FUN
WITH FIGURES

KENNETH WILLIAMS

BRILLIANT MENTAL MATHS
SHORT CUTS THAT WILL AMAZE EVERYONE!

KENNETH WILLIAMS

INSPIRATION BOOKS

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On seeing this kind of work actually being performed by the little children, the doctors, professors and other "big guns" of mathematics are wonder-struck and exclaim:-

'Is this mathematics or magic?'

And we invariably answer and say: 'It is both.
It is magic until you understand it;
and it is mathematics thereafter'...

Bharati Krsna Tirthaji
Vedic Mathematics Scholar

INTRODUCTION

Ten-year old Truman Henry
Safford (born 1836)
was asked:

'Multiply in your head
365,365,365,365,365,365
by 365,365,365,365,365,365.

He flew around the room
like a top, pulled his
pantaloons over the top
of his boots, bit his hand,
rolled his eyes in their sockets,
sometimes smiling and talking,
and then seeming to be in an agony,
until, in not more than one minute, said he,

"133,491,850,208,566,925,016,658,299,941,583,225!"'

'Lightning calculators', are not that uncommon and while we may not be able to match the brilliance of a Truman Henry Safford, we can all develop, with the aid of this book, a talent at mental mathematics.

With these super-easy methods you need no longer be caught between the drudgery of the old dinosaur methods and the 'cop-out' of the calculator. When Bharati Krsna Tirthaji reconstructed the ancient system of Vedic Maths (used in this book) earlier this century, he uncovered a beautifully integrated and complete system of maths which had been lost for centuries. The Vedic system mirrors the way the mind naturally works and so is designed to be done mentally.

Fun with Figures is for those who think they are no good at maths- and for those who are good at maths. It is for those who would like to steal a little lightning. The book answers a need of our time, offering easy, enjoyable maths which improves mental agility and memory, promotes confidence and creativity as well as being useful in everyday life.

Each double page shows a simple mathematical method and so is independent of the others (with two exceptions, which are indicated). In addition to the various everyday situations indicated in this book, you will surely find many other occasions for the use of these easy methods. There are many exercises for you to practice and answers at the end of the book.

CONTENTS

AMAZE YOUR FRIENDS

*Use the formula **ALL FROM 9 AND THE LAST FROM 10** to amaze your friends with instant subtractions.*

- For example **1000 - 357 =** <u>**643**</u>

We simply take each figure in 357 from 9 and the last figure from 10:

1 0 0 0 -	3	5	7
	from 9	from 9	from 10
=	6	4	3

So the answer is **1000 - 357 =** <u>**643**</u>

And that's all there is to it!

This always works for subtractions from numbers consisting of a 1 followed by noughts: 100; 1000; 10,000 etc.

Similarly **10,000 - 1049 = <u>8951</u>**

1 0 , 0 0 0 - 1 0 4 9

from 9 from 9 from 9 from 10

= 8 9 5 1

For 1000 - 83 in which we have more zeros than figures in the numbers being subtracted we simply suppose that 83 is 083.

So **1000 - 83** becomes **1000 - 083 = <u>917</u>**

Try some yourself:

1. 1000 - 777=
2. 1000 - 283 =
3. 1000 - 505 =
4. 10,000 - 2345 =
5. 10000 - 9876 =
6. 10,000 - 1101 =
7. 100 - 57 =
8. 1000 - 57 =
9. 10,000 - 321 =
10. 10,000 - 38 =

Mathematics, rightly viewed, possesses not only truth but supreme beauty. . .

BERTRAND RUSSELL

IN THE SHOP

Instantly find the change due from £10 or £20

Suppose you buy something for \$3.33 and you give a \$10 note. How much change would you expect to get?

