# MATH BLASTER!™

by Janice G. Davidson, Ph.D.
and Richard K. Eckert, Jr.

Atari/Commodore 64 Version

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*To our children,*
*Elizabeth, Emilie, and John Davidson,*
*Noel and Christopher Eckert,*
*who have taught us so much about learning.*

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## Math Blaster!

**has received the following awards for excellence:**

BEST IN CHILDREN'S MEDIA
—*Parents' Choice*

BEST NEW PRODUCT OF THE YEAR
Education Category
—Softsel/*BusinessWeek*

TOP SELLER 1984
Education/Home Category
—*Software Retailing*

TEACHER CERTIFIED
—National Education Association

# INTRODUCTION

Welcome to MATH BLASTER!

You will find MATH BLASTER an interesting and exciting way to learn basic mathematical facts. The program contains extensive data files of facts in addition, subtraction, multiplication, division, fractions, decimals and percents. The program also contains a versatile, easy-to-use editor which allows you to enter your own set of facts to use with all the learning activities.

MATH BLASTER was designed to accomplish three major objectives:

1. to help you memorize math facts that are essential to building basic math skills

2. to help improve your accuracy and increase your speed

3. to build math skills in an interesting, entertaining, and effective way.

Each of the program's 25 data files provides concentrated attention on "families" of facts. These are facts that should be memorized. You should know them instantly without stopping to calculate. For this reason, during the program when a 2 digit answer is called for, you will NOT be asked to type in the answer from right to left as if you were calculating it, but from left to right as if you were recalling it.

MATH BLASTER is useful for the elementary student who must master the mathematical facts which are essential building blocks for more advanced mathematics. (It's a wonderful way to learn multiplication tables!)

The section on fractions and decimals is especially helpful to the 6th or 7th grade student preparing for algebra and higher math. The more difficult files, such as the fraction/percent equivalents, can help the college-bound student to increase speed so essential to a high SAT score.

MATH BLASTER can also be effective as a brush-up tool for the adult who wishes to sharpen his math skills. Mastery of these facts is valuable in quickly and accurately making various day to day computations, as well as useful in making more difficult, involved calculations.

MATH BLASTER was designed by Dr. Janice Davidson and programmed by Richard Eckert. The data files were designed by Cathy Johnson, a math teacher who has been using computers as an instructional tool for the past six years.

MATH BLASTER was tested on students at the educational facility of Upward Bound in Palos Verdes, California. In private sessions under the direction of an instructor, Upward Bound's students significantly increased their speed and sharpened their accuracy. Students who spent 15 to 20 minutes daily on MATH BLASTER's well-designed, fast-moving activities made impressive gains. You will find, as these students have, that learning math facts has never been so much fun, so exciting and so effective!

# GETTING STARTED

## Included in this Package

In this package you will find:

- a MATH BLASTER Program Disk
- a MATH BLASTER Data Disk
- the manual which you are now reading.

On the front side of each disk is the Atari version of MATH BLASTER. On the reverse side of each disk is the Commodore version. Be sure to use the correct side of each disk. The Atari side will not run on the Commodore computer and vice versa.

## What You Need

To use **MATH BLASTER - Atari version** you need:

- an Atari 800, 800XL, 1200XL, 65XE, or 130XE computer
- a monitor (or tv)
- an 850, 1050 or compatible disk drive
- the MATH BLASTER Program Disk (front side)
- the MATH BLASTER Data Disk (front side)
- a printer (optional)
- a joystick (optional)

To use the **MATH BLASTER - Commodore version** you need:

- a Commodore 64 or 128 computer
- a monitor (or tv)
- a 1541 or compatible disk drive
- the MATH BLASTER Program Disk (reverse side)
- the MATH BLASTER Data Disk (reverse side)
- a printer (optional)
- a joystick (optional).

Keep this manual handy and refer to it often until you are thoroughly familiar with the program.

## Starting the Program

Before you begin, make a copy of the data disk to have as a back-up. Use the copy program designed for your computer. See page 6.

To run **MATH BLASTER - Atari version,** follow these steps.

1. Make sure your computer is off, and that there is no disk in the drive. Turn on the disk drive.

2. Insert the MATH BLASTER Program Disk into the disk drive.

3. Turn on the computer and the monitor.

To run **MATH BLASTER - Commodore version** follow these steps:

1. Make sure your computer is off, and that there is no disk in the disk drive. First, turn on the disk drive; then, turn on the computer.

2. Insert the MATH BLASTER Program Disk into the disk drive.

3. Type LOAD"MATH BLASTER",8 <Return>.

4. When the disk drive stops running, type RUN <Return>. Be patient, it takes about a minute and a half to load.

After a brief introduction, you will be asked the following:

- your name
- color/monochrome
- joystick/keyboard

Then you will be instructed to remove the Program Disk and insert the Data Disk.

The Main Menu will appear on thè screen. You may select Addition, Subtraction, Multiplication, Division, or Fractions and Decimals. Item 6 on the Main Menu allows you to list the problems which you entered using MATH BLASTER'S editor.

