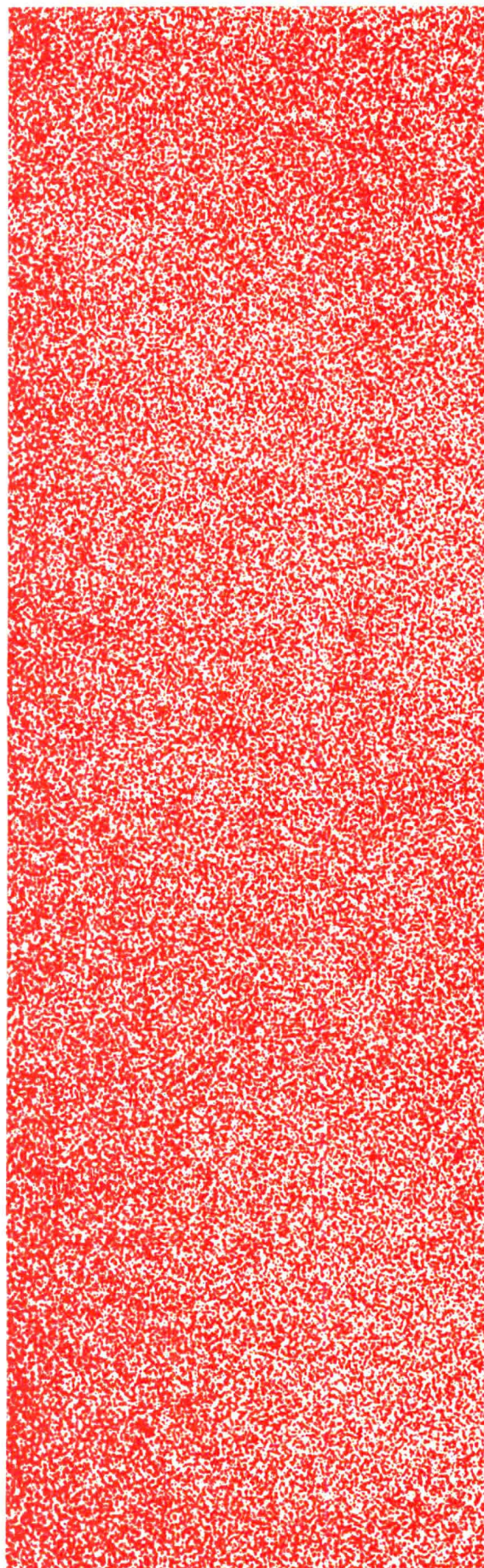
5. $\frac{7}{13} \times \frac{5}{2}$

6. $\frac{6}{7} \times \frac{11}{5}$

7. $\frac{21}{2} \times \frac{1}{4}$

8. $\frac{19}{3} \times \frac{1}{2}$

9. $\frac{9}{2} \times \frac{5}{4}$

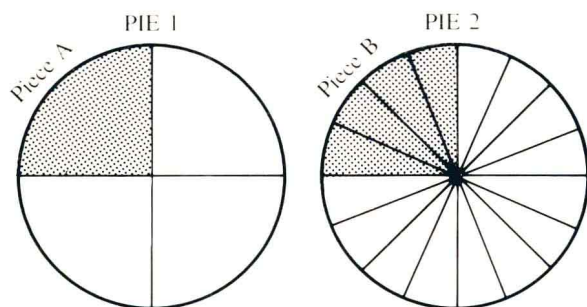


10. $\frac{7}{8} \times \frac{9}{1}$

Passing score is no more than 1 error.

Section 5 Simplifying Fractions (cont.)

Look at the diagrams below.



1. Into how many pieces has Pie 1 been divided?
2. How would you describe the size of Piece A?
3. Into how many pieces has Pie 2 been divided?
4. How would you describe the size of Piece B?

Look again at the diagrams.

Notice that A and B are exactly the same size. However, describing the size of the piece as $\frac{1}{4}$ is simpler than describing it as $\frac{4}{16}$.

Read the following carefully.

$$\frac{3}{8} \times \frac{1}{3} = \frac{3}{24}$$

However, $\frac{3}{24} = \frac{1}{8}$.

The result of multiplying two fractions is usually expressed in the simplest terms.

Let us find out how to reduce a proper fraction to its simplest terms.

Consider the following fraction:

$$\frac{2}{4}$$

5. What is the largest number by which the numerator and the denominator can both be divided *evenly*?

Notice what happens when both the numerator and denominator are divided by 2.

$$\frac{2 \div 2}{4 \div 2} = \frac{1}{2}$$

Consider the following fraction:

$$\frac{4}{8}$$

6. What is the largest number by which the numerator and denominator can both be divided *evenly*?

Notice what happens when both the numerator and denominator are divided by 4.

$$\frac{4 \div 4}{8 \div 4} = \frac{1}{2}$$

To reduce any fraction, try to find the largest number by which both the numerator and denominator can be divided evenly. Dividing the numerator and denominator by the same number reduces the fraction.

Let us try a few problems. Consider the following fraction:

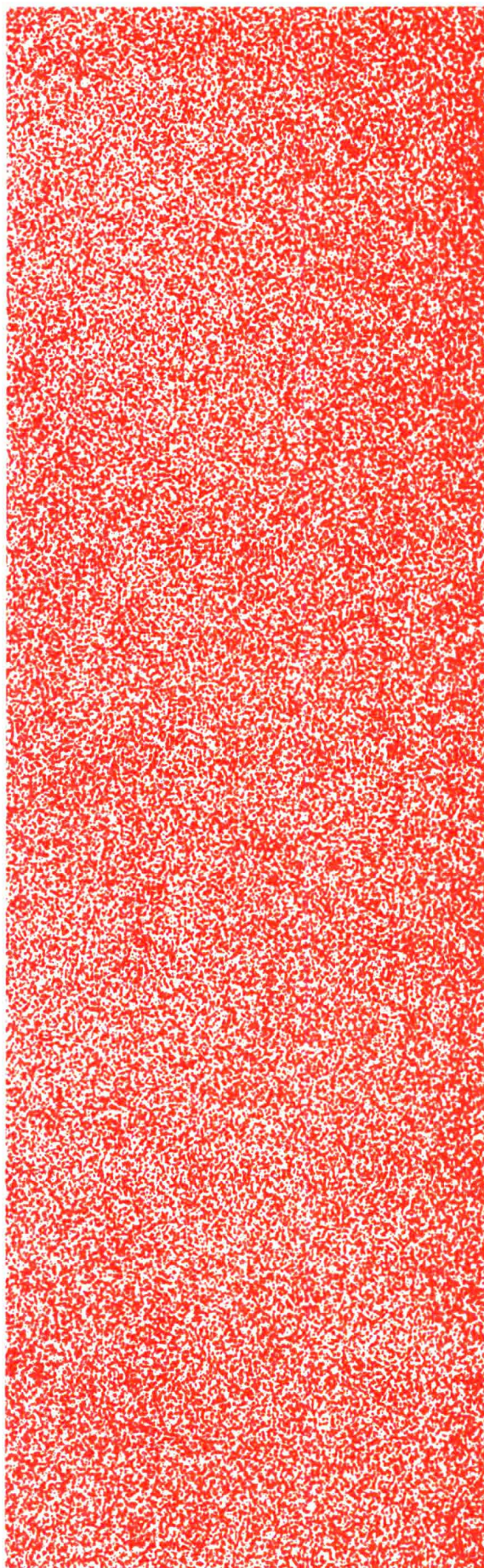
$$\frac{3}{9}$$

7. What is the largest number by which both the numerator and denominator can be evenly divided?

Consider the following fraction:

$$\frac{5}{15}$$

8. What is the largest number by which both the numerator and denominator can be evenly divided?
9. Reduce the fraction to its simplest terms by dividing both the numerator and denominator by 5.



Consider the following fraction:

$$\frac{12}{16}$$

10. What is the largest number by which both the numerator and denominator can be evenly divided?
11. Reduce the fraction to its simplest terms by dividing both the numerator and denominator by 4.

12. Reduce $\frac{6}{9}$ to its simplest terms.

13. Reduce $\frac{6}{8}$ to its simplest terms.

Reduce each of the following fractions to its simplest terms.

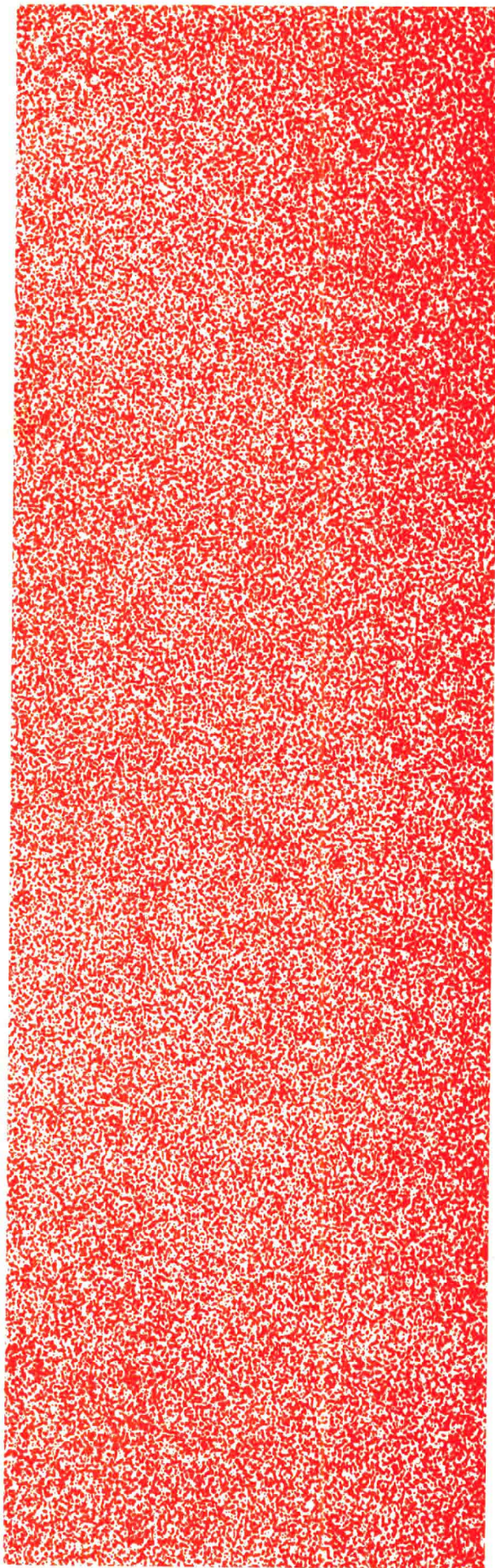
14. $\frac{7}{49}$

15. $\frac{4}{12}$

16. $\frac{8}{10}$

17. $\frac{10}{25}$

18. $\frac{3}{9}$



19. $\frac{24}{42}$

20. $\frac{16}{20}$

21. $\frac{14}{42}$

22. $\frac{80}{100}$

Passing score is no more than 2 errors.

Section 6 Simplifying Fractions (cont.)

Look at the following fraction:

$$\frac{28}{36}$$

Notice that the numbers in the numerator and denominator are rather large. Because the numbers are large, you may find it difficult to determine the *largest* number by which both the numerator and denominator can be divided evenly.

Here's all you do.

Notice that the numerator and denominator are even numbers. Therefore, the fraction can be reduced by dividing both numerator and denominator by 2. For example:

$$\frac{28}{36} = \frac{14}{18}$$

Notice that the numerator and denominator are still even numbers. Therefore, the fraction can be further simplified by dividing again by 2.

$$\frac{14}{18} = \frac{7}{9}$$