You just apply **ALL FROM 9 AND THE LAST FROM 10** to the \$3.33 and you get <u>\$6.67</u>

1 0 - 3 . 3 3

3 from 9 → 6; 3 from 9 → 6; 3 from 10 → 7

= 6 . 6 7

$10 - $2.30 = $7.70

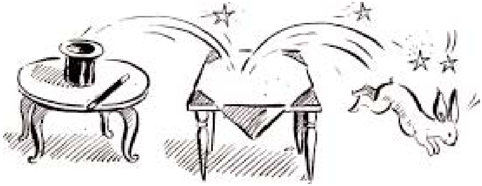
Here "the last" is the 3 as zero does not count.
So we take 2 from 9 and 3 from 10.

Try these:

1. $10 - $7.77 =
2. $10 - $4.44 =
3. $10 - $6.36 =
4. $10 - $5.67 =
5. $100 - $84.24 =
6. $100 - $31.33 =

Zerah Colburn (1804-40), when he was eight, was asked to raise the number 8 to the sixteenth power: he announced the answer (281,474,976,710,656) "promptly and with facility", causing the academic audience to weep. He was next asked to raise the numbers 2,3,....9 to the 10th power: and he gave the answers so rapidly that the gentleman who was taking them down was obliged to ask him to repeat them more slowly.

TABLES MAGIC



Don't know your tables? Never mind, in this system you don't need them beyond 5 × 5!

Suppose you need **8 × 7**.

8 is 2 below 10 and 7 is 3 below 10.
Think of it like this:

8	**2**	
7	**3**	
5	**6**	answer

The answer is 56.
The diagram below shows how you get it.

8	**2**	
×	|	
7	**3**	
5	**6**	answer

You subtract crosswise: 8 - 3 or 7 - 2 to get **5**,
the first figure of the answer.
And you multiply vertically: 2 × 3 to get **6**,
the last figure of the answer.

That's all you do!

Think how far the numbers are below 10, subtract one number's deficiency from the other number, and multiply the deficiencies together.

✵ **7 × 6 = 42**

7	**3**
6	**4**
3	**$_{1}$2** = **42**

Here there is a carry: the 1 in the 12 goes over to make the 3 into 4.

Multiply these:

1. 8	2. 9	3. 8	4. 7	5. 9	6. 6
8	7	9	7	9	6
__	__	__	__	__	__

The whole heaven is number and harmony

ARISTOTLE

AT THE PARTY

At a party surprise your friends with this spectacular way of multiplying large numbers together in your head.

Here's how to use the formula **VERTICALLY AND CROSSWISE** for multiplying numbers close to 100.
This follows on from the previous page.

- Suppose you want to multiply 88 by 98.

  Not easy, you might think. But with **VERTICALLY AND CROSSWISE** you can put the answer straight down, using the same method as on the last page.

  Both 88 and 98 are close to 100.
  88 is 12 below 100 and 98 is 2 below 100.

  You can imagine the sum set out like this:

88 - 12

✕ |

<u>**98** - 2</u>

<u>**86 24**</u>

As before the **86** comes from subtracting crosswise: 88 - 2 = 86 (or 98 - 12 = 86: you can subtract either way, you will always get the same answer).

And the **24** in the answer is just 12 × 2: you multiply vertically.
So **88** × **98** = <u>**8624**</u>

This is so easy it is just mental arithmetic.

Try some:

1.	2.	3.	4.	5.	6.	7.
87	88	77	93	94	64	98
98	97	98	96	92	99	97
___	___	___	___	___	___	___

Where there is life there is pattern and where there is pattern there is mathematics

JOHN D. BARROW

EXERCISE YOUR BRAIN CELLS

While waiting in a queue why not exercise your brain cells by multiplying numbers just over 100.

- **103 × 104 = <u>10712</u>**

  The answer is in two parts: 107 and 12.
  107 is just 103 + 4 (or 104 + 3),
  and 12 is just 3 × 4

  Similarly **107 × 106 = <u>11342</u>**

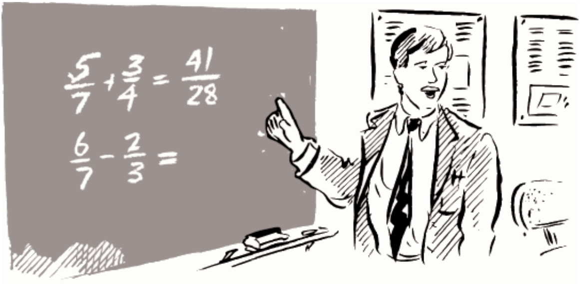
- 107 + 6 = 113 and 7 × 6 = 42

Again, just mental arithmetic.
Try a few:

1. 102 × 107	2. 106 × 103
3. 104 × 104	4. 109 × 108
5. 101 × 123	6. 103 × 102

I proposed to him (Jedediah Buxton, 1702-72) the following random question: In a body whose 3 sides are 23,145,789 yards, 5,642,732 yards, and 54,965 yards, how many cubical eighths of an inch? After once naming the several figures distinctly, one after another, in order to assure himself of the several dimensions and fix them in his mind, without more ado he fell to work amidst more than 100 of his fellow- laborers, and after leaving him about 5 hours, on some necessary concerns (in which time I calculated it with my pen) at my return, he told me he was ready: upon which, taking out my pocket book and pencil, to note down his answer, he asked which end I would begin at, for he would direct me either way.... I chose the regular method........ and in a line of 28 figures, he made no hesitation nor the least mistake.

SHOW YOUR CLASS



Teacher - show your class the easy way to add and subtract fractions.

Use **VERTICALLY AND CROSSWISE** and write the answer straight down.

✵ $\frac{2}{3}+\frac{1}{5}=\frac{10+3}{15}=\frac{13}{15}$

Multiply crosswise and add to get the top of the answer:
2×5=10 and 1×3=3. Then 10+3=13.
The bottom of the fraction is just 3×5=15.
You multiply the bottom numbers together.

❋ So $\frac{5}{7}+\frac{3}{4}=\frac{20+21}{28}=\frac{41}{28}$

Subtracting is just as easy: multiply crosswise as before, but then subtract:

❋ $\frac{6}{7}-\frac{2}{3}=\frac{18-14}{21}=\frac{4}{21}$

Try a few:

1. $\frac{4}{5}+\frac{1}{6}=$
2. $\frac{1}{3}+\frac{1}{4}=$
3. $\frac{2}{7}+\frac{2}{3}=$
4. $\frac{4}{5}-\frac{1}{6}=$
5. $\frac{1}{4}-\frac{1}{5}=$
6. $\frac{8}{3}-\frac{9}{5}=$

... nature is the realisation of the simplest conceivable mathematical ideas.

EINSTEIN

ON A WALK

*Out walking with your friends, show them this quick way to square numbers that end in 5 using the formula **BY ONE MORE THAN THE ONE BEFORE**.*

75^2 = <u>5625</u>

75^2 means 75×75.
The answer is in two parts: 56 and 25.
The last part is always **25**.

The first part is the first number, 7, multiplied by the number "one more", which is 8: so 7×8=**56**.

$$\mathbf{7\ \ 5^2 = 56\ \ 25}$$

7×8=56

✵ Similarly $\mathbf{85^2 = \underline{7225}}$ because 8×9=72.

Try these:

1. 45^2 2. 65^2 3. 95^2 4. 35^2 5. 15^2

For the harmony of the world is made manifest in Form and Number, and the heart and soul and all the poetry of Natural Philosophy are embodied in the concept of mathematical beauty.

D'ARCY THOMPSON

AT THE OFFICE

Show your colleagues in the office this beautiful method for multiplying numbers where the first figures are the same and the last figures add up to 10.

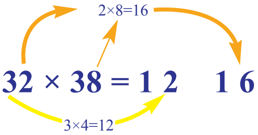
✵ **32 × 38 = 1216**

Both numbers here start with 3 and the last figures (2 and 8) add up to 10.

So we just multiply 3 by 4 (the next number up) to get **12** for the first part of the answer.

And we multiply the last figures: 2×8=**16** to get the last part of the answer.

Diagrammatically:



✱ And **81 × 89 =** **<u>7209</u>**

We put 09 since we need two figures as in all the other examples.