1. Select a level. Each subject has 5 levels. (See the Appendix for help in selecting a level.)

2. You may select any of these four learning activities:

    1. Look and Learn
    2. Build Your Skill
    3. Challenge Yourself
    4. Math Blaster!

In the chapter "Using the Program," each activity is described in detail.

## Back-Up Copies

**Program Disk** - The Program Disk is protected and you will not be able to make a copy of it. However, if you wish to have a back-up copy on hand, you may purchase one for $10.00 from Davidson & Associates, Inc. This can be done when you return your Warranty Card or by writing to Davidson & Associates, Inc. You must have a Warranty Card on file in order to purchase a back-up copy. Davidson & Associates provides a one year warranty and will replace, free of charge, a malfunctioning or damaged disk.

**Data Disk** - The Data Disk is not protected and you should make a back-up copy.

**Atari** - Boot the Data Disk. Answer No to the format question. When the cursor appears, type DOS <Return>. When the DOS menu appears on the screen, remove the Data Disk and insert the blank disk. Choose option I to format the disk, then select option J to duplicate the data disk.

**Commodore** - Use the copy program designed for your computer.

# USING THE PROGRAM

## Selecting a Subject and a Level

You may select addition, subtraction, multiplication, division, or fractions, decimals and percents. Each subject has five levels.

The levels for addition, subtraction, multiplication, and division are sequential in difficulty.

In the fractions, decimals and percents section,

Level 1 provides practice in reducing common fractions,

Level 2 drills on renaming improper fractions,

Level 3 is concerned with renaming common fractions as decimals,

Level 4 focuses on renaming decimals as percents,

Level 5 provides practice in renaming percents as fractions.

You may want to use the following as a guide to help you select a level.

ADDITION

Level 1 - Grade 1
Level 2 - Grade 1
Level 3 - Grade 2
Level 4 - Grade 2
Level 5 - Grade 3

SUBTRACTION

Level 1 - Grade 2
Level 2 - Grade 2
Level 3 - Grade 2
Level 4 - Grade 3
Level 5 - Grade 3

MULTIPLICATION

Level 1 - Grade 3
Level 2 - Grade 3
Level 3 - Grade 3
Level 4 - Grade 4
Level 5 - Grade 4

DIVISION

Level 1 - Grade 3
Level 2 - Grade 3
Level 3 - Grade 3
Level 4 - Grade 4
Level 5 - Grade 4

FRACTIONS AND DECIMALS

Level 1 - Grade 5
Level 2 - Grade 5
Level 3 - Grade 6
Level 4 - Grade 6
Level 5 - Grade 6

The grades specified are the grades in which the facts are usually introduced in school. Any level is appropriate for practice, review and mastery as needed by the older student.

You may find it helpful to look at the Appendix of this manual to view the problems presented on each level for each subject.

## Working through the Exercises

Once you have selected a level, begin with Look and Learn and continue working through the activities in the order they are presented.

**Look and Learn** - This activity presents the facts contained in the file. You will be asked to choose the

horizontal display $4 + 6 = 10$

vertical display

$$\begin{array}{r} 4 \\ +\ 6 \\ \hline 10 \end{array}$$

or a mixed display which alternately presents the two formats.

Each fact will be displayed for 4 seconds. If you wish to change the display time, press M for more time or L for less time.

**Build your Skill** - This activity asks you to recall what you have just learned. You may choose the horizontal, vertical, or mixed format. When the problem appears on the screen, type in the answer <Return>. When you finish, your score will be displayed. You will then have an opportunity to retake the items you missed. Retake them until you get a perfect score.

**Challenge Yourself** - This activity requires that you not only know the math fact but reason with it as well. The problem will be presented with a part of it missing. Type in the number or numbers of the missing part <Return>. When you finish, your score will be displayed. Again, you will have an opportunity to retake the items you missed. Retake them until you get a perfect score.

**Math Blaster!** - Math Blaster! is a fast-action arcade game that reinforces learning in an interesting and exciting way. The object of the game is to shoot the man out of the cannon at the correct answer. The problem appears at the bottom of the screen. The correct answer will be one of four choices displayed at the top of the screen. Each game consists of 30 math facts.

You may use either the keyboard or a joystick to play MATH BLASTER! If you use the keyboard, press K to move the man left, and L to move the man right. Press Z to shoot.

On the left side of the screen is a seal bouncing a ball on his nose. The seal serves as a timer for each problem. You must shoot the man out of the cannon before the ball returns to the seal's nose.

Watch the balloon! On the right side of the screen is a balloon that is floating down to the platform. Beware! There is a needle on the platform, and if the balloon pops, the game will be over. You must move your man over to the right and have him push the balloon back up in the air again to keep the game going. Use the Z key or the button on your joystick to do this.

The game can be played at five speeds. Begin with the regular speed and proceed to faster speeds as you gain proficiency.

The faster you are able to play the game, the higher your score will be. Of course, getting a high score requires a thorough knowledge of the math facts.

## Special Features

**Positive Reinforcement** - Throughout the MATH BLASTER program, your correct answers are rewarded with positive, encouraging messages. You are never scolded for an incorrect answer. If your first response is incorrect, you will be asked to "Try again." After a second incorrect response, the correct answer will appear. In the Build your Skill and Challenge Yourself activities, you will receive a special message for each group of ten correct answers and for a perfect score. Learning has never been so much fun!

