

The Strategy Game That Sharpens Your Math Skills

An original learning game by Joe DeMuth for
children ages 10 and up

HAYDEN SOFTWARE

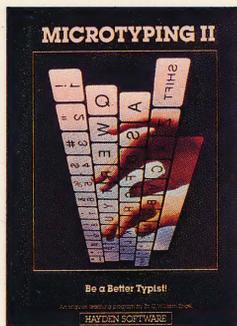
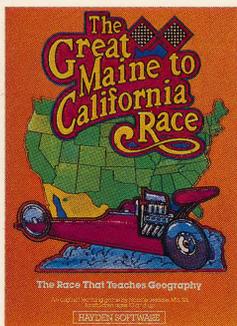
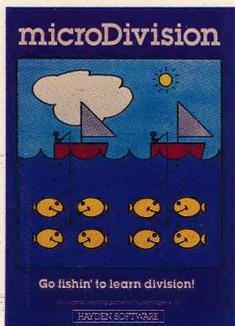
Math Skill Is Your Most Effective Weapon

Factor Blast provides 3 levels of difficulty and teaches the factoring of numbers through 100 – so essential to learning fractions and algebra. You'll develop your math skills and have fun at the same time. When you're an expert at factoring, work on your strategy. Soon you'll be a Factor Blast champ!

What are the whole number factors of 51? When you think you have the answers, blast them off the screen. If you picked numbers 3 and 17 then you're a real sharpshooter. But are you as accurate as a friend or classmate – or even Robyte, the Computer? Play Factor Blast and see.



You'll also enjoy these other learning programs from Hayden:



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Hayden Software Company, 600 Suffolk Street, Lowell, MA 01853

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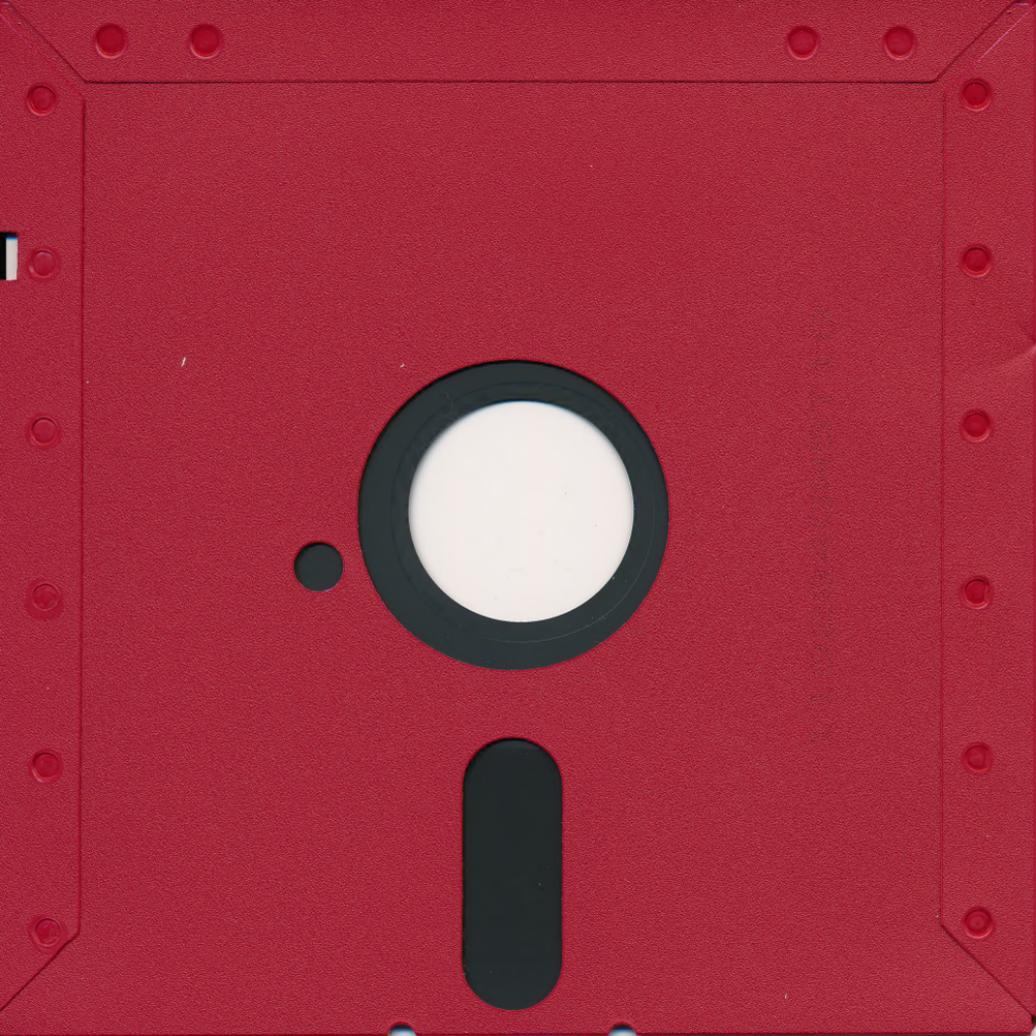
FACTOR BLAST