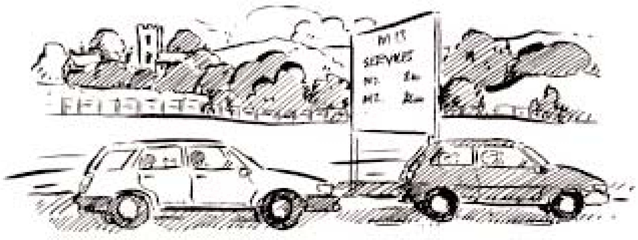
Practise some:

1. 43 × 47 =   2. 24 × 26 =   3. 62 × 68 =
4. 17 × 13 =   5. 59 × 51 =   6. 77 × 73 =

The mathematician does not study pure mathematics because it is useful; he studies it because he delights in it and he delights in it because it is beautiful.

POINCARÉ

ON THE MOTORWAY



On a car journey, get the children to find the digit sum of car number plates.

Any number of any size can always be reduced to a single figure by adding its digits.

- For example 42 has two digits which add up to 6. We say "the digit sum of 42 is 6".
- The digit sum of 413 is 8 because 4+1+3=8.
- For 20511 the digit sum is 9.

Try a few:

1. 34 2. 61 3. 303 4. 3041 5. 21212

Now suppose we want the digit sum of 417.
Adding 4, 1 and 7 gives 12.
But as 12 is a 2-figure number we add its digits to get 3 (1+2=3).

We could write **417 = 12 = 3.**

And so 737 = 17 = 8.

We simply add the digits in the number and add again if necessary.

This is simple and one of its uses is in checking sums, as we will see.

Find the digit sum for each of the following:

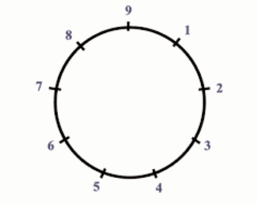
1. 85 2. 38 3. 77 4. 99 5. 616 6. 7654

All things that can be known have number; for it is not possible that without numbers anything can be either conceived or known

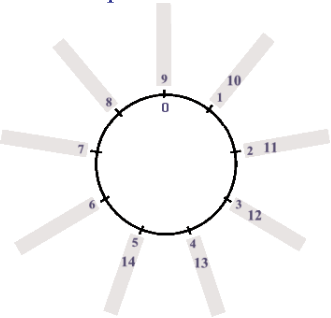
PHILOLAUS

THE NINE-POINT CIRCLE

Since all numbers, no matter how long, can be reduced to a single figure every number finds its place on the nine-point circle:



This circle shows the numbers from 1 to 9 and continuing to number round the circle would put 10 at the same place as 1.
11 would be at the same place as 2 and so on as shown below:



Notice also that 0 goes at the same place as 9 because, numbering backwards round the circle, 0 comes before 1.

So all numbers will have their place somewhere round this circle.

Now, looking at the last circle, the digit sum of 10 is 1, and 10 is next to 1 on the circle.
The digit sum of 11 is 2, and 11 is next to 2.
And so on.

To find which branch of the circle a number is on we simply find its digit sum.

- For example the digit sum of 34 is 7 so 34 will come on the '7 branch'.
  You could check this by continuing to number round the circle until you get to 34.

- 77 will be on the '5 branch' as 77=14=5.

Put these numbers on the correct branch of the circle:

1. 88   2. 373   3. 555   4. 67348

IN YOUR MATHS LESSON

Why not check your sums by this fascinating method using digit sums.

Suppose you want to check that the addition simple sum below is correct.

$$\begin{array}{r} 4\ \ 3 \\ \underline{3\ \ 2} + \\ \underline{7\ \ 5} \end{array}$$

We find the digit sum of 43, 32 and 75 and check that the first two digit sums add up to the third digit sum:

$$\begin{array}{rcr} 4\ \ 3 & & 7 \\ \underline{3\ \ 2} & + & \underline{5}\ + \\ \underline{7\ \ 5} & & \underline{3} \end{array}$$

The digit sums are shown on the right and 7+5=3 is correct in digit sums because 7+5=12=3 (1+2=3). This indicates that the answer is correct.