**Reviewing the Items You Missed** - At the conclusion of Build your Skill and Challenge Yourself, MATH BLASTER will give you an opportunity to retake the items you missed, allowing you to concentrate your efforts on only those facts you have not yet mastered.

**Escape Feature** - The ESC key (Atari) or f1 key (Commodore) allows you to leave an activity at any time during the program. Simply press the key and the program returns you to the menu.

**Elapsed Time Indicator** - You will note an elapsed time indicator at the bottom right hand corner of the screen during the Build your Skill and Challenge Yourself activities. It is counting the number of seconds it takes you to answer the problem. This will show you how much your speed is improving.

# USING THE EDITOR

You can enter your own list of problems with MATH BLASTER's easy-to-use editor. Use them with all four learning activities.

Many different kinds of editors were tested in the development of this software package. The editor selected was one which had the greatest versatility. It allows you to make corrections with ease as well as to add or remove items from the file.

To use the editor, you will need:

- the MATH BLASTER Program Disk
- a new, formatted disk on which to save your new list of problems.

Follow the steps outlined below.

### Step 1 - Composing your Data File

First, compose your list of problems on paper. For each list you will need:

- 5 to 30 problems
- a line of directions which will appear under the problem in the Build Your Skill activity (no more than 25 characters and spaces in length)
- a line of directions for the Challenge Yourself activity.

Use the following guidelines for your problems.

- Each set of problems must contain at least 5 problems, but no more than 30 problems.

- Each list must contain at least 5 different answers.

- The maximum length for each problem is 18 characters and spaces, with no more than 6 to the right of the equal sign.

- Use only one operation sign (+, −, *, #) in each problem.

- DO NOT use commas or colons at any point in the file.

- You may type words (your directions) only on lines 1 and 2 of each file. Words or letters inserted within the problems themselves will NOT allow the program to work properly.

- Symbols that will work properly with the program are:

  + (for addition)
  − (for subtraction)
  * (for multiplication)
  # (for division)
  = (for the equal sign)
  % (for the percent sign)
  / (for fractions)
  . (for the decimal point)

No other symbols will work correctly with the MATH BLASTER Program.

## Step 2 - Formatting a New Data Disk

Follow the instructions below to format a new blank disk.

**MATH BLASTER - Atari version**

You will need a disk formatted for DOS 2.Ø.

Turn on your disk drive and insert the MATH BLASTER Data Disk. Then turn on your computer to boot the Data Disk. Follow the instructions that appear on the screen.

**MATH BLASTER - Commodore version**

If your computer is off, make sure there is no disk in the drive. Turn on the printer first, if you plan to use one. Turn on the disk drive before turning on the computer.

Insert the new blank disk that you have labeled "Additional Data" into the disk drive.

Type OPEN15,8,15,"NEWØ:BLASTER VOLUME 2,Ø2" <Return>.

When the disk drive light goes out, the disk formatting process is completed.

## Step 3 - Accessing the Editor

**MATH BLASTER - Atari version**

Turn on the disk drive and insert the MATH BLASTER Program Disk. Turn on the computer.

Press E (for editor) while the program is loading.

Select light or dark background (L/D).

Remove the Program Disk and insert your own formatted data disk.

Press the space bar, and the Editor screen will appear.

**MATH BLASTER - Commodore version**

Insert the MATH BLASTER Program Disk into the disk drive.

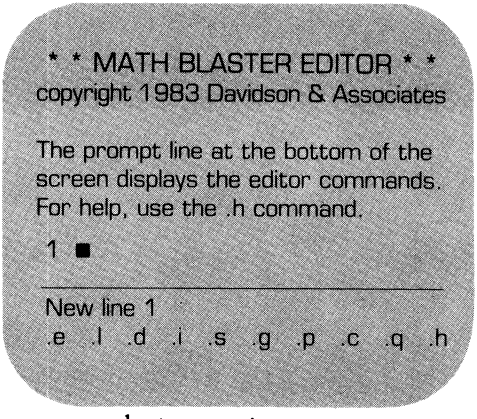
Type LOAD "EDITOR",8 <Return>.

Type RUN <Return>.

Select light or dark background (L/D).

Remove the Program Disk and insert your formatted data disk.

Press the space bar, and the Editor screen will appear.




The editor is now ready to receive your new set of problems.

STOP AND READ CAREFULLY all the remaining steps before proceeding.

## STEP 4 - Entering your New Data File

Use the following guidelines when you type in your new problems.

- On line 1, type in the directions (i.e. TYPE THE QUOTIENT) for Build your Skill and press <Return>.

- On line 2, type in the directions for Challenge Yourself (i.e. TYPE THE MISSING DIVIDEND) and press <Return>. Even if these directions are the same as those in line 1, they must be typed in again if they are to appear on the screen during this activity.

- On line 3, type in the first problem on your list <Return>. Press the space bar between each part of the problem and before and after the equal sign. For example, to enter the problem 2 + 2 = 4

  type 2
  press space bar
  type +
  press space bar
  type 2
  press space bar
  type =
  press space bar
  type 4
  press <Return>.