Apple II, II Plus, IIe
48 K

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S O F T W A R E

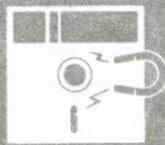
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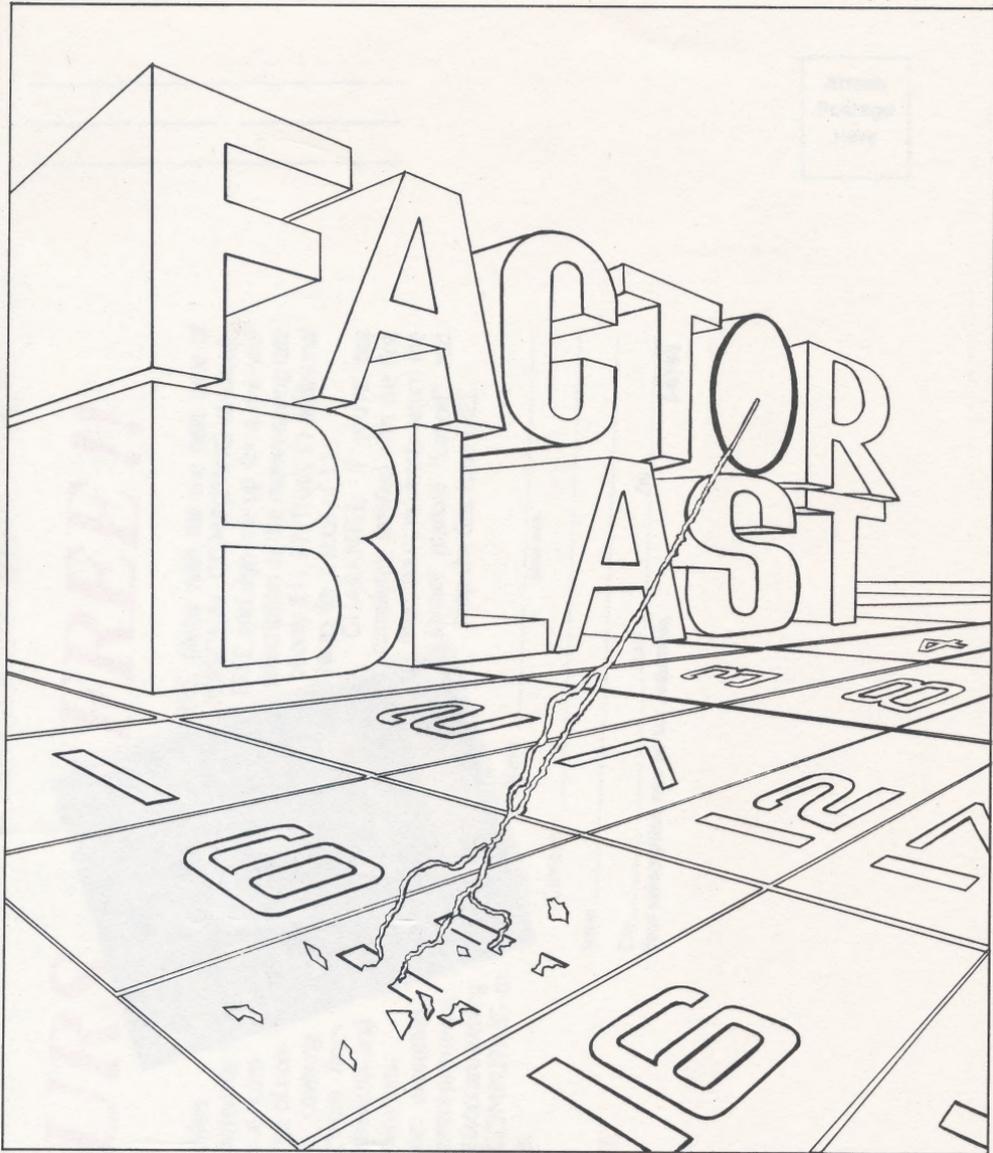


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10°C–52°C
50°F–125°F



By Joe DeMuth

HAYDEN SOFTWARE

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Note to Parents

Mastery of factoring is important for many of the math and science courses which your child will study.