All sums, even the most complex, can be checked in this way.

Check the following sums and find out which are wrong:

1. 56	2. 83	3. 77	4. 545	5. 357
88 +	38 +	69 +	273	753
144	121	156	818	1010

It is worth noting (in case you want to check subtraction sums using the nine-point circle) that in digit sums 7-5=2, 6-6=0 and so on, but 3-4=8. You can see this on the circle by starting at 3 and going 4 jumps backwards round the circle. Or, alternatively you can add 9 to the 3 so that 3-4 becomes 12-4, which is 8.

The advancement and perfection of Mathematics are intimately connected with the prosperity of the state

NAPOLEON

CHECK YOUR BILL

Use this easy method of adding numbers to check your bank statement or supermarket bill.

The usual way to add numbers works from right to left and so is not useful for mental maths.
Numbers are written and spoken from left to right and so it is easier to work from left to right especially when doing it in your head.

34 + 52 = <u>86</u>
This is easy to do from left to right.
We add 3 and 5 to get 8.
And we add 4 and 2 to get 6.

Just practise one or two:

1. 44 + 34 =   2. 52 + 37 =   3. 246 + 642 =

You can use the digit sum method to check these.

Now suppose that there is a carry figure.

76 + 86 = <u>162</u>

The figures on the left add up to 7+8=15.
The figures on the right add up to 6+6=12.

$$\mathbf{1 \qquad 5 \qquad {}_{1}2 = 162}$$

Now as 12 is a 2-figure number the 1 will be carried over to make the 15 into 16, giving 162.

This is easy to do in your head- for any 2-figure number carry the left-hand figure to the left.

373 + 474 = <u>847</u>

First we get 7.
Then we get 14: $\mathbf{7\ {}_{1}4 = 84}$.

Finally we get 7 which gives **847**.

Try these:

1. 44 + 77 =
2. 87 + 86 =
3. 28 + 38 =
4. 65 + 56 =
5. 464 + 262 =
6. 773 + 883 =
7. 177 + 277 =

CHECK YOUR CHANGE

*Using **BY SUBTRACTION AND BY ADDITION** you can easily check your change in the shop.*

Suppose you offer 50p for something costing 18p.

❋ **50 - 18 = <u>32</u>**

To take 18 from 50, we note that 18 is close to 20, so we take 20 away from 50 (to get 30) and add 2 back on.

❋ Similarly in 73 - 49 we decide to take 50 away from 73 and then add 1 back on.

Try these:

1. 62	2. 84	3. 71	4. 43	5. 55
36 -	48 -	27 -	16 -	28 -
—	—	—	—	—

Behold the heaven, the earth, the sea; all that is bright in them or above them; all that creep or fly or swim; all have forms because all have number. Take away number and they will be nothing...

ST AUGUSTINE

IN THE DIY SHOP

This astonishing method for multiplying numbers is so easy because it works from left to right

Suppose you want to know the cost of 6 hinges at 73p each.

✳ **73 × 6 = <u>438</u>**

We first multiply the 7 by 6 to get 42.
We then multiply the 3 by 6 to get 18.

$$\mathbf{42\ {}_{1}8 = 438}$$

The 1 in the 18 is mentally carried back to the 42 to make it 43.

So any double figure number after the first involves carrying the first figure to the left and adding it on.

Similarly **234 × 7 = <u>1638</u>**

We get 2×7=14 then 3×7=21 and **14 $_{2}$1 = 161**
Next we have 4×7=28, so **161 $_{2}$8 = 1638**

282 × 4 = <u>1128</u>

As **8 $_{3}$2 = 112** and **112 8 = 1128**

And **43 × 7 = 28 $_{2}$1 = 301** (28 becomes 30)

Try a few of these:

1. 56 × 6 =	2. 43 × 4 =	3. 77 × 5 =
4. 88 × 9 =	5. 66 × 7 =	6. 18 × 8 =
7. 45 × 7 =	8. 444 × 3 =	9. 383 × 7 =

Mathematics is the Queen of the Sciences and Arithmetic the Queen of Mathematics

GAUSS

HAVE A BREAK

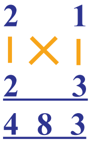
NOT-SO-LONG MULTIPLICATION

At break time at school or in the office try out this elegant way of multiplying numbers using a simple pattern.