- Use the * for a multiplication sign. Use the # for a division sign. Use the + for addition and the dash – for subtraction.

- On line 4, type in the second problem <Return>.

- On line 5, type in the third problem <Return>.

- Continue typing a problem on each line until you have entered your entire list. Remember, there must be at least 5 (with 5 DIFFERENT answers) and no more than 30 problems in each file.

The following is a sample file for your reference.

```
1 TYPE THE QUOTIENT
2 TYPE THE MISSING DIVIDEND
3 6 # 2 = 3
4 10 # 5 = 2
5 12 # 2 = 6
6 8 # 2 = 4
7 15 # 3 = 5
```

Be sure to follow the format exactly as it is outlined. You can easily correct any errors you make, either at the time you make them or later. See the COMMANDS OF THE EDITOR section.

### Step 5 - Saving your File

To save the new file onto your data disk follow the instructions below. (Don't worry; this step is reversible. If you find an error later, you can easily access the file and correct it.)

- Be sure your formatted disk is inserted into the disk drive.

- Type .s <Return>.

- When you are asked "Save file name?" type in the name of your data file using no more than 8 characters (Atari) or 15 characters and spaces (Commodore).

- Be sure that you do NOT duplicate a file name already on the disk. Press .d to list the files.

The bottom of the screen will look something like this:

```
33  .s
Save file name?  set1
```

When you press <Return>, the disk will whirl and your file will be saved onto the disk.

To test your file with the program, exit the editor by typing .q and follow the instructions on the screen.

If you are not going to test your file at this time, be sure to remove the disk from the drive before turning off the computer or the drive.

### Step 6 - Using your New File

To use your new file with the MATH BLASTER program, follow these steps.

- Start the program as outlined in the Getting Started section of the manual.

- Insert your new data disk.

- When you are asked to select a subject, press 6 (Data Disk) and a list of all the files on your data disk will be displayed.

- Type in the number (Commodore) or the name (Atari) of the file you wish to access <Return>.

## Editing your New File

You may want to change a problem or edit your file to correct an error. To do this:

- Access the editor as described in Step 3.
- Type .g (to get the file) <Return>.
- Enter the name of your file <Return>.
- If you aren't sure of the name, type .d to list the files on the disk.

Your file is now in the computer's memory. You may list your file to review it or edit individual lines that need correcting.

Remember to save your file if you make any changes.

## Commands of the Editor

**Edit** - This command allows you to change a line that has been entered. To use this command:

- type .e followed by the line number you wish to change <Return>
- the line you wish to edit will appear
- retype the line <Return>.

**List** - This command allows you to view your entire file. To utilize this command:

- type .l <Return>
- use the space bar to stop and restart the scroll.

You may begin listing the file at any point. Simply type in .l followed by the line number you wish to begin listing. To terminate the listing before all lines have been displayed, press <Return>.

**Delete** - This command will remove an entire line from the file and automatically renumber all the lines following it. If you wish to remove the words and leave a blank line, use the edit command. To use the delete command:

- type .d followed by the number of the line you wish to delete <Return>
- the line will appear and you will be asked "Delete this? (Y/N)"
- if you press "Y", the line will be deleted; if you press "N", it will remain.

**Insert** - This command allows you to insert one or more lines into the file. To use this feature:

- type .i followed by the line number at which you wish to begin inserting <Return>
- insert as many lines as you wish
- type .q at the beginning of the next line to quit inserting <Return>.

**Save** - This command saves a new file or a corrected file onto a disk. Be sure to use this command each time you enter a new file or make any corrections on a file already on the disk. To use this command:

- type .s <Return>
- enter the name of the file <Return>.

Be sure that you do NOT duplicate a name already on the disk unless you wish to replace an existing file. Press .d to list the files.

**Get** - The get command will load a file from the disk into the computer's memory. To use this command:

- type .g <Return>
- you will be asked "Get file name?"
- type in the name of the file <Return>.

If you are not sure of the exact name of the file, type .d <Return> to list the files on the disk.

**Print** - The print feature will allow you to print out your list of problems. If you do not have a printer, DO NOT attempt to use this command. To use the Print Command:

- be sure that the file you want printed is the one now loaded into the computer's memory
- if you are using a printer, it should have been turned on earlier, before the disk drive and the computer
- type .p <Return>.

**Clear** - This command clears the screen to get ready for a new file. To use this command:

- type .c <Return>.

Be sure you have saved your data or your corrections on the disk. The editor will double check to make sure you really want to clear.

**Quit** - This command allows you to exit the editor and return to the MATH BLASTER program. To use this command:

- type .q <Return>.

Remember to save your file first if you want to keep it.

**Help** - This command will display a list of all the commands and their functions. If at any point you are puzzled about which command to use,

- type .h <Return>.

## Additional Notes on the Editor

The first few times you use the editor, create a small data file, using only 5 to 10 problems. Try using the file with the MATH BLASTER program to be sure you're on the right track. You can add more problems to the file later.

It is a good practice to save your file every 15 minutes or so while you are working on it. Then if you should ruin a file in memory, you can retrieve a copy from the disk and prevent the loss of all your hard work.