When adding and subtracting fractions, factoring is used to find the lowest common denominator. And fractions are much easier to add or subtract when they have the lowest common denominator!

Reducing a fraction is the division of its numerator and denominator by a common factor.

In algebra, factoring polynomials and solving quadratic equations requires letter and number factors.

Physics and chemistry also involve solving equations. Knowing how to factor makes the job easier!

See the Appendix to these instructions for two fun factoring exercises for you to try with your child.

Introduction

Learning to factor numbers, fun??? With FACTOR BLAST the answer is YES!

As you enjoy playing against a friend or ROBYTE (the computer), you sharpen your skills in recognizing factors of numbers through one hundred.

The object of the game is to get the highest score by choosing the best numbers from the game board and outscore your opponent. First, Player 1 selects a number to blast from the board; Player 2, the opponent, finds factors of that number to blast away. Then Player 2 blasts a number for which Player 1 identifies factors. Each number blasted increases that player's score by its value. The winner is the player with the higher score when all numbers have been blasted from the game board.

The level of difficulty is determined by your choice of board size and decision regarding penalties. Other options ensure that FACTOR BLAST is never dull!

Ages

10 and up

Required Hardware

Apple II Plus or IIe with 48K RAM, disk drive, and a color or black and white monitor. Paddles optional.

Number of Players

Two, or one against the computer.

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For your convenience, your program has not been copy protected. We suggest that you follow the instructions in your Apple Disk Operating System Manual to make a back-up copy of the program for your personal use.*

Getting Started

To play FACTOR BLAST, simply insert the disk in the disk drive, close the door, and turn on the computer and monitor.

The title screen appears for a few moments, followed by a screen of factor facts. The factor facts screen will appear from time to time as the game is being loaded from the disk into the computer's memory. Press RETURN to begin.

The following list of game options appears on the screen.

DIRECTIONS	PENALTY	LEVEL
<input type="checkbox"/> Yes	<input type="checkbox"/> Yes	Factoring to 25
<input checked="" type="checkbox"/> No	<input type="checkbox"/> No	Factoring to 64
		Factoring to 100

◀Space Bar▶ to move finger
◀Return▶ to accept

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Choose an option by pressing the space bar to move the hand up or down. When the finger is pointing to the option you want, press RETURN to enter your choice and move the hand to the next column.

Directions

If you are playing for the first time or want to review the directions, press the space bar until the finger points to YES. Press RETURN and a screen of directions appears. Press RETURN at the prompt and the directions are continued. Then press RETURN to get back to the menu.

If you wish to bypass the directions, be sure the finger is pointing to NO and press RETURN to move the hand to the PENALTY option column.

Penalty

The PENALTY option makes achieving a high score more challenging. When the PENALTY option is in effect, two points are subtracted from your score whenever you miss an opportunity to blast a factor. In addition, when you blast a number which is *not* a factor, the value of the number tried is deducted. However, your score will never go below zero.

If you choose the NO PENALTY option, no penalties are assessed for overlooked or incorrectly chosen factors.

Beware of choosing the YES PENALTY option when you play against the computer. ROBYTE never selects an incorrect factor, and it never misses a factor on the board.

Press the space bar until the finger is pointing to your choice of YES or NO. Press RETURN to enter your choice. Next the hand moves to the LEVEL column.

Level

The three levels of difficulty are determined by the size of the game board. The more numbers on the board, the more factors you'll need to know. Your choices are:

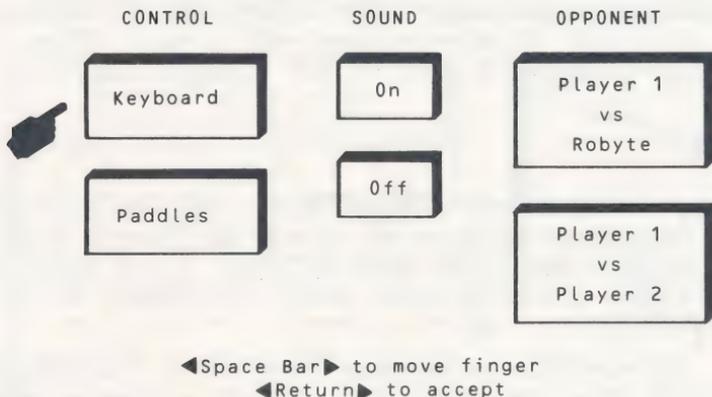
Level 1: A 5×5 grid with factoring to 25.