21 × 23 = 483

This is normally called long multiplication but actually the answer can be written straight down using the **VERTICALLY AND CROSSWISE** formula.

We first put, or imagine, 23 below 21:



There are 3 steps:

a) Multiply **vertically on the left**: 2×2=**4**.

This gives the first figure of the answer.

b) Multiply **crosswise and add:** 2×3 + 1×2=**8**.
This gives the middle figure.
c) Multiply **vertically on the right:** 1×3=**3**.
This gives the last figure of the answer.

And that's all there is to it.

Similarly **61× 31 =** **<u>1891</u>**

6 1
| × |
<u>3 1</u>
<u>18 9 1</u>

6×3 = 18; 6×1 + 1×3 = 9; 1×1 = 1

Try these, just write down the answer:

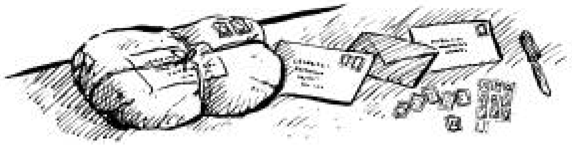
1. 14	2. 22	3. 21	4. 21	5. 32
<u>21</u>	<u>31</u>	<u>31</u>	<u>22</u>	<u>21</u>
___	___	___	___	___

This method is extended on the next page.

The creative principle resides in mathematics

EINSTEIN

AT THE POST OFFICE



Multiply any 2-figure numbers together by mere mental arithmetic!

If you want 21 stamps at 26 pence each
you can easily find the total price in your head.

There were no carries in the method given on the previous page. These only need one extra small step however.

✵ **21 × 26 = <u>546</u>**

2 1

| × |

<u>2 6</u>

<u>4 ₁4 6</u> = <u>546</u>

The method is the same as on the previous page except that we get a 2-figure number, 14, in the middle step, so the 1 is carried over to the left (4 becomes 5).

So 21 stamps cost £5.46.

Practise a few:

1. 2 1	2. 2 3	3. 3 2	4. 4 2	5. 7 1
4 7	4 3	5 3	3 2	7 2
___	___	___	___	___

33 × 44 = <u>1452</u>

There may be more than one carry in a sum:

$$\begin{array}{ccc} 3 & & 3 \\ | & \times & | \\ \underline{4} & & \underline{4}\ \times \end{array}$$

$$\underline{12\ {}_{2}4\ {}_{1}2} = \underline{1452}$$

Vertically on the left we get 12.
Crosswise gives us 24, so we carry 2 to the left and mentally get 144.
Then vertically on the right we get 12 and the 1 here is carried over to the 144 to make 1452.

6. 2 2	7. 3 2	8. 3 1	9. 4 4	10. 5 4
5 6	5 4	7 2	5 3	6 4
___	___	___	___	___

Actually any two numbers, no matter how big, can be multiplied in one line by this method.

IMPRESS YOUR PARENTS

Multiplying a number by 11 is incredibly easy - astonish your parents and friends with this.

To multiply any 2-figure number by 11 we just put the total of the two figures between the 2 figures.

26 × 11 = <u>286</u>

$$26 \times 11 = 2\ 8\ 6$$

2+6=8

Notice that the outer figures in 286 are the 26 being multiplied.
And the middle figure is just 2 and 6 added up.

So 72 × 11 = 792

Multiply by 11:

1. 43 2. 81 3. 15 4. 44 5. 11

77 × 11 = 847

This involves a carry figure because 7+7=14.
We get 77 × 11 = $7_{1}47$ = 847.

Multiply by 11:

6. 88 7. 84 8. 48 9. 73 10. 56

Longer numbers can also be easily multiplied by 11.

234 × 11 = 2574

We put the **2** and the **4** at the ends.
We add the first pair: 2+3=**5**,
and we add the last pair: 3+4=**7**.