## Having Trouble?

If your new file does not work smoothly with the program, check to see that you have

- directions only on the first two lines
- only one operation sign in each problem
- the right number of characters per problem
- the correct spacing in each entry
- between 5 and 30 problems in the file
- not used symbols other than +, −, *, #, =, ., %, /
- named your file properly.

## Math Readiness Data File

On your MATH BLASTER Data Disk is a math readiness file named PREMATH. This file is for pre-school and kindergarten age children. It is a number recognition file that can be used with all the MATH BLASTER activities. You access it as you would one of your own data files (see Step 6). Premath will run successfully only in the horizontal mode.

## ABOUT THE AUTHORS

Jan Davidson holds a B.A. from Purdue University, and an M.A. and Ph.D. from the University of Maryland. She is founder and director of Upward Bound, a nonprofit educational center in Palos Verdes, California. She also serves as an educational computer consultant to schools in southern California.

Richard Eckert holds a B.S. in Electrical Engineering from Purdue University. He is a professional programmer and has written a variety of software, particularly educational software.

Other software packages written by the authors include WORD ATTACK, SPELL IT, and SPEED READER II.

## ACKNOWLEDGMENTS

The authors are indebted to many people who participated in the development of this software. The teachers and students at Upward Bound who so willingly tested the software made a substantial contribution. A special note of thanks also to Cathy Johnson, who prepared and edited the problems for the data files and made numerous contributions in the development and testing of the software.

# APPENDIX

## Addition

### Level 1

Combinations with sums to 10.

1 + 1 = 2
2 + 0 = 2
2 + 1 = 3
3 + 0 = 3
3 + 1 = 4
2 + 2 = 4
4 + 0 = 4
4 + 1 = 5
3 + 2 = 5
5 + 0 = 5
5 + 1 = 6
4 + 2 = 6
3 + 3 = 6
6 + 1 = 7
5 + 2 = 7
4 + 3 = 7
7 + 1 = 8
6 + 2 = 8
5 + 3 = 8
4 + 4 = 8
8 + 1 = 9
7 + 2 = 9
6 + 3 = 9
5 + 4 = 9
9 + 0 = 9

### Level 2

Bridging the 10's, with sums to 14.

9 + 1 = 10
8 + 2 = 10
7 + 3 = 10
6 + 4 = 10
5 + 5 = 10
10 + 1 = 11
9 + 2 = 11
8 + 3 = 11
7 + 4 = 11
6 + 5 = 11
10 + 2 = 12
9 + 3 = 12
8 + 4 = 12
7 + 5 = 12
6 + 6 = 12
11 + 2 = 13
10 + 3 = 13
9 + 4 = 13
8 + 5 = 13
7 + 6 = 13
11 + 3 = 14
10 + 4 = 14
9 + 5 = 14
8 + 6 = 14
7 + 7 = 14

## Level 3

Sums from 15 to 18.

13 + 2 = 15
12 + 3 = 15
11 + 4 = 15
10 + 5 = 15
9 + 6 = 15
8 + 7 = 15
14 + 2 = 16
13 + 3 = 16
12 + 4 = 16
11 + 5 = 16
10 + 6 = 16
9 + 7 = 16
8 + 8 = 16
14 + 3 = 17
13 + 4 = 17
12 + 5 = 17
11 + 6 = 17
10 + 7 = 17
9 + 8 = 17
14 + 4 = 18
13 + 5 = 18
12 + 6 = 18
11 + 7 = 18
10 + 8 = 18
9 + 9 = 18

## Level 4

Sums from 20 to 100, addends in multiples of 10.

10 + 10 = 20
20 + 10 = 30
30 + 10 = 40
40 + 10 = 50
30 + 20 = 50
50 + 10 = 60
40 + 20 = 60
30 + 30 = 60
60 + 10 = 70
50 + 20 = 70
40 + 30 = 70
70 + 10 = 80
60 + 20 = 80
50 + 30 = 80
40 + 40 = 80
80 + 10 = 90
70 + 20 = 90
60 + 30 = 90
50 + 40 = 90
90 + 10 = 100
80 + 20 = 100
70 + 30 = 100
60 + 40 = 100
50 + 50 = 100

## Level 5

Bridging the 20's,
with sums from 19 to 25.

11 + 8 = 19
11 + 9 = 20
11 + 10 = 21
12 + 7 = 19
12 + 8 = 20
12 + 9 = 21
12 + 10 = 22
13 + 6 = 19
13 + 7 = 20
13 + 8 = 21
13 + 9 = 22
13 + 10 = 23
14 + 5 = 19
14 + 6 = 20
14 + 7 = 21
14 + 8 = 22
14 + 9 = 23
14 + 10 = 24
15 + 4 = 19
15 + 5 = 20
15 + 6 = 21
15 + 7 = 22
15 + 8 = 23
15 + 9 = 24
15 + 10 = 25

## Subtraction

### Level 1

Minuends from 8 to 10, subtrahends from 0 to 9.