Level 2: An 8×8 grid with factoring to 64.

Level 3: A 10×10 grid with factoring to 100.

Press the space bar until the finger points to the game board you want. Then press RETURN.

After a pause, the following menu appears on your screen.



Control

You can choose either the keyboard or game paddles to position and enter your moves.

Choosing the **KEYBOARD** option allows you to use the I (for up), J (for left), K (for right), and M (for down) keys to move the cursor, and the RETURN key to enter the move.

Selecting the **PADDLE** option allows you to use the paddle (or two paddles if there are two players) to move the cursor. Turn the paddle control to the right (or left) to move the cursor to the right (or left). When the cursor reaches the end of a row on the board, it jumps to the opposite end of the next row (or the row above it, if you were turning the paddle control to the left). When the cursor reaches the end of the board, it jumps back to the beginning (or to the end, if you were turning the paddle control to the left).

Press the space bar so that the finger points to the control method of your choice and press RETURN. The hand shifts to the **SOUND** column.

Sound

You may play FACTOR BLAST with or without sound. With the sound ON, you hear the blaster ray remove numbers from the grid, as well as prompts that signal which player's turn it is and when a mistake is made. With the sound OFF, the game is played with no sound effects. Position the hand so the finger points to ON or OFF and press RETURN.

Opponent

Your opponent can be human or ROBYTE, the computer. If you are playing with a friend, press the space bar to move the finger to the PLAYER 1 VS. PLAYER 2 option and press RETURN. If you decide to play against ROBYTE, be sure the finger points to PLAYER 1 VS. ROBYTE and press RETURN.

A screen appears with the message PLAYER 1, PLEASE ENTER YOUR NAME. Type your name, using as many as 8 letters, and press RETURN. If there are two players, Player 2 will do the same.

To begin the game, press RETURN. After a screen of factor facts, the game board you chose appears on the screen.

Playing the Game

Refer to the instruction box at the top left of your screen for the directions you need as you play the game.

The message in the instruction box asks if you wish to remove a number from the game board. You might want to do so if you have played FACTOR BLAST more than once and don't want the pattern of moves to become predictable. Type Y or N (for yes or no). If you type Y, you are instructed to move the cursor to the number you wish to remove. Press RETURN or the paddle button. Player 2 is then instructed to remove a different number.

Now you are ready to begin playing the game. As an example, imagine that a game is being played between Kate (Player 1) and Todd (Player 2). They choose to play with no penalties, keyboard control, and the game board numbered through 25.

It is Kate's turn. Using the I (↑), J (←), K (→), and M (↓) keys, she positions the cursor on the number 23, remembering that Todd's score will increase by the value of the factors of the number which she blasts from the board. Kate presses RETURN to enter her move. The blaster zaps "23" from the board and 23 points will be added to Kate's score (see below).

Kate's turn: IJKM to select move RETURN to enter move					<table border="1" style="border-collapse: collapse; width: 100%;"> <tr><td style="text-align: center;">S C O R E</td></tr> <tr><td style="text-align: center;">Kate</td></tr> <tr><td style="text-align: center;">Todd</td></tr> </table> 	S C O R E	Kate	Todd
S C O R E								
Kate								
Todd								
1	2	3	4	5				
6	7	8	9	10				
11	12	13	14	15				
16	17	18	19	20				
21	22	23	24	25				

Now Todd takes his turn to blast the factors of Kate's number. He positions the cursor on "1", which is a factor of 23. He presses RETURN, and "1" is blasted from the board and added to his score. Then Todd types N as there are no other factors of 23 on the board (see below).

Todd gets factors of 23. IJKM move/RETURN N for NO FACTORS					<table border="1" style="border-collapse: collapse; width: 100%;"> <tr><td style="text-align: center;">S C O R E</td></tr> <tr><td style="text-align: center;">Kate 0023</td></tr> <tr><td style="text-align: center;">0001 Todd</td></tr> </table> 	S C O R E	Kate 0023	0001 Todd
S C O R E								
Kate 0023								
0001 Todd								
2	3	4	5					
6	7	8	9	10				
11	12	13	14	15				
16	17	18	19	20				
21	22		24	25				

Now it is Todd's turn to blast a number.