Find the sums below using three different methods for each:
A: 98 × 92
B: 19 × 11

DELIGHT YOUR CHILD

Show your child this truly beautiful method of dividing by 9.

❋ **23 ÷ 9 = <u>2 remainder 5</u>**

The first figure of 23 is 2, and this is the answer.
The remainder is just 2 and 3 added up!

❋ **43 ÷ 9 = <u>4 remainder 7</u>**

The first figure, 4, is the answer
and 4+3=7 is the remainder - could it be easier?

Divide by 9:

1. 61   2. 33   3. 44   4. 53   5. 80

Longer numbers are also easy.

134 ÷ 9 = 14 remainder 8

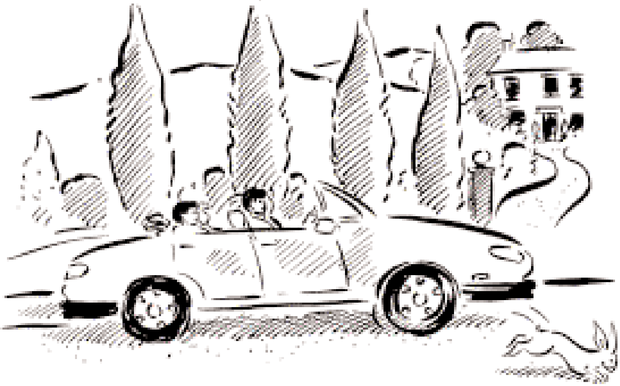
The answer consists of **1**, **4** and **8**.
1 is just the first figure of 134,
4 is the total of the first two figures 1+3=4,
and **8** is the total of all three figures 1+3+4=8.

Divide by 9:

6. 232   7. 151   8. 303   9. 212   10. 2121

...otherwise than according to her [mathematics] order nothing can exist, and nothing takes place in contradiction to her laws...
WILLIAM SPOTTISWOODE

IMPROVE YOUR MIND



On a long car journey why not improve your mind by dividing the car numbers by 9 using this remarkably easy method

This follows on from the previous page because these sums may have carry figures.

❋ **842 ÷ 9** = 8_12 remainder 14 = **92 remainder 14**

Actually a remainder of 9 or more is not usually permitted because we are trying to find how many 9's there are in 842.
Since the remainder, 14, has one more 9 with 5 left over the final answer will be **93 remainder 5**

Divide these by 9:

1. 771 2. 942 3. 565 4. 555
5. 777 6. 2382 7. 7070

When he was twelve George Parker Bidder (1806-78) was asked "if a pendulum clock vibrates the distance of 9.75 inches in a second of time, how many inches will it vibrate in 7 years, 14 days, 2 hours, 1 minute, 56 seconds, each year being 365 days, 5 hours, 48 minutes, 55 seconds?"
George gave the answer, 2,165,625,744.75 inches, in less than 1 minute.

ON THE TRAIN

NOT-SO-LONG DIVISION

On a long train journey?- liven up your trip with this marvelous method for dividing numbers

As in the case of 'long' multiplication 'long' division in this system is not long at all and, in fact, the answer to any division sum can be put down in one line.

✳ **369 ÷ 72 = 5 remainder 9**

We use **THE FIRST BY THE FIRST AND THE LAST BY THE LAST.**
Divide the 36 at the beginning of 369 by the first figure of 72: 36÷7=5 remainder 1.

This gives: $36_19 \div 72 = 5$

The remainder, 1, is placed as shown and makes 19 with the 9 following it.
From this 19 we subtract 2×5 (the answer figure multiplied by last figure of 72):
19-10=9, the remainder.

To sum up: for **369 ÷ 72**:

36 ÷ 7 = 5 remainder 1 gives **$36_{1}9 \div 72 = 5$**

and 19-2×5=9 the remainder, so **$36_{1}9 \div 72 = 5$ rem 9**

Similarly **468 ÷ 73 = <u>6 remainder 30</u>**

Because 46÷7=6 remainder 4: $46_{4}8 \div 73 = 6$,

then 48 - 3×6=30, the remainder.

Try a few yourself:

1. 456 ÷ 87	2. 468 ÷ 73	3. 369 ÷ 84
4. 543 ÷ 76	5. 357 ÷ 61	6. 131 ÷ 43

Similarly squares, squares roots are easily tackled (in one line) by the Vedic method. We can also solve equations and geometrical and trigonometrical problems. The Vedic system covers all areas of mathematics.

It is not possible to show all variations of the methods in this book: all the techniques shown can be extended in various ways (see page 52).

Number rules the universe

PYTHAGORAS

ANSWERS

Page 9

1. 223 2. 717 3. 495 4. 7655 5. 0124
6. 8899 7. 43 8. 943 9. 9679 10. 9962

Page 11

1. £2.23 2. £5.56 3. £3.64 4. £4.33
5. £15.76 (apply the formula to 8424) 6. £68.67

Page 13

1. 64 2. 63 3. 72 4. 49 5. 81 6. $2_16=36$

Page 15

1. 8526 2. 8536 3. 7546 4. 8928
5. 8648 6. 6336 7. 9506 (we put 06 because, like all the others, we need two figures in each part)

Page 17

1. 10914 2. 10918 3. 10816 4. 11772
5. 12423 6. 10506 (we put 06, not 6)

Page 19

1. $\frac{29}{30}$ 2. $\frac{7}{12}$ 3. $\frac{20}{21}$ 4. $\frac{19}{30}$ 5. $\frac{1}{20}$ 6. $\frac{13}{15}$

Page 21

1. 2025 2. 4225 3. 9025 4. 1225 5. 225

ANSWERS

Page 23

1. 2021 2. 624 3. 4216 4. 221 5. 3009 6. 5621

Page 24

1. 7 2. 7 3. 6 4. 8 5. 8

Page 25

1. 4 2. 2 3. 5 4. 9 5. 4 6. 4

Page 27

1. 7-branch 2. 4-branch 3. 6-branch 4. 1-branch

Page 29

3 is wrong as 5 + 6 does not equal 3 in digit sums and 5 is wrong as 6 + 6 does not equal 2.

Page 30

1. 78 2. 89 3. 888

Page 31

1. 121 2. 173 3. 66 4. 121 5. 726

6. $15_156 = 1656$ 7. $3_14_14 = 454$

Page 33

1. 26 2. 36 3. 44 4. 27 5. 27

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Page 35

1. 336 2. 172 3. 385 4. 792 5. 462

6. 144 7. 315 8. $12_{1}2_{1}2 = 1332$

9. $21_{5}6_{2}1 = 2681$

Page 37

1. 294 2. 682 3. 651 4. 462 5. 672

Page 39

1. 987 2. 989 3. 1696 4. 1344 5. 5112

6. 1232 7. 1728 8. 2232 9. 2332 10. 3456

Page 41

1. 473	2. 891	3. 165	4. 484
5. 121	6. 968	7. 924	8. 528
9. 803	10. 616		

Page 41

A: 9016 by method of pages 14, 22, 38

B: 209 by method of pages 22, 38, 40

Page 43

1. 6 r7 2. 3 r6 3. 4 r8 4. 5 r8 5. 8 r8

6. 25 r7 7. 16 r7 8. 33 r6 9. 23 r5 10. 235 r6

ANSWERS

Page 45

1. $7_{1}4$ r15 = 84 r15 = 85 r6
2. $9_{1}3$ r15 = 103 r15 = 104 r6
3. $5_{1}1$ r16 = 61 r16 = 62 r7
4. $5_{1}0$ r15 = 60 r15 = 61 r6
5. $7_{1}4$ r21 = 84 r21 = 86 r3
6. $25_{1}3$ r15 = 263 r15 = 264 r6
7. $77_{1}4$ r14 = 784 r14 = 785 r5

Page 47

1. 5 r21 2. 6 r 30 3. 4 r33 4. 7 r11 5. 5 r52
6. 3 r2

RELATED BOOKS

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