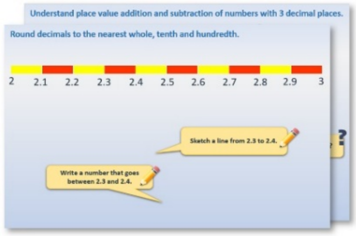
Week 13, Day 4

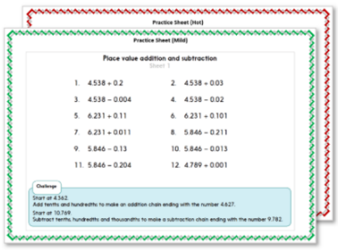
Napier’s rods

Each day covers one maths topic. It should take you about 1 hour or just a little more.

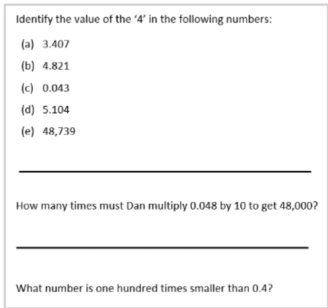
1. Start by reading through the **Learning Reminders**.



2. Think you’ve got it? Have a go at the **Investigation** or **Practical Activity**.



3. Have I mastered the topic? A few questions to **Check your understanding**.
Fold the page to hide the answers!


Identify the value of the ‘4’ in the following numbers:

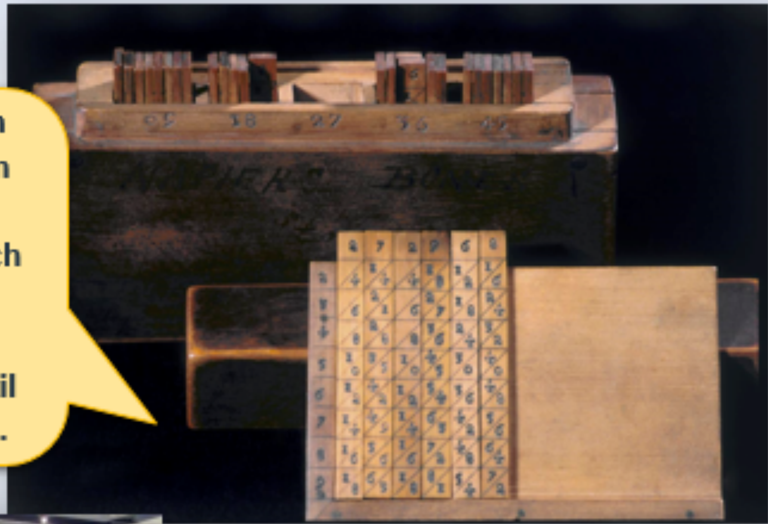
(a) 3.407
(b) 4.821
(c) 0.043
(d) 5.104
(e) 48,739

How many times must Dan multiply 0.048 by 10 to get 48,000?

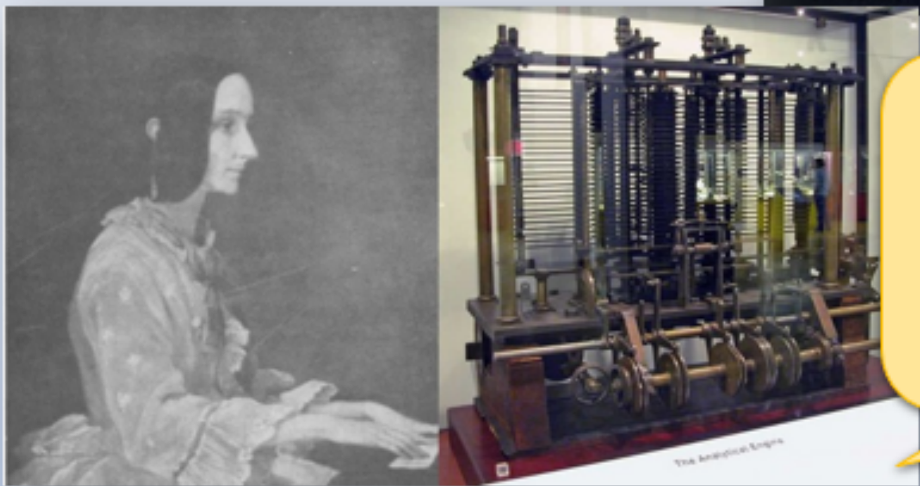
What number is one hundred times smaller than 0.4?

Learning Reminders

Napier's rods.



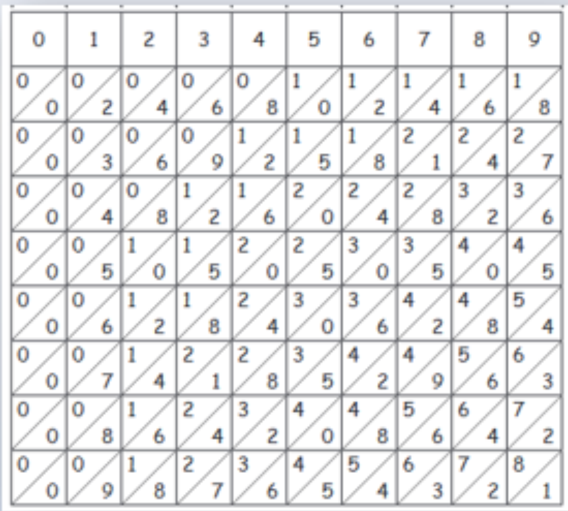
John Napier (1550–1617) was a Scottish mathematician particularly interested in calculation. He created a system of number rods (named after himself) which were used to make multiplying and dividing easier. The method was commonly used for about 200 years until mechanical calculators were developed.



Charles Babbage (1791 – 1871) later invented the 'analytical adding machine'. Ada Lovelace (one of the few women allowed to study mathematics at the time), wrote what is now considered to be the first ever computer program for it.

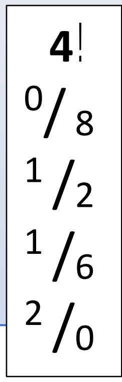
Learning Reminders

Napier's rods.



Here is a set of Napier's rods – sometimes called 'bones' as they used to be made from bone.

The rods go DOWN the grid.

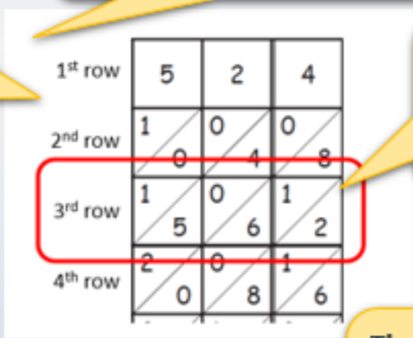


Here is the 4 'rod'. Do you see the multiples of 4 (8, 12, 16 etc.)?

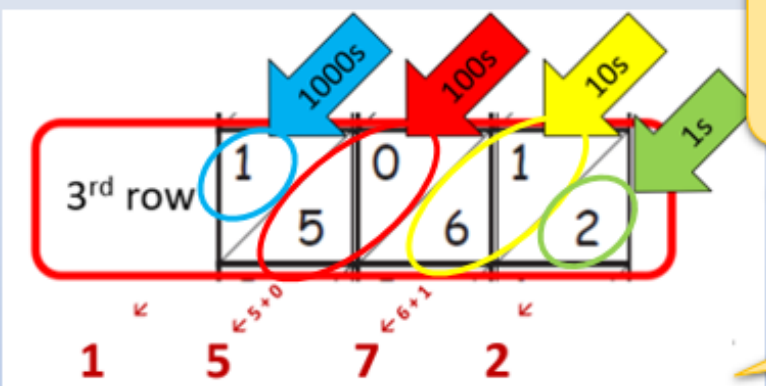
Napier's rods.

We're going to use them to calculate 524 x 3.

First, we find the rods that have the numbers 5, 2 and 4 at the top and place them side by side in that order.



We're multiplying by three, so we need to look at the third row down (counting 5 2 4 as the 1st row):

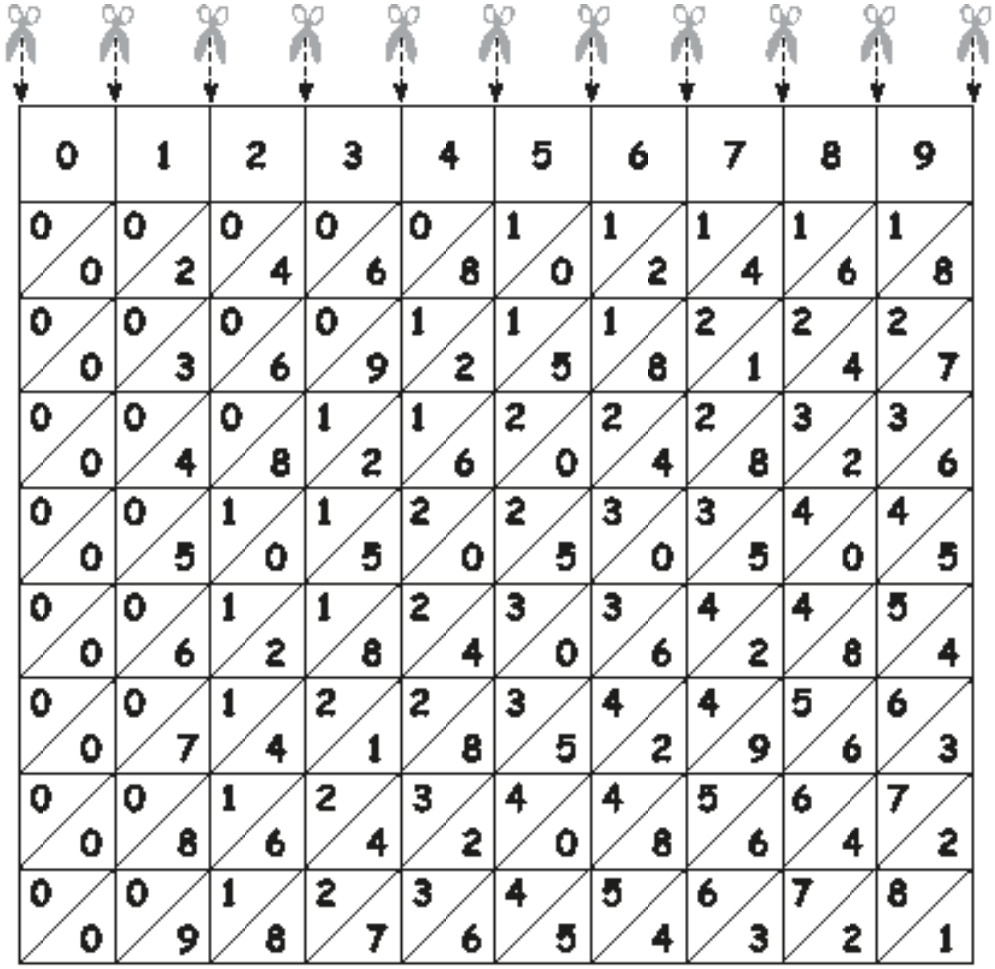


The answer is given by adding digits in the diagonal place value columns formed, where the column furthest to the right is the 1s.

So 524 x 3 = 1572.

Can you see the similarities with the grid method?

Napier's rods/bones



0	1	2	3	4	5	6	7	8	9
0 / 0	0 / 2	0 / 4	0 / 6	0 / 8	1 / 0	1 / 2	1 / 4	1 / 6	1 / 8
0 / 0	0 / 3	0 / 6	0 / 9	1 / 2	1 / 5	1 / 8	2 / 1	2 / 4	2 / 7
0 / 0	0 / 4	0 / 8	1 / 2	1 / 6	2 / 0	2 / 4	2 / 8	3 / 2	3 / 6
0 / 0	0 / 5	1 / 0	1 / 5	2 / 0	2 / 5	3 / 0	3 / 5	4 / 0	4 / 5
0 / 0	0 / 6	1 / 2	1 / 8	2 / 4	3 / 0	3 / 6	4 / 2	4 / 8	5 / 4
0 / 0	0 / 7	1 / 4	2 / 1	2 / 8	3 / 5	4 / 2	4 / 9	5 / 6	6 / 3
0 / 0	0 / 8	1 / 6	2 / 4	3 / 2	4 / 0	4 / 8	5 / 6	6 / 4	7 / 2
0 / 0	0 / 9	1 / 8	2 / 7	3 / 6	4 / 5	5 / 4	6 / 3	7 / 2	8 / 1

How is each strip made?
To calculate 4896 x 7, take the 4, 8, 9 and 6 strips:

1	4	8	9	6
2	0 / 8	1 / 6	1 / 8	1 / 2
3	1 / 2	2 / 4	2 / 7	1 / 8
4	1 / 6	3 / 2	3 / 6	2 / 4
5	2 / 0	4 / 0	4 / 5	3 / 0
6	2 / 4	4 / 8	5 / 4	3 / 6
7	2 / 8	5 / 6	6 / 3	4 / 2
8	3 / 2	6 / 4	7 / 2	4 / 8
9	3 / 6	7 / 2	8 / 1	5 / 4

Look along the seventh row. The units digit is 2, so write this down.
The tens digit is 7 (3 + 4), the hundreds digit is 2 (6 + 6 – 12, write down the 2 and carry the 1), the thousands digit is 4 (8 + 5 + 1 – 14, write down 4, can carry the 1), the ten thousands digit is 3 (2 + 1). The answer is 34,272. Choose your own numbers to multiply by 7.
Start with 2-digit numbers, then 3-digit numbers, and even 4-digit numbers if you are feeling super confident!
Check your answers using short multiplication.

Check your understanding

Questions

Maya says that 2578 x 4 gives the same product as 8 x 1289.
Is she correct? Demonstrate why/why not.

Multiply 1386 by 9. Write the product.
Add the same number (1386) to the product.
What do you notice?
Repeat with 2547 x 9, adding 2547 to the product.
Explain what happens.
Could you use this to make finding the product easier?

Write the missing digits in this multiplication:

3 6 □ 2 x 8 = □ 9 □ 3 6

Check your understanding

Answers

Maya says that 2578 x 4 gives the same product as 8 x 1289.
Is she correct? Demonstrate why/why not.
Maya is correct, the product of each is 10,312.
Comparing the two questions, 4 has been doubled and 2578 halved, which produces the same product.

Multiply 1386 by 9. Write the product. 12,474
Add the same number (1386) to the product. 13,860.
What do you notice? This is the same as 10 x 1386.
Repeat with 2547 x 9, adding 2547 to the product.
Explain what happens.
2547 x 9 = 22,923; adding 2547 gives 25,470.
Could you use this to make finding the product easier?
You can find the answer to 9 times any number by finding 10x the number, then subtracting the number itself.

Write the missing digits in this multiplication.

3 6 4 2 x 8 = 2 9 1 3 6

Probably best solved by setting out as a short multiplication.

NB Where children are making mistakes with the questions in this set, it is most likely due to errors with the layout, but also check for times table mistakes.