He positions the cursor on "25" and presses RETURN. 25 is added to his score. Now Kate blasts factors of 25 which are left on the board. She positions the cursor on "5", presses RETURN, and 5 points are added to her score. She then types N as there are no other factors of 25 on the board.

Play continues in this manner with Kate and Todd taking turns blasting numbers and their factors from the game board until there are no numbers left. The player with the higher score is announced as the winner in the instruction box.

If you wish to play another game, press any key and the first option screen will appear on your screen. If you wish to quit, remove your disk from the disk drive and turn off your computer and monitor.

Playing Against Robyte

If your opponent is ROBYTE (the computer), it will take Player 2's turn.

If you opt to remove a number from the board at the start of the game, ROBYTE deletes a random number. If you decide not to remove a number, ROBYTE follows suit.

Play is essentially the same as described above except that ROBYTE will always find all of the number's factors, and its number choice (taking into account the factors Player 1 will be able to blast) will always give it the highest possible point advantage over its opponent.

Although ROBYTE always opts for the highest point advantage in any particular round of play, don't give up—you can still beat the computer. The secret is to look further ahead in the game than ROBYTE can. You must not only take into account the point value of factors ROBYTE will score from a number you blast, but also "guess" what number ROBYTE will choose in the next round.

Factoring Tips

If one number divides evenly into a second number, the first is called a factor of the second. For example, because 4 divides into 12 exactly 3 times, 4 is called a factor of 12. Other factors of 12 are 1, 2, 3, 6 and 12. All whole numbers have at least two factors, 1 and the number itself. If these are the only factors, then the number is called a prime number. For example, 19 is prime because it has only two factors, 1 and 19. Here is a list of all the prime numbers to 100: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, and 97.*

Even numbers (those ending in 0, 2, 4, 6, or 8) have 2 as a factor.

Numbers made up of digits having a sum divisible by 3 have 3 as a factor—example: 3 is a factor of 39 because $3 + 9 = 12$ and 12 is divisible by 3.

Numbers ending in 0 or 5 have 5 as a factor.

Numbers made up of digits which add up to 9 have 9 as a factor—example: 54 has 9 as a factor because $5 + 4 = 9$.

Numbers ending in 0 have 10 as a factor.

Double digit numbers in which both digits are the same (11, 22, 33 etc.) have 11 as a factor.

Strategy Hints

When choosing your move, consider how many points your opponent will score by blasting factors of the number you pick. To do this, look for the factors yourself.

Some of the tips discussed above can be used together to find other factors. For example, if a number has both 2 and 3 as factors, then it must also have 2×3 , or 6, as a factor. Or if a number has both 3 and 5 as factors, it also has 15 as a factor.

*NOTE: The number 1 is not considered prime because it has only itself as a factor—a prime number always has itself plus the number 1 as factors.

In addition to looking at factors of your move, try to think ahead one turn to see the consequence of your move. A time when such foresight is critical is when you are considering a number which is less than half the board size. Imagine that in a game on a 5×5 grid you have the chance to blast either 22 or 11. Which do you choose? If you blast 11, there are no factors for your opponent to blast, which seems like a good move. But on your opponent's next turn 22 is available, and you will be left with at most 2 as a factor. Therefore, in this round you may score $11 + 2$, or 13 points, but your opponent has earned 22. It would be better for you to blast 22, leaving your opponent the factors 2 and 11, giving you the point advantage of $22 - (11 + 2)$, or 9.

Another tactic is to look at multiples of factors that have just been blasted. For example, if your opponent has just blasted 52 on a 64 square board, you would blast all the factors of 52 still on the board — 1, 2, 4, 13, and 26. Then on your turn to blast a number, use the factors you just blasted to help find a good choice. Look for the multiples of 13 that are left on the board, such as 39 which is 3×13 . 39 may not have been a good choice earlier, but now that 13 is off the board, its only factor is 3, netting you at least 36 points for the turn.

Prime numbers are often good choices when it is your turn to blast a number for your opponent to factor. Sometimes, however, choosing a prime number is not the best move. If, for example, you are playing on a 25 square board and 1 and 23 have already been blasted, then 25 is actually a better choice than the prime number 19. You receive 25 points. If your opponent blasts the factor 5, you still have an advantage of 20 points (25-5).