8 - 1 = 7
8 - 2 = 6
8 - 3 = 5
8 - 4 = 4
8 - 5 = 3
8 - 6 = 2
8 - 7 = 1
9 - 1 = 8
9 - 2 = 7
9 - 3 = 6
9 - 4 = 5
9 - 5 = 4
9 - 6 = 3
9 - 7 = 2
9 - 8 = 1
10 - 0 = 10
10 - 1 = 9
10 - 2 = 8
10 - 3 = 7
10 - 4 = 6
10 - 5 = 5
10 - 6 = 4
10 - 7 = 3
10 - 8 = 2
10 - 9 = 1

### Level 2

Minuends from 11 to 15, subtrahends from 0 to 5.

11 - 0 = 11
11 - 1 = 10
11 - 2 = 9
11 - 3 = 8
11 - 4 = 7
11 - 5 = 6
12 - 0 = 12
12 - 1 = 11
12 - 2 = 10
12 - 3 = 9
12 - 4 = 8
12 - 5 = 7
13 - 0 = 13
13 - 1 = 12
13 - 2 = 11
13 - 3 = 10
13 - 4 = 9
13 - 5 = 8
14 - 0 = 14
14 - 1 = 13
14 - 2 = 12
14 - 3 = 11
14 - 4 = 10
14 - 5 = 9
15 - 0 = 15
15 - 1 = 14
15 - 2 = 13
15 - 3 = 12
15 - 4 = 11
15 - 5 = 10

## Level 3

Minuends from 11 to 15, subtrahends from 6 to 11.

11 - 6 = 5
11 - 7 = 4
11 - 8 = 3
11 - 9 = 2
11 - 10 = 1
11 - 11 = 0
12 - 6 = 6
12 - 7 = 5
12 - 8 = 4
12 - 9 = 3
12 - 10 = 2
12 - 11 = 1
13 - 6 = 7
13 - 7 = 6
13 - 8 = 5
13 - 9 = 4
13 - 10 = 3
13 - 11 = 2
14 - 6 = 8
14 - 7 = 7
14 - 8 = 6
14 - 9 = 5
14 - 10 = 4
14 - 11 = 3
15 - 6 = 9
15 - 7 = 8
15 - 8 = 7
15 - 9 = 6
15 - 10 = 5
15 - 11 = 4

## Level 4

Minuends from 60 to 100, subtrahends from 20 to 90 in multiples of 10.

60 - 50 = 10
60 - 40 = 20
60 - 30 = 30
60 - 20 = 40
70 - 60 = 10
70 - 50 = 20
70 - 40 = 30
70 - 30 = 40
70 - 20 = 50
80 - 70 = 10
80 - 60 = 20
80 - 50 = 30
80 - 40 = 40
80 - 30 = 50
80 - 20 = 60
90 - 80 = 10
90 - 70 = 20
90 - 60 = 30
90 - 50 = 40
90 - 40 = 50
90 - 30 = 60
90 - 20 = 70
100 - 90 = 10
100 - 80 = 20
100 - 70 = 30
100 - 60 = 40
100 - 50 = 50
100 - 40 = 60
100 - 30 = 70
100 - 20 = 80

## Level 5

Minuends from 15 to 20,
subtrahends from 5 to 9.

15 - 5 = 10
15 - 6 = 9
15 - 7 = 8
15 - 8 = 7
15 - 9 = 6
16 - 5 = 11
16 - 6 = 10
16 - 7 = 9
16 - 8 = 8
16 - 9 = 7
17 - 5 = 12
17 - 6 = 11
17 - 7 = 10
17 - 8 = 9
17 - 9 = 8
18 - 5 = 13
18 - 6 = 12
18 - 7 = 11
18 - 8 = 10
18 - 9 = 9
19 - 5 = 14
19 - 6 = 13
19 - 7 = 12
19 - 8 = 11
19 - 9 = 10
20 - 5 = 15
20 - 6 = 14
20 - 7 = 13
20 - 8 = 12
20 - 9 = 11

## Multiplication

### Level 1

Multipliers from 2 to 5, multiplicands from 1 to 5.

2 x 1 = 2
2 x 2 = 4
2 x 3 = 6
2 x 4 = 8
2 x 5 = 10
3 x 1 = 3
3 x 2 = 6
3 x 3 = 9
3 x 4 = 12
3 x 5 = 15
4 x 1 = 4
4 x 2 = 8
4 x 3 = 12
4 x 4 = 16
4 x 5 = 20
5 x 1 = 5
5 x 2 = 10
5 x 3 = 15
5 x 4 = 20
5 x 5 = 25

### Level 2

Multipliers from 1 to 5, multiplicands from 6 to 9.

1 x 6 = 6
1 x 7 = 7
1 x 8 = 8
1 x 9 = 9
2 x 6 = 12
2 x 7 = 14
2 x 8 = 16
2 x 9 = 18
3 x 6 = 18
3 x 7 = 21
3 x 8 = 24
3 x 9 = 27
4 x 6 = 24
4 x 7 = 28
4 x 8 = 32
4 x 9 = 36
5 x 6 = 30
5 x 7 = 35
5 x 8 = 40
5 x 9 = 45

## Level 3

Facts from 6 x 0 to 6 x 11
and from 7 x 0 to 7 x 11.

