Learn how to solve problems that calculators can't

999 999 x 222 222 + 333 333 x 333 334 = ?

Computing Large Whole Numbers

Math Olympiad Training

SUPPAHUB

LEARNING NEW SKILLS

The Concept

1234   = 1000 x a + 100 x b + 10 x c + 1 x d

         = 1000 x 1 + 100 x 2 + 10 x 3 + 1 x 4

         = 1000 + 200 + 30 + 4

Try: 543

543   = 100 x 5 + 10 x 4 + 3

        = 500 + 40 + 3

Example 1 – Simplification

999 999 x 222 222 + 333 333 x 333 334 = ?

= (333 333 x 3 x 222 222) + (333 333 x 333 334)

= 333 333 x [(3 x 222 222) + (333 334)]

= 333 333 x (666 666 + 333 334)

= 333 333 x 1 000 000

= 333 333 000 000

Simple subtraction tips

2200 – 22

= 2178

222 000 – 222

= 22 1 778

2222 0000 – 2222

= 222 1 7778

Simple subtraction tips

3300 – 33

= 3267

333 000 – 333

= 33 2 667

Example 2 – Find sum of digits

Find the sum of all digits of 333…333 x 666…666.

2008 3s   2008 6s

333…333 x 666…666

= 333…333 x 3 x 222…222
= 999…999 x 222…222
= (1000…000 − 1) x 222…222

2008 0s   2008 2s

= 222…222 000…000 − 222…222

= 222…222 1 777…7778

?? 2s   ?? 7s

2 + 7 = 9 (How many pairs of 9?)

1 + 8 = 9 - one more here

2008 x 9 = 18 072

Example 3 – using Algebra

The sum of three digits is 21.

Digit in the ones place is greater than the tens place.

A new number is 198 more than the original one, is formed by interchanging the digit in the ones place with the digit in the hundreds place.

What is the original number?

Solution

1. Represent the 3 digit number as "abc".
2. Guess the number -> abc = ?   678 – is it only answer?
3. Equation (1) : $100a + 10b + c = abc$
4. Equation (2) : $100c + 10b + a - abc = 198$ (after interchanging)
5. Solve the equations:

$100c + 10b + a - (100a + 10b + c) = 198$

$99c - 99a = 198$

$99(c - a) = 198$

$c - a = 198 / 99$

$c - a = 2$

Try – 759?

$957 - 759 = 198$

Example 4 – Application of Algebra

Miss C was born on the 1st January many years ago. In 2002, her age was the sum of all the four digits of the year that she was born in. How old was Miss C in 2002?

Solution

1. Express the year she was born in using equation: 1000 + 100a + 10b + c since she must be born before year 2000.

2. Her age = sum of digits of the year she was born

3. 2002 – (1000 + 100a + 10b + c) = 1 + a + b + c

4. Tip = We know she can't be that old so we assumed "a" is 9.

5. 1001 = 101a + 11b + 2c => 1001 – 101 x 9 = 11b + 2c

6. b = (92 – 2c) / 11

7. Since b must be a whole number – we can guess c has to be 2.

Answer:

Miss C is born in 1982

2002 – 1982 = 20 =>
And she is 20 in 2002

Maths Olympiad

Unleash The Maths Olympian In You!

Advanced (Pr 5 & 6, suitable for 11-13 years old)

- **Get into the spirit of Maths Olympiad**
  Non-routine questions classified by type that challenge you to think beyond typical solutions

- **Boost your mathematics problem-solving skills**
  Learn mind-sharpening skills and methodologies that transcend curricular knowledge

- **Q.E.D. (Quite Easily Done!)**
  Adopt and apply elegant and efficient solutions to complex MO-type problems

- **Step-by-step worked solutions**
  Implicit and alternative answers to further learning and understanding

Terry Chew B. Sc.