The more you play FACTOR BLAST (particularly against ROBYTE), the easier it will be to spot the best moves. Don't be afraid to experiment with different strategies. Remember, the computer will always agree to a rematch!

APPENDIX: FACTORING EXERCISES

Writing a Number as the Product of Its Prime Factors

Every number has exactly one set of prime factors which when multiplied together produce that number. For example, 2, 3, 5, 67, 97, and 113 are prime numbers. Here are examples of numbers written as the product of their prime factors:

$$\begin{aligned}4 &= 2 \times 2 \\12 &= 2 \times 2 \times 3 \\42 &= 2 \times 3 \times 7 \\143 &= 11 \times 13 \\1155 &= 3 \times 5 \times 7 \times 11\end{aligned}$$

There is no other set of prime factors which when multiplied together is equal to 42; only $2 \times 3 \times 7$. Try it!

Example 1

Define 24 as the product of its prime factors.

- a. Define 24 as the product of any two factors.

$$24 = 4 \times 6$$

- b. Replace any factors which are not prime numbers with prime.

$$4 = 2 \times 2$$

$$6 = 2 \times 3$$

- c. Check to see if all factors are prime numbers.

$$24 = 2 \times 2 \times 2 \times 3$$

They are, so the example is completed.

Example 2

Define 72 as the product of its prime factors.

- a. Define 72 as the product of any two factors.

$$72 = 8 \times 9$$

- b. Replace any factors which are not prime numbers.

$$8 = 2 \times 4$$

$$9 = 3 \times 3$$

- c. Check to see if all factors are prime numbers. 4 is not a prime number, so repeat step b.

$$72 = 2 \times 4 \times 3 \times 3$$

$$4 = 2 \times 2$$

- d. Check to see if all factors are prime numbers.

$$72 = 2 \times 2 \times 2 \times 3 \times 3$$

Now try a few examples of your own. Follow the steps outlined above and define numbers as the product of their prime factors. Some good examples to start with are 8, 14, 27, 50, 68, 100, 132, and 300.

Finding the Greatest Common Factor of a Set of Numbers

The greatest common factor of a set of numbers is the largest number which is a factor of each member of that set.

Example 1

Find the greatest common factor (G.C.F.) of 20 and 35.

- a. List the factors of each number.

Number	Factors
20	1,2,4,5,10,20
35	1,5,7,35

- b. Look for the largest number which is a factor of each.

5 is the largest factor of 20 and 35.

- c. The G.C.F. of 20 and 35 is 5.

Example 2

Find the greatest common factor (G.C.F.) of 12, 18, 30.

- a. List the factors of each number.

Number	Factors
12	1,2,3,4,6,12
18	1,2,3,6,9,18
30	1,2,3,5,6,10,15,30

- b. Look for the largest number which is a factor of each.

6 is the largest factor of 12, 18, and 30.

- c. The G.C.F. of 12, 18, and 30 is 6.

Now we'll look at another way to find the greatest common factor (G.C.F.) of 12, 18, and 30 using prime factors.

- a. Define each number as the product of its prime factors.

$$12 = 2 \times 2 \times 3$$

$$18 = 2 \times 3 \times 3$$

$$30 = 2 \times 3 \times 5$$

- b. Look for factors which are common to all the numbers.

2 and 3 are common to 12, 18, and 30.

Multiply 2×3 .

- c. The G.C.F. of 12, 18, and 30 is 6.

Now try a few examples on your own using either method. Follow the steps outlined above and find the G.C.F. of:

1. 24 and 36
2. 9, 21, and 63
3. 20, 60, and 100
4. 8, 28, 48, and 58
5. 27, 63, 72, and 90

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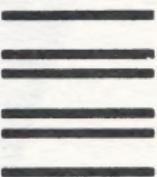
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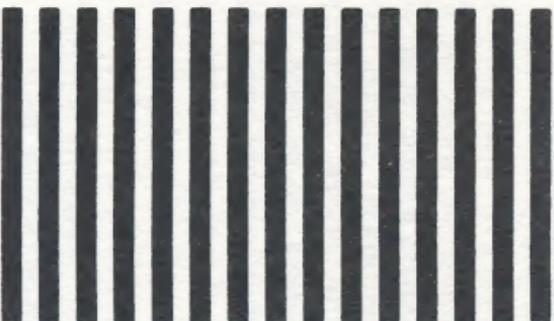
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