6 x 0 = 0
6 x 1 = 6
6 x 2 = 12
6 x 3 = 18
6 x 4 = 24
6 x 5 = 30
6 x 6 = 36
6 x 7 = 42
6 x 8 = 48
6 x 9 = 54
6 x 10 = 60
6 x 11 = 66
7 x 0 = 0
7 x 1 = 7
7 x 2 = 14
7 x 3 = 21
7 x 4 = 28
7 x 5 = 35
7 x 6 = 42
7 x 7 = 49
7 x 8 = 56
7 x 9 = 63
7 x 10 = 70
7 x 11 = 77

## Level 4

Facts from 8 x 0 to 8 x 11
and from 9 x 0 to 9 x 11.

8 x 0 = 0
8 x 1 = 8
8 x 2 = 16
8 x 3 = 24
8 x 4 = 32
8 x 5 = 40
8 x 6 = 48
8 x 7 = 56
8 x 8 = 64
8 x 9 = 72
8 x 10 = 80
8 x 11 = 88
9 x 0 = 0
9 x 1 = 9
9 x 2 = 18
9 x 3 = 27
9 x 4 = 36
9 x 5 = 45
9 x 6 = 54
9 x 7 = 63
9 x 8 = 72
9 x 9 = 81
9 x 10 = 90
9 x 11 = 99

## Level 5

Facts from 11 x 1 to 11 x 12
and from 12 x 1 to 12 x 12.

11 x 1 = 11
11 x 2 = 22
11 x 3 = 33
11 x 4 = 44
11 x 5 = 55
11 x 6 = 66
11 x 7 = 77
11 x 8 = 88
11 x 9 = 99
11 x 10 = 110
11 x 11 = 121
11 x 12 = 132
12 x 1 = 12
12 x 2 = 24
12 x 3 = 36
12 x 4 = 48
12 x 5 = 60
12 x 6 = 72
12 x 7 = 84
12 x 8 = 96
12 x 9 = 108
12 x 10 = 120
12 x 11 = 132
12 x 12 = 144

## Division

### Level 1

Divisors from 2 to 5,
quotients from 1 to 5.

$2 \div 2 = 1$
$4 \div 2 = 2$
$6 \div 2 = 3$
$8 \div 2 = 4$
$10 \div 2 = 5$
$3 \div 3 = 1$
$6 \div 3 = 2$
$9 \div 3 = 3$
$12 \div 3 = 4$
$15 \div 3 = 5$
$4 \div 4 = 1$
$8 \div 4 = 2$
$12 \div 4 = 3$
$16 \div 4 = 4$
$20 \div 4 = 5$
$5 \div 5 = 1$
$10 \div 5 = 2$
$15 \div 5 = 3$
$20 \div 5 = 4$
$25 \div 5 = 5$

### Level 2

Divisors from 1 to 5,
quotients from 6 to 9.

$6 \div 1 = 6$
$7 \div 1 = 7$
$8 \div 1 = 8$
$9 \div 1 = 9$
$12 \div 2 = 6$
$14 \div 2 = 7$
$16 \div 2 = 8$
$18 \div 2 = 9$
$18 \div 3 = 6$
$21 \div 3 = 7$
$24 \div 3 = 8$
$27 \div 3 = 9$
$24 \div 4 = 6$
$28 \div 4 = 7$
$32 \div 4 = 8$
$36 \div 4 = 9$
$30 \div 5 = 6$
$35 \div 5 = 7$
$40 \div 5 = 8$
$45 \div 5 = 9$

## Level 3

Divisors of 6 and 7,
quotients from 0 to 11.

$0 \div 6 = 0$
$6 \div 6 = 1$
$12 \div 6 = 2$
$18 \div 6 = 3$
$24 \div 6 = 4$
$30 \div 6 = 5$
$36 \div 6 = 6$
$42 \div 6 = 7$
$48 \div 6 = 8$
$54 \div 6 = 9$
$60 \div 6 = 10$
$66 \div 6 = 11$
$0 \div 7 = 0$
$7 \div 7 = 1$
$14 \div 7 = 2$
$21 \div 7 = 3$
$28 \div 7 = 4$
$35 \div 7 = 5$
$42 \div 7 = 6$
$49 \div 7 = 7$
$56 \div 7 = 8$
$63 \div 7 = 9$
$70 \div 7 = 10$
$77 \div 7 = 11$

## Level 4

Divisors of 8 and 9,
quotients from 0 to 11.

$0 \div 8 = 0$
$8 \div 8 = 1$
$16 \div 8 = 2$
$24 \div 8 = 3$
$32 \div 8 = 4$
$40 \div 8 = 5$
$48 \div 8 = 6$
$56 \div 8 = 7$
$64 \div 8 = 8$
$72 \div 8 = 9$
$80 \div 8 = 10$
$88 \div 8 = 11$
$0 \div 9 = 0$
$9 \div 9 = 1$
$18 \div 9 = 2$
$27 \div 9 = 3$
$36 \div 9 = 4$
$45 \div 9 = 5$
$54 \div 9 = 6$
$63 \div 9 = 7$
$72 \div 9 = 8$
$81 \div 9 = 9$
$90 \div 9 = 10$
$99 \div 9 = 11$

## Level 5

Divisors of 11 and 12,
quotients from 1 to 12.

$11 \div 11 = 1$
$22 \div 11 = 2$
$33 \div 11 = 3$
$44 \div 11 = 4$
$55 \div 11 = 5$
$66 \div 11 = 6$
$77 \div 11 = 7$
$88 \div 11 = 8$
$99 \div 11 = 9$
$110 \div 11 = 10$
$121 \div 11 = 11$
$132 \div 11 = 12$
$12 \div 12 = 1$
$24 \div 12 = 2$
$36 \div 12 = 3$
$48 \div 12 = 4$
$60 \div 12 = 5$
$72 \div 12 = 6$
$84 \div 12 = 7$
$96 \div 12 = 8$
$108 \div 12 = 9$
$120 \div 12 = 10$
$132 \div 12 = 11$
$144 \div 12 = 12$

## Fractions and Decimals

### Level 1

Reducing common fractions to lowest terms.

4/8 = 1/2
6/12 = 1/2
8/16 = 1/2
4/12 = 1/3
6/18 = 1/3
6/9 = 2/3
8/12 = 2/3
12/18 = 2/3
3/12 = 1/4
4/16 = 1/4
6/8 = 3/4
9/12 = 3/4
12/16 = 3/4
2/10 = 1/5
3/15 = 1/5
4/10 = 2/5
6/10 = 3/5
8/10 = 4/5
2/12 = 1/6
10/12 = 5/6
2/14 = 1/7
4/14 = 2/7
6/14 = 3/7
8/14 = 4/7
10/14 = 5/7
12/14 = 6/7
2/16 = 1/8
6/16 = 3/8
10/16 = 5/8
14/16 = 7/8

### Level 2

Renaming improper fractions.

2/2 = 1
3/2 = 1 1/2
4/2 = 2
5/2 = 2 1/2
6/2 = 3
3/3 = 1
4/3 = 1 1/3
5/3 = 1 2/3
6/3 = 2
4/4 = 1
5/4 = 1 1/4
7/4 = 1 3/4
8/4 = 2
5/5 = 1
6/5 = 1 1/5
7/5 = 1 2/5
8/5 = 1 3/5
9/5 = 1 4/5
10/5 = 2
8/8 = 1
9/8 = 1 1/8
11/8 = 1 3/8
13/8 = 1 5/8
15/8 = 1 7/8
16/8 = 2
10/10 = 1
11/10 = 1 1/10
13/10 = 1 3/10
17/10 = 1 7/10
20/10 = 2

## Level 3

Renaming common fractions as decimals.

| | | |
|---|---|---|
| 1/10 | = | .1 |
| 3/10 | = | .3 |
| 5/10 | = | .5 |
| 7/10 | = | .7 |
| 9/10 | = | .9 |
| 1/100 | = | .01 |
| 3/100 | = | .03 |
| 5/100 | = | .05 |
| 9/100 | = | .09 |
| 10/100 | = | .10 |
| 18/100 | = | .18 |
| 25/100 | = | .25 |
| 36/100 | = | .36 |
| 52/100 | = | .52 |
| 70/100 | = | .70 |
| 81/100 | = | .81 |
| 98/100 | = | .98 |
| 1/1000 | = | .001 |
| 3/1000 | = | .003 |
| 5/1000 | = | .005 |
| 9/1000 | = | .009 |
| 10/1000 | = | .010 |
| 18/1000 | = | .018 |
| 25/1000 | = | .025 |
| 52/1000 | = | .052 |
| 70/1000 | = | .070 |
| 100/1000 | = | .100 |
| 120/1000 | = | .120 |
| 203/1000 | = | .203 |
| 476/1000 | = | .476 |

## Level 4

Renaming decimals as percents.

| | | |
|---|---|---|
| 1 | = | 100% |
| 1.5 | = | 150% |
| 2 | = | 200% |
| 5 | = | 500% |
| 15 | = | 1500% |
| 21 | = | 2100% |
| .1 | = | 10% |
| .2 | = | 20% |
| .3 | = | 30% |
| .5 | = | 50% |
| .8 | = | 80% |
| .9 | = | 90% |
| .01 | = | 1% |
| .05 | = | 5% |
| .07 | = | 7% |
| .12 | = | 12% |
| .16 | = | 16% |
| .25 | = | 25% |
| .47 | = | 47% |
| .69 | = | 69% |
| .83 | = | 83% |
| .001 | = | .1% |
| .006 | = | .6% |
| .013 | = | 1.3% |
| .025 | = | 2.5% |
| .027 | = | 2.7% |
| .105 | = | 10.5% |
| .135 | = | 13.5% |
| .307 | = | 30.7% |
| .751 | = | 75.1% |

## Level 5

Renaming percents as common fractions.

50% = 1/2
33 1/3% = 1/3
66 2/3% = 2/3
25% = 1/4
75% = 3/4
20% = 1/5
40% = 2/5
60% = 3/5
80% = 4/5
16 2/3% = 1/6
83 1/3% = 5/6
12 1/2% = 1/8
37 1/2% = 3/8
62 1/2% = 5/8
87 1/2% = 7/8
10% = 1/10
30% = 3/10
70% = 7/10
90% = 9/10
8 1/3% = 